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Standardized Baseline Assessment for Rural Off-Grid-Electrification in Sub-Saharan Africa

A standardization tool to streamline and simplify the CDM project cycle

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MDG Carbon provided the technical support for this report. MDG Carbon is an innovative programme to harness the resources of the carbon market in order to bring long-term sustainable development, at scale, to a wide range of developing countries. Since its launch in 2007, MDG Carbon has assisted developing countries in implementing low-carbon interventions, spanning multiple technologies, active in all regions of the world, and leveraging significant amounts of independent co-investments. www.mdgcarbon.org

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Carbon Africa is a climate finance project advisory company headquartered in Nairobi, Kenya that assists clients in Sub – Saharan Africa to develop, implement and monitor climate finance and clean technology projects and provides related advisory services for governments, international organisations, development agencies and local entrepreneurs.

Carbon Africa has experience with both large and small-scale project types including renewables, biomass co-generation, improved cook stoves, off-grid lighting, waste management, mass rapid transit and reducing emissions from deforestation and forest degradation.

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Acronyms

CDM	Clean Development Mechanism
CER	Certified Emission Reductions
DOE	Designated Operational Entity
DNA	Designated National Authority
EB	Executive Board of the CDM
ECOWAS	Economic Community of West African States
ECREE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EEPCO	Ethiopian Electric Power Corporation
EF	Emission Factor
EWURA	Tanzanian Energy Water Utilities Regulatory Authority
GHG	Greenhouse Gas
IEA	International Energy Agency
IRENA	International Renewable Energy Agency
NAMA	Nationally Appropriate Mitigation Action
PoA	Program of Activities
REA	Rural Electrification Authority
SSC	Small-scale
SE4ALL	Sustainable Energy for All
SMME	Small, Medium and Micro Enterprise
SME	Small and Medium Enterprise
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNDP	United Nations Development Program

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Foreword

The Clean Development Mechanism (CDM) aims to direct private sector investment into emissions-reduction projects in developing countries while at the same time promoting sustainable development benefits. All CDM projects must meet the same criteria and complete the same steps. This process is commonly known as the CDM project cycle. The first step in the project cycle involves a lengthy exercise of assessing if the project is eligible under the CDM. This initial step includes the identification of a baseline scenario which pinpoints the level of emissions that would have occurred were it not for the CDM project. Project stakeholders have raised concerns that establishing baselines is an expensive and time-consuming exercise. In order to address this challenge, the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) have called for the use of standardization tools, including but not limited to Standardized Baselines (SBs), in order to streamline and simplify the CDM project cycle. By reducing the transaction costs of projects, it is hoped that SBs will increase access to the CDM and to programmatic CDM activities, particularly with regard to under-represented countries in sub-Saharan Africa, and scale up the abatement of greenhouse gas emissions as well as achieve local social and economic goals.

UNDP has been tasked to take the lead in advancing the "bottom-up" energy agenda within the Sustainable Energy for All (SE4ALL) initiative. The SE4ALL initiative is a global energy partnership and campaign led by UN Secretary General Ban Ki-Moon, that intends to catalyze action in all countries for achieving the following inter-related goals by 2030:

i. Ensuring universal access to modern energy services;

ii. Doubling the global rate of improvement in energy efficiency; and

iii. Doubling the share of renewable energy in the global energy mix.

UNDP's efforts in energy for sustainable development will include support for the scaling up decentralized, off-grid and mini-grid energy solutions aimed at poverty reduction, policy, regulatory and institutional reforms and sector-specific market transformation efforts.

In light of these developments, UNDP's Regional Bureau of Africa regional environment project on *the Management of Environmental Services and Financing for Sustainable Development*, has supported the development of this assessment report on the opportunities for the development of standardized baselines for projects in the rural off-grid electrification sector in sub-Saharan Africa. The objective of this report is to assist countries in sub-Saharan Africa, especially least developed countries, to improve their level of participation in the CDM, programmatic CDM, as well as in next generation instruments (e.g. Nationally Appropriate Mitigation Actions, and New Market Mechanisms) by promoting the development of standardized baselines which simplify and streamline the project development process.

UNDP will continue to work with a broad range of stakeholders to assist communities move towards low-carbon pathways while advancing long-term sustainable development benefits. It is hoped that this report will promote the development of standardized baselines in several countries in Sub-Saharan Africa in order to expand investment and increase access to sustainable energy, especially to off-grid sources of renewable energy.

Lebogang Motlana
Director,
UNDP Regional Service Center for Africa

Executive Summary

This report defines approaches for the development of standardized baselines in CDM projects on off-grid power generation in sub-Saharan Africa. Standardisation allows for baseline establishment and additionality demonstration for project types in a defined geography, rather than on a project-by-project basis. Standardisation thereby facilitates access to climate finance or carbon markets.

Two-thirds of the population in sub-Saharan Africa lives in scarcely populated rural areas without access to an electric grid. In many of these regions grid connections are prohibitively expensive. The development of decentralized energy generation facilities is often the most viable option to secure access to energy.

UNDP has taken the lead in advancing the "bottom-up" energy agenda within the Sustainable Energy for All (SE4ALL) initiative, including scaling up decentralized, off-grid solutions. To facilitate access to carbon finance, UNDP is funding an assessment of standardization opportunities for rural electrification projects in Sub-Saharan Africa.

The *Guidelines for the Establishment of Sector Specific Standardized Baseline*[1] (herein after referred to as the Guidelines) provide guidance on standardized baseline establishment and a generic calculation method. In some cases a standardized baseline calculated using this method for off-grid electrification delivers more emission reductions than when relying on the calculation methods from approved methodologies, newly submitted methodologies or approved CDM tools.

Not all countries in sub-Saharan Africa are equally prepared for the development of a standardized baseline. The level of 'standardized baseline readiness' is mainly defined by the availability of reliable data. Six countries were found to qualify for a grouped standardized baseline development: Mali, The Gambia, Kenya, Nigeria, Ethiopia and Tanzania. However, in these countries the data available should be verified, in particular with respect to the definitions applied to distinguish off-grid, mini-grid and grid connected electricity. To facilitate data collection this report introduces a data form template that lists specific data needs for the establishment of off-grid electrification standardized baselines.

This report also describes how a baseline can be determined and how an additionality positive list can be established. The positive list allows for the selection of technologies which are automatically deemed additional. All off-grid renewable energy technologies can be included in the positive list. The added value of such a list, however, is limited since most small-scale off-grid renewables are already additional by default due to their listing in the microscale additionality tool.

[1] Guidelines for the Establishment of Sector Specific Standardized Baseline – Version 02.0

The standardized baseline will probably be most applied in projects that use CDM methodologies AMS-I.A. and AMS-I.L. The applicability of these methodologies includes the introduction of renewable electricity to households, Small and Medium Enterprises (SMEs) and small communities that lack access to power or only have access to small-scale fossil fuel-based power generation.

Suppressed demand plays an important role for electrification projects in sub-Saharan Africa. In both approved CDM methodologies AMS-I.A. and AMS-I.L., suppressed demand concepts are already incorporated with the use of a counterfactual baseline scenario that is not based on historic consumption levels. The standardized baseline will be developed based on the approach from the Guidelines, and can apply similar suppressed demand principles.

Generation of electricity with small diesel generators is presumably the default off-grid electricity generation option in most countries in sub-Saharan Africa. For the six countries selected for the development of a grouped standardized baseline, the assumed baseline technology in this report is an inefficient diesel generator with a low energy conversion coefficient and a Load Factor of 25% or even lower. Making use of the calculation approach in the *Guidelines* gives a baseline emission factor of around 1.7 tCO_2/MWh.

Developing and regularly updating a standardized baseline for one country is estimated to require between 20 and 25 days of work per year over the first 20 years. For a regional or grouped standardized baseline covering six countries the required work load is estimated between 90 and 125 days of work per year.

The outlook for standardized baseline development in sub-Saharan Africa is tightly linked to off-grid data availability. Out of the thirty-three countries assessed only six showed preliminary off-grid data availability, yet not enough for the development of a standardized baseline. Field surveys would probably make more countries accessible for standardized baseline development, allowing them to benefit from economies of scale.

I. Introduction

This report defines opportunities and approaches for baseline and additionality standardization in CDM projects on off-grid power generation in sub-Saharan Africa. Standardization allows for baseline establishment and additionality demonstration for project types in a defined geography, rather than on a project-by-project basis. Thereby standardization facilitates access to climate finance or carbon markets.

The focus of this report is on standardized baseline development for renewable power generation for households and small businesses that previously had no access to power from a regional or national grid. In this context, providing households and business with access to power is also referred to as "electrification".

1.1. ENERGY ACCESS IN SUB-SAHARAN AFRICA

According to the International Energy Association (IEA)[2], in 2008, 587 million people or 70% of the population in sub-Saharan Africa lacked access to electricity. This value is expected to increase to 698 million in 2030 as the population growth rate out paces the rate of electrification (Figure 1). With the exception of South Africa, the energy sectors of the countries in the region are characterized by low access rates for households and public facilities to either grid or off-grid electricity sources such as diesel generators or other renewable technologies, insufficient generation capacity to meet rapidly growing demand, poor reliability of supply and high costs.[3]

Sub-Saharan Africa possesses an abundance of untapped decentralized renewable energy resources that could address both the limited supply and power access in remote areas. The region has considerable solar and hydropower resources which in some parts could be complemented by wind and geothermal resources. The estimates of the technologically feasible renewable energy potential in sub-Saharan African countries exceed current consumption levels 10-12 times[4].

Two-thirds of the population in sub-Saharan Africa lives in scarcely populated rural areas without access to an electric grid. In many of these regions grid connections are prohibitively expensive. The development of decentralized energy generation facilities is often the most viable option to secure access to energy.

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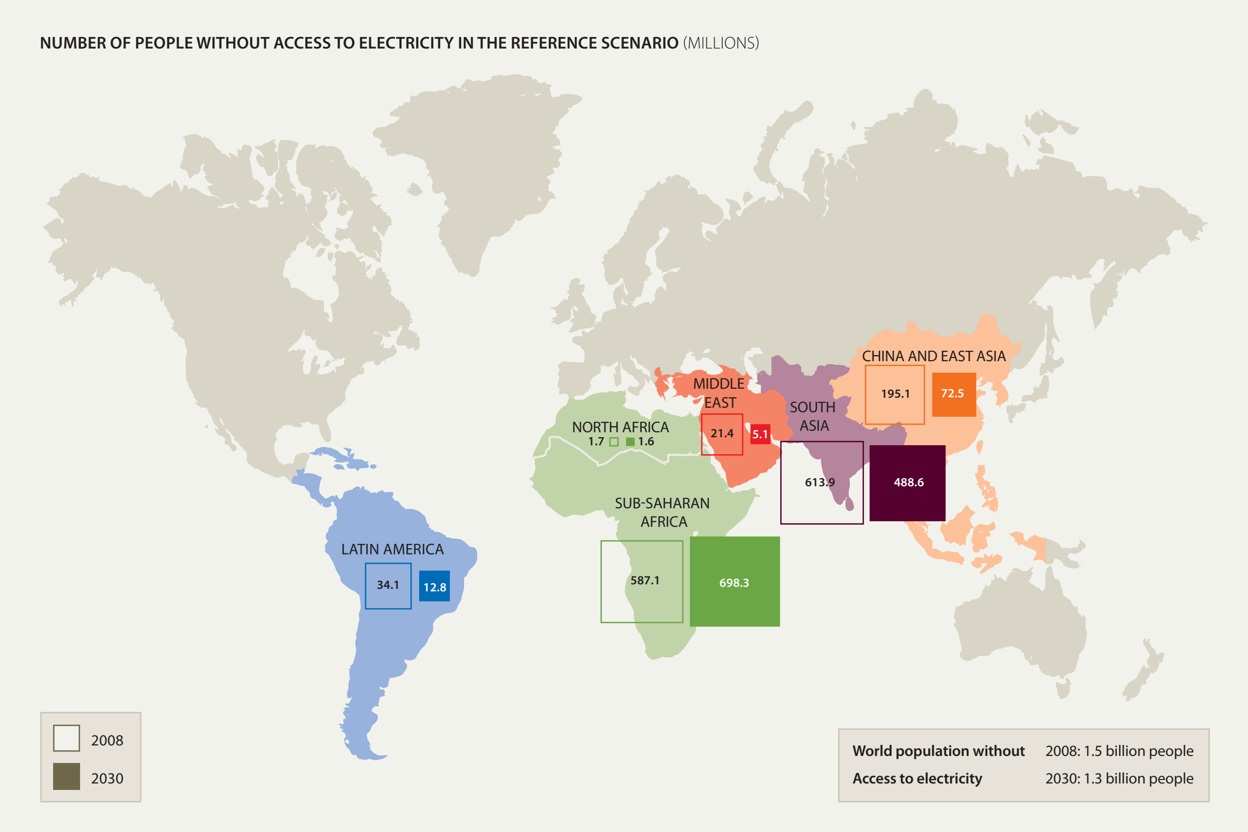
[2] Energy access for all - 2011

[3] World Bank "Sustainable Infrastructure Action Plan – FY 2009 -2011

[4] Deichman *et al*. "The Economics of Renewable Energy Expansion in Rural Sub-Saharan Africa." (2011)

Figure 1: Population per continent without access to electricity (2008-2030)[2]



Source: IEA World Energy Outlook 2009 – Reference Scenario.

The Sustainable Energy for All (SE4ALL) initiative is a global energy partnership and campaign led by UN Secretary General Ban Ki-moon. The initiative aims to catalyze action in all countries for achieving the following inter-related goals by 2030:

1. Ensuring universal access to modern energy services;

2. Doubling the global rate of improvement in energy efficiency; and

3. Doubling the share of renewable energy in the global energy mix.

UNDP has the lead in advancing the "bottom-up" energy agenda within the SE4ALL initiative, including scaling up decentralized, off-grid and mini-grid energy solutions. To simplify access to carbon finance, UNDP is funding an assessment of standardization opportunities for rural electrification projects in Sub-Saharan Africa.

1.2 THE CLEAN DEVELOPMENT MECHANISM

Despite the great renewable energy potential, sub-Saharan Africa has hardly benefitted from the Clean Development Mechanism (CDM) to support renewable energy investments. Only 2.1% of CDM projects for renewable energy are located in sub-Saharan Africa. For projects bundled as Programmes of Activities (PoA) the portion of projects located in Africa is significantly higher (at 20%) but most of these projects still need to start issuing Certified Emission Reductions (CERs).[5]

Most of the demand for CERs is still from the European Union Emission Trading Scheme (EU ETS). Since the end of 2012, EU ETS demand for new CDM projects is restricted to Least Developed Countries (LDCs). This offers unique EU ETS access for new CDM projects in 33 out of the 49 sub-Saharan Africa countries. However, given the current CER price below 1.0 EUR/CER,[6] the carbon project feasibility relies largely on limiting the CDM transaction costs.

1.3 STANDARDIZED BASELINES FOR OFF-GRID ELECTRIFICATION

Carbon finance should support access to sustainable electricity sources in sub-Saharan Africa by providing additional financial incentives. Developing carbon finance however is often time-consuming and expensive. CDM project developers traditionally develop project emission baselines and demonstrate project additionality on a project-by-project basis. This changes when baselines are standardized. Baseline standardization implies that baseline and additionality establishment are centralized independently of individual projects; and periodically updated and independently assessed by third parties. This can be done on a national or supra-national level, thereby saving time and effort for the development of individual CDM projects. Baseline emission factors for standardized baselines are developed as averages for a project type, technology or sector in one or several CDM host countries with similar social, economic, environmental and technological circumstances.

Recognizing this opportunity, the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) called for the development and use of standardized baselines at the 2010 Cancun Climate conference.

Standardized baselines, once approved, can also provide a carbon metric for new climate finance mechanisms under development at the UNFCCC, including New Market Mechanisms (NMMs), Nationally Appropriate Mitigation Actions (NAMAs), and/or Market and non-market mechanisms under the Framework for Various Approaches (FVA). This could allow governments and project developers in sub-Saharan Africa to access financing from climate funds or carbon markets.

[5] UNEP Risoe "CDM Pipeline Database" (2013); Institute for Global Environmental Strategies "IGES CDM Programme of Activities (PoA) Database" (2012)

[6] On the European Climate Exchange CERs for December 2013 were traded at EUR 0.57, www.theice.com, 29 July 2013.

1.4 STRUCTURE

This report starts with listing the most applicable off-grid electrification CDM methodologies (Chapter 2) to be used as a guideline when an off-grid electrification standardized baseline is applied in combination with these methodologies.

Chapter 3 elaborates on the approach for the establishment of an off-grid electrification standardized baseline. It also presents the results of a screening of data availability in countries in sub-Saharan Africa. Based on the results of the screening, 11 countries were selected for further analysis. Section 3.3 discusses the options for the establishment of additionality under an off-grid standardized baseline and section 3.4 defines the exact data requirements to establish a standardized baseline.

Chapter 4 proposes ways to comply with the procedure for updating a standardized baseline and Chapter 5 lists cost estimates for development and updates of standardized baselines. Overall conclusions, recommendations and outlook are presented in Chapter 6.

II. Off-grid electrification methodologies

The *Guideline* for the *Establishment of Sector Specific Standardized Baseline*[1] provides guidance on standardized baseline establishment and a generic calculation method. An approach to standardized baseline calculation can rely on this method or on the calculation methods proposed in approved methodologies, newly submitted methodologies or approved CDM tools.

This section explains how the standardized baseline calculation as described in the *Guidelines*, may yield higher emission reductions for some cases of off-grid electrification projects and why the calculation methods for baseline emissions described in the approved CDM methodologies AMS-I.A. and AMS-I.L. may yield lower baseline emissions.

2.1. METHODOLOGIES FOR OFF-GRID POWER GENERATION

Standardized baselines can be developed on the basis of an approved methodology, an approved tool, together with a newly submitted methodology or with the *Guidelines*. Once approved by the Executive Board (EB), the standardized baseline can be used by CDM project developers in the baseline and additionality sections of their Project Design Documents (PDDs). The standardized baseline then replaces the discussions on baseline scenario establishment, baseline emission (factor) calculation and the demonstration of additionality.

A standardized baseline that has been established by a certain tool or methodology can also be applied in CDM projects that make use of other methodologies or tools as long as the applicability of the approved standardized baseline justifies its use.

Before selecting the best approach for the establishment of the standardized baseline, it is necessary to determine which methodologies will benefit from it. The methodologies in which the standardized baseline will be used, to a large extent define the characteristics of the standardized baseline, and thereby also the best approach to its establishment.

AMS-I.A.[7] is an approved methodology which is most applicable to the targeted project activities or mitigation actions of the standardized baseline for rural electrification. AMS-I.A. applies to households without connection to electricity grids. The methodology also covers all types of renewable energy technologies for the decentralized generation of the power.

[7] Small Scale CDM Methodology: AMS-I.A. "Electricity generation by user" – Version 16.0

Another approved methodology that would benefit from this standardized baseline is AMS-I.L.[8], the applicability of which is extended to communities and applies to providing households, small businesses and public buildings with renewable off-grid power. Table 1 gives an overview of the applicability of these two methodologies.

Table 1: Applicability of AMS-I.A. and AMS-I.L.

Methodology	Title and version	Applicability
AMS-I.A	Electricity generation by the user — Version 16.0	Project supplies renewable electricity to individual or groups of households located in off-grid areas that lack connection to a grid or electricity, or which are connected but with very limited power supply. The renewable energy generation units include technologies like solar, hydro, wind, biomass gasification and other technologies that produce electricity all of which is used on-site or locally by the user (e.g. solar home systems, wind battery chargers). The renewable generating units may be new installations (Greenfield) or replace existing onsite fossil-fuel-fired generation. To qualify as a small-scale project, the total output of the unit(s) shall not exceed the limit of 15 MW.
AMS-I.L	Electrification of rural communities using renewable energy — Version 1.0	This methodology is applicable to electrification of a community achieved through the installation of new, renewable electricity generation systems (e.g. solar photovoltaic systems) that displace fossil fuel use, such as fossil fuel-based stand-alone power generators. The applicability of this methodology is limited to end use facilities and energy consumers that do not have access to any regional or national electricity distribution system or network before project implementation. End-users of the electricity may be households; public buildings; and/or small, medium and micro enterprises (SMMEs). At least 75% of the end-users must be households. To qualify as a small-scale project, the total output of the unit(s) shall not exceed the limit of 15 MW.

2.2 ELIGIBLE MEASURES, THEIR BASELINES AND ADDITIONALITY

The use of the standardized baseline will not be restricted to CDM projects that apply AMS-I.A. and AMS-I.L. but these two methodologies will guide the definition of the baseline and additionality. Another element where these methodologies provide guidance is on the definition of rural electrification projects that the standardized baseline should support. This definition is referred to as "eligible measures". This term takes into account that the standardized baseline could benefit both "project activities" under the CDM but also "mitigation measures" as foreseen under future mechanisms under the UNFCCC.

Table 2 describes the eligible measures, applicability criteria, approach to baseline identification and additionality demonstration for both methodologies AMS-I.A and AMS-I.L.

[8] Small Scale CDM Methodology: AMS-I.L. "Electrification of rural communities using renewable energy" – Version 1.0

Table 2. Applicability, baseline and additionality under AMS-I.A. and AMS-I.L.

	AMS-I.A.	AMS-I.L.
Eligible measures	Providing power from renewable energy sources to individual households and users who had no national or regional grid connection prior to the project.	Providing power from renewable energy sources to a group of end-users of which at least 75% are households who had no access to any electricity distribution system/network such as a national grid, regional grid prior to project implementation.
Applicable technologies	Solar, hydro, wind, biomass gasification and other technologies that produce electricity all of which is used on-site/locally by the user, e.g. solar home systems, wind battery chargers.	Renewable electricity generation systems (e.g. solar photovoltaic systems) that displace fossil fuel use.
Baseline calculation	Baseline emissions are calculated as power consumption multiplied with an emission factor (tCO_2e/MWh). For the emission factor: • Default value of 0.8 tCO_2e/MWh, which is derived from diesel generation units, may be used. • A small-scale project proponent may, with adequate justification use a higher emissions factor from Table I.F.1 under the category AMS-I.F "Renewable electricity generation for captive use and mini-grid". In case where the project activity displaces existing fossil fuel captive electricity generation, emission factor of the captive electricity generation shall be determined using Scenario B of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".	Three emission factor options (tCO_2e/MWh) are provided for different tranches of power consumed per crediting period: • 6.8 tCO2e/MWh below 55 kWh; • 1.3 tCO2e/MWh between 55 and 250 kWh; • 1.0 tCO2e/MWh above 250 kWh.
Additionality	According to the *Guidelines on the demonstrating of additionality of SSC project activities* (Previously referred to as "Attachment A of Appendix B to simplified modalities and procedures of small scale CDM project activities"). Or If eligible as micro-scale (CPA aggregated capacity below 5MW), off-grid renewable energy projects can be automatically deemed as additional using the *Guidelines for Demonstrating Additionality of Microscale Project Activities*[9] under paragraph 2 (b): *"The project activity is an off-grid activity supplying energy to households/communities"*	

Table 2 shows that both methodologies apply the same unit baseline emission factors, tCO_2/MWh, and use the same approach to additionality (the same tools for the demonstration of additionality). Thus the future standardized baseline can be applicable to both methodologies equally. For project development however, one should take into consideration the applicability criteria of each methodology depending on the project type and goals. It is noteworthy to mention that if a project's aggregated installed capacity is under 5 MW, it is considered as a microscale project and as an off-grid activity it can be automatically deemed additional.[9]

[9] The Guidelines for Demonstrating Additionality of Microscale Project Activities – Version 04.0

2.3 BASELINE ASSESSMENT AND ADDITIONALITY

2.3.1. Baseline identification/determination

A standardized baseline can be established through approved methodologies or tools, newly submitted methodologies or with the *Guidelines*. Table 3 shows that when using the *Guidelines*, the baseline emissions are likely to be higher than when using either AMS-I.A. or AMS-I.L. This is because the two methodologies mainly use default emission factors, which may result in less emission reductions from some project cases.[10] Higher baseline figures are advantageous for project developers since they result in more emission reductions and hence more sellable carbon credits.

Table 3. Off-grid electrification baseline scenarios AMS-I.A., AMS-I.L. and standardized baseline

<table>
<tr><th>Methodology</th><th>Baseline emission factor</th></tr>
<tr><td>AMS-I.A.</td><td>

The default baseline emission factor can be set at: 0.8 tCO_2/MWh or
An alternative is the use of conservative factors from Table I.F.1 “Emission Factors for diesel generator systems” under AMS-I.F.[11], where factors range from 0.8 to 2.4 tCO_2/MWh (for off-grid mini-grids), depending on the load factor and whether there is storage capacity.
Another alternative is applying the approach from scenario B of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”. This approach calculates the emission factor based on the actual power production and fuel consumption.

</td></tr>
<tr><td>AMS-I.L.</td><td>
This methodology applies default baseline emission factors based on the amount of electricity consumed per year.
<table>
<tr><th>Tranche of power consumption</th><th>Baseline emission factor</th></tr>
<tr><td>Below 55kWh/year</td><td>6.8 tCO_2/MWh[13]</td></tr>
<tr><td>Between 55-250kWh/year</td><td>1.3 tCO_2/MWh</td></tr>
<tr><td>Above 250kWh/year</td><td>1.0 tCO_2/MWh</td></tr>
</table>
</td></tr>
<tr><td>Standardized baseline</td><td>Most the diesel generators in sub-Saharan Africa are inefficient and have a Load Factor of 25% or even lower. This gives a baseline emission factor of around 1.7 tCO^2/MWh.[13] (Please note that this calculation is based on a stand-alone diesel generator, mini-grid systems from Table I.F.1 under AMS-I.F. may yield higher emission factors)</td></tr>
</table>

[10] The annual consumption of 55kWh is more or less equal to one medium efficient light bulb of 25W. The consumption level under AMS-I.L. for a group of households would most probably be higher than this level thus the applicable emission factor in most of the cases would be 1.0-1.3 tCO_2/MWh.

[11] Table I.F.1 from AMS-I.F., Emission Factors for diesel generator systems

[12] Tool to calculate baseline, project and/or leakage emissions from electricity consumption(Version 01)

[13] The estimated emission factor of 1.7 t CO_2/MWh is derived based on a 30kW diesel generator working with 0.25 of its load which generates 0.0075MWh electricity in one hour and emits 13.1 $kgCO_2$. This calculation is based on the IPCC emissions factor of diesel (74,100 kg/TJ), Net Calorific Value of 43 TJ/Gg, engine's fuel consumption rate of 4.83l/h and diesel density of 0.83kg/l. The source used for fuel consumption rate is: www.dieselserviceandsupply.com/Diesel_Fuel_Consumption.aspx. It should be noted that this baseline emission factor is solely based on the above mentioned assumptions. Surveys on off-grid diesel generation in sub-Saharan Africas may give other figures.

Further to benefiting from higher baseline emission factor in some project cases, another argument for the use of the *Guidelines* for standardized baseline establishment is that it allows for baseline standardization for electrification regardless of the technology used. This way, the baseline can be applied to most project mitigation activities or technologies for off-grid electrification, including photovoltaic, wind, renewable mechanical generators, hybrid systems etc.

In any case, the baseline information of registered CDM projects will have to be updated upon renewal of their crediting periods. This is independent of whether they opted for a baseline under the applied methodology or a standardized baseline.

2.3.2. Additionality

Additionality in a standardized baseline is defined ex-ante for specific technologies under a so-called positive list. Technologies deemed additional are determined through an additionality threshold rate that compares the baseline scenario technologies or business as usual practices with technologies with a lower share in the sector's annual output (e.g. comparing off-grid power generation through diesel generators as a common practice technology vs. solar power generation in sub-Saharan Africa). The EB has defined baseline and additionality thresholds per sector in the approved *Guidelines* to identify the boundary between technologies that are baseline or business as usual and technologies that are additional within a given sector. After passing specific steps (see Chapter 3), technologies that are deemed automatically additional without going through the process of additionality demonstration as explained in Table 2, are included in the positive list. In addition off-grid project activities with aggregated installed capacity below 5 MW can be deemed additional9. Therefore the positive list as a product of standardized baseline establishment may be only useful for project activities with aggregated installed capacity above 5 MW.

2.4 SUPPRESSED DEMAND AND OFF-GRID ELECTRIFICATION

In the CDM, baseline emissions are typically established against historic emissions or by comparison to what would have been built without the CDM. In some situations neither of these approaches applies. This is particularly the case in situations where users do not have access or cannot afford technologies that feature in the baseline. For instance users of a rural electrification project that did not have access to electricity prior to the project activity will have no baseline emissions. Objective emissions due to the implementation of the project seem only to increase. This does not represent a workable baseline scenario and basis for the calculation of the baseline emissions.

This issue can be addressed with the CDM concept of 'suppressed demand'. Suppressed demand is the situation where energy services provided are insufficient to meet the development needs of communities due to poverty or lack of access to technology.

The baseline emissions are determined as a combination of power consumption multiplied by a baseline emission factor. In the context of a suppressed demand calculation it is useful to separate these two elements.

For many rural electrification projects, historic power consumption is obviously zero. Taking into account the suppressed demand, the baseline emissions can be calculated based on the actual consumption of electricity in the project scenario. In other words, the standardized baseline would assume that the amount of electricity actually consumed after project implementation is the same amount that would have been consumed without the project.

This assumption is already an integral part of the two selected methodologies. In both AMS-I.A and AMS-I.L. one may assume that the baseline electricity consumption is equal to the electricity consumption in the project scenario. In concrete terms this means that the monitored amount of power consumed by the project is the basis for the calculation of the baseline emissions.[14]

The second element of a baseline emission level is the emission factor, or in the case of electrification projects, the amount of CO^2 equivalents emitted per kWh consumed. The amount of CERs generated by renewable energy projects is typically determined against the carbon intensity of the national power grid, the grid emissions factor. For community level electrification projects in remote areas, a grid connection is generally not a feasible option. When installing off-grid electricity solutions for small business and households in sub-Saharan Africa fed with locally generated renewable energy, a more likely baseline scenario would be the installation of a diesel generator. In most countries in sub-Saharan Africa, the baseline emissions of such a scenario are well above the grid emissions factor of that country. Many countries in sub-Saharan Africa have already a high share of renewable energy on their grid (e.g. by constructing large scale hydropower plants).

The rationale of suppressed demand is incorporated in both AMS-I.A. and AMS-I.L. The electricity in the baseline scenario would be generated with the most common off-grid power generation practices in the country. For most off-grid power generation that would be stand-alone diesel generators, which is among the most carbon-intensive technologies available. Also on the element of the carbon emission factor, the notion of suppressed demand is integrated in both methodologies as the assumption that without the project households, public services and small businesses would adopt diesel generators, even though that is not what they used prior to project implementation.[15]

[14] TAMS-I.A. allows for more baseline consumption options including the historic trend in fuel consumption (when an existing technology is replaced, e.g. efficient lighting projects) and the use of the average annual individual energy consumption observed in closest grid electricity systems among rural grid connected consumers.

[15] "Identification of baseline technology/measures" in the Guidelines on the Consideration of Suppressed Demand in CDM methodology – Version 02.0

III. Standardized baseline establishment

This section elaborates on the elements required for the establishment of a standardized baseline. It concludes that lack of data on off-grid electrification is one of the main barriers against standardized baseline development in countries in sub-Saharan Africa. A detailed data assessment of countries showed that although they all lack detail off-grid data for the assessment and development of a standardized baseline, six countries may be initially grouped for a regional off-grid electrification standardized baseline. These countries are Mali, The Gambia, Kenya, Nigeria, Ethiopia and Tanzania. Due to the potential high portion of diesel generation in annual off-grid (combined mini-grid and decentralized) electricity generation in sub-Saharan Africa, off-grid renewable technologies can easily be included in the additionality positive list.

For the development of a standardized baseline, the following elements must be defined:

- **Host country data availability:** Determine the host country to develop a standardized baseline, mainly based on data availability;
- **Sector, output and measure:** Identify the target sectors, output and measures;
- **Positive list and additionality:** Establish additionality criteria for the identified measures (e.g. positive lists of fuels/feed stocks and technologies);
- **Data requirement:** Identify the baseline for the measures (e.g. baseline fuel, technology, level of GHG destruction);
- **Standardized baseline determination:** Determine the baseline emission factor where relevant.

Each of these elements is discussed in the following sections 3.1 to 3.5.

3.1 HOST COUNTRY DATA AVAILABILITY

Data availability is an important determinant for standardized baseline development. All sub-Saharan African countries have been screened on data availability. The selection of countries from the initial data availability screening has been assessed in more detail in Annex I, based on which a final selection of six countries was made.

In sub-Saharan African countries the information on decentralized off-grid data is often combined with mini-grid or isolated off-grid data. This is caused by differences in the definition of "off-grid". The development of standardized baselines requires harmonization of the definitions and terminology used for data gathering. In some countries this might require additional data collection effort. See Annex I under "Data quality" and "Recommendations to Conduct Off-grid Surveys in Africa".

In remote rural areas of sub-Saharan Africa the use of renewable technologies such as solar photovoltaic systems are popular off-grid technologies. In some cases they are even more common than diesel generators.

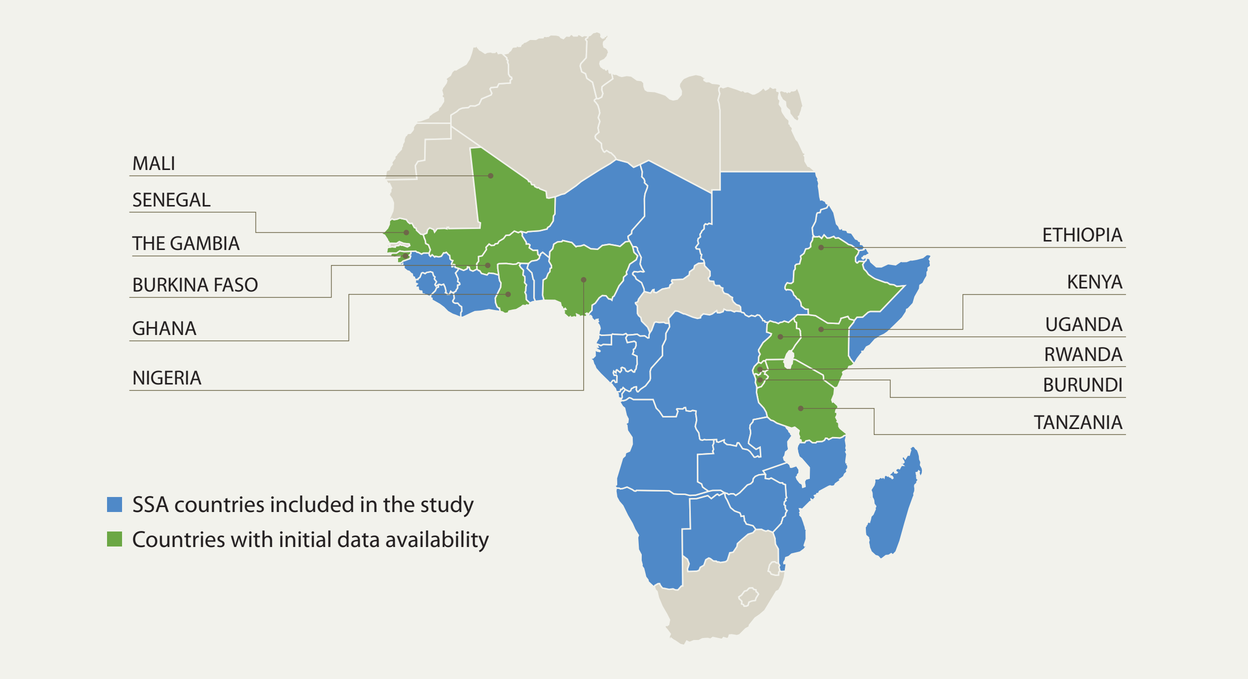
3.1.1. Initial data availability screening

All countries in sub-Saharan Africa have been screened on their ability to participate in the development of a grouped standardized baseline. The most important participation criterion in this study was the availability of background off-grid data. In addition to off-grid data the following relevant information was collected:

- Rural electrification rates and size of the population without access to electricity;
- The number of CDM and PoA projects in the country, as one of the goals of increased standardization is to facilitate access to carbon finance, and scale-up the abatement of greenhouse gas (GHG) emissions, while ensuring environmental integrity.

Twenty-one countries lacked data on off-grid power generation and were not considered for further assessment. Twelve countries (Figure 2) had limited data on off-grid power generation, generally on a mix of decentralized, mini and isolated grids. These countries were subject to a more detailed data availability and quality assessment. The results of the initial data availability screening can be found in Annex I.

Figure 2: Map showing focus countries with initial data availability for further data investigation



3.1.2. Detailed data availability assessment

A key piece of information for the establishment of standardized baselines is the share of off-grid power generated by specific baseline technologies. This information allows for the definition of a baseline threshold and subsequent additionality positive list for technologies applied in CDM projects and mitigation actions. Table 10 in Annex I provides further details on the power situation in the twelve selected countries.

3.1.3. Final selection

Diesel generation can be determined as being the default technology for the baseline scenario of the standardized baseline if the annual portion of off-grid power generation through diesel generators is at least 80% (Figure 3). Six of the twelve countries met this criteria (Table 4) providing a basis for the development of a grouped standardized baseline with diesel generation as the baseline technology. Still, there are probably more countries in sub-Saharan Africa where more than 80% of their off-grid power is generated with diesel generators but there is no data of sufficient reliability available to substantiate this claim. In addition, the use of renewable energy sources is gaining popularity in some areas, indicating that the share of diesel generation in the energy mix might be decreasing in some countries.

The countries where data availability substantiates that diesel generation is a realistic baseline are Ethiopia, the Gambia, Kenya, Mali, Nigeria and Tanzania (Figure 3). However, for all sub-Saharan Africa countries the data will need to be verified to confirm that definitions of concepts like off-grid, mini-grid and grid connected have been applied in a consistent manner for the collection of data.

Figure 3: Countries with higher and lower baseline portions vs. the baseline threshold (Y_b=80%)[16]

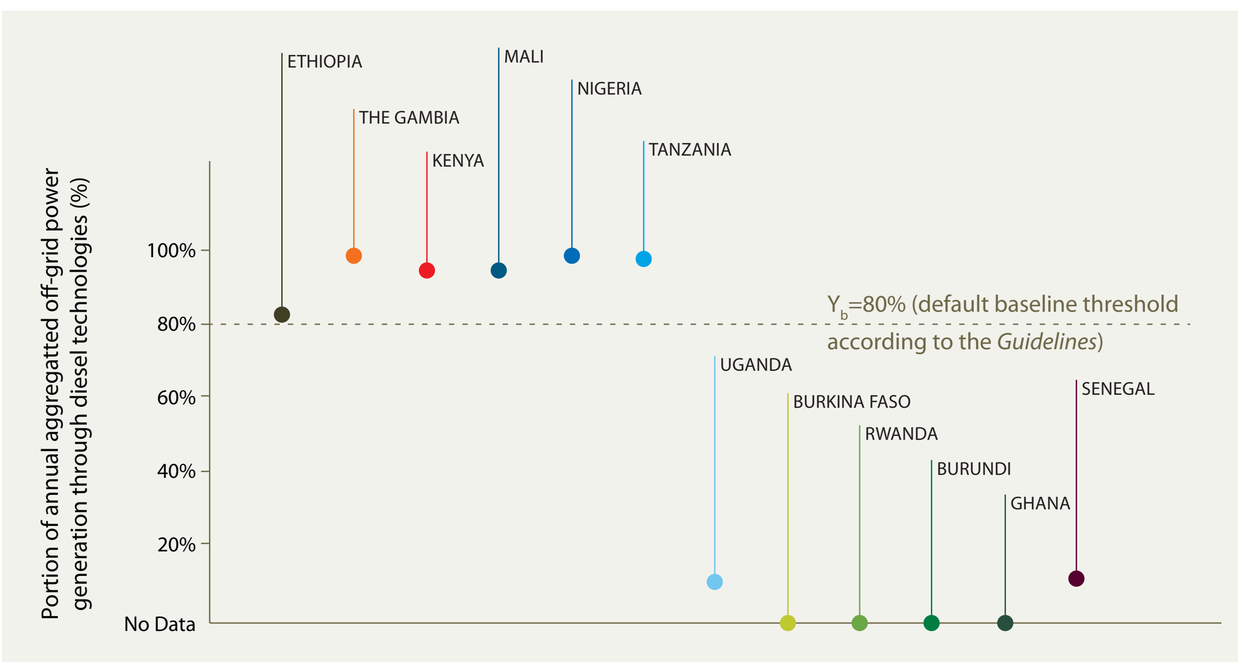


Table 4. Off-grid power generation by diesel generators in the six selected countries

Country	Portion of off-grid power generated by diesel generation technologies
Mali	96%
The Gambia	100%
Kenya	96%
Nigeria	100%
Ethiopia	84%
Tanzania	99%

3.2 SECTOR, OUTPUT AND MEASURE

Specific features of the standardized baseline need to be defined when following the Guidelines. These are sector, output and measure.

3.2.1. Sector

Sector is a segment of a national economy that delivers defined output(s) (e.g. clinker manufacturing, domestic/household energy supply). The sector is characterized by the output(s) it generates; the specific sector in this standardized baseline assessment is off-grid rural electrification that delivers kWh of electricity to households, small and medium enterprises (SMEs). This excludes power delivered to grid connected and/or mini grids.

3.2.2. Output

Output are goods or services with comparable quality, properties, and application areas (e.g. clinker, lighting, residential cooking). The output is off-grid generated electricity, measured in kWh.

3.2.3. Measure

For emission reduction activities, a broad class of GHG emission reduction activities possessing common features exists. Four types of measures are currently covered by the standardized baseline framework:

- Fuel and feedstock switch;
- Switch of technology with or without change of energy source (including energy efficiency improvement);
- Methane destruction;
- Methane formation avoidance.

The measure for this assessment is defined as "Switch of technology with or without change of energy source (including energy efficiency improvement)".

3.3 POSITIVE LIST AND ADDITIONALITY

Standardized baseline determination also requires defining a positive list of technologies that are deemed additional.

Nevertheless, as was demonstrated in section 2.2, most renewable technologies for off-grid activities may already be deemed additional as long as they fall under microscale project criteria (i.e. aggregated installed capacity below 5 MW).[9] Yet, in the case of larger project activities with aggregated installed capacity above 5 MW, the following instruction for establishing the positive list may apply. According to the *Guidelines*, the positive list can be determined by the following three steps:

1. The cumulative percentage of off-grid power output (Oi) in MWh produced based on technology *i* shall be arranged in descending order of carbon intensity of the technologies as reported by the IPCC;

2. Technologies that have lower greenhouse gas intensity than the technology(ies) that produce aggregately more than the threshold percentage and are commercially less attractive are deemed as additional. This additionality threshold is called Ya% in the *Guidelines* and is equal to 80% for the defined sector. In the example in Figure 4 the output portion of 80% with the highest carbon intensity is used to identify the additional technologies: any technologies not included in the 80% highest carbon intensity outputs can be considered for the positive list and would be automatically additional.

3. Technologies are deemed less commercially attractive if their cost per unit of output (e.g. EUR/MWh) is higher than that of all technologies used to produce off-grid power aggregately more than 80% of the output(s) Oi of the sector, and (a) There is no national or sub-national enforced regulation mandating the use of these technologies; (b) The Board clarifications on the consideration of national and or sectoral policies and circumstances in baseline scenarios is taken into account. The price per unit of output for each technology can be calculated as follows:

$$PO = C_{O\&M} + \left(\frac{C_{Capital}}{PLT} \right)$$

Where:

PO = Price per output (e.g. USD/MWh)

$C_{O\&M}$ = Annual operation cost per MWh (USD/MWh)

$C_{Capital}$ = Average investment cost (USD)

PLT = Total power generation in the technologies lifetime (MWh)

Any technology with a *higher price per output* than the price per output of the baseline technology is eligible for the positive list, provided that its use is not mandated by law.

Figure 4: Determination of the additionality, positive list and the standardized baseline[17]

In the example in Figure 4 the diesel generators comprise 85% of the off-grid power generation in a country. This is more than the additionality (Y_a) and baseline (Y_b) thresholds of 80%. The remaining 15% is generated through hybrid systems, wind and solar. All the technologies are listed in order from the most carbon intensive (Diesel) to the least (Solar).

The defined Ya% as per the *Guidelines* for the sector is 80% which means that all technologies listed on the right hand side of the baseline technology threshold can be included in the positive list when they pass the commercial analysis and country regulations demonstration.

3.4 DATA REQUIREMENTS

Besides the off-grid data and parameters used in the detailed country assessment in 3.1, for the establishment of the positive list and actual determination of the baseline there are commercial factors and sector-specific requirements. As established in the *Guidelines*, the data should be taken from the most recent three years for which data is available. Table 5 is a template that shows the data required. The commercial information per unit of output is necessary to ensure that technologies in the Positive List are less commercially attractive than the baseline technologies.

Table 5 has two sections. One lists the data or information required for the determination of the standardized baseline and the second lists the commercial information required to define additional technologies to be included in the positive list.

[17] Climate Focus 2013

Table 5. Proposed data template for standardized baseline establishment

Required data and information for baseline determination and additionality positive list	
Baseline determination Off-grid data	Total installed off-grid power capacity (MW)
	Annual off-grid power generation (MWh)
	Portion of off-grid power generated by different technologies in the baseline (%)
	Emission factor of the off-grid power generation in the baseline by different technologies (tCO_2/MWh)
Additionality/positive list Price per unit of Output for each technology	Annual operation and maintenance cost of off-grid power generation through each technology ($/MWh)
	Average Investment Cost for installed off-grid power capacity for different technologies ($/MW)
	Average lifetime output per MW installed power for different technologies (MWh/MW)

3.5 BASELINE DETERMINATION

The baseline threshold indicator Y_b%[18] (different from Y_a that is used in the context of the positive list) is used to identify the baseline technologies. If captive diesel generators make up to 80% or more of the off-grid power output in the country, diesel generators will be set as the baseline technology (see Figure 4).

Referring to the example in Figure 4, diesel generators comprise of almost 85% of the annual aggregated off-grid power generation in a country. They can thus be considered as the technology that would have been used in the baseline scenario for the rural off-grid electrification standardized baseline. In this example, the baseline will be the emission factor of the off-grid power generation through diesel generators.

[18] Y_b% = 80% for the defined sector according to Appendix I in the *Guidelines for the Establishment of Sector Specific Standardized Baselines*

IV. Standardized baseline submission and updating procedures

This section describes the procedure for the periodic updating of the standardized baseline. It concludes that new guidance and updates from the Executive Board are expected.

4.1 SUBMISSION PROCEDURES

Once a standardized baseline is designed, it would need to be submitted and approved according to the *"Procedure for the submission and consideration of standardized baselines"* [19]. The first step is the submission to the DNAs of all the Parties for which the standardized baseline is proposed. Once they all give their approval, any one of the DNAs can submit the proposed standardized baseline, all additional documentation and an assessment report[20] conducted by a Designated Operational Entity (DOE) to the UNFCCC. However, a concept note by the CDM Executive Board, '*Further revision of the standardized baseline regulatory framework*' [21] states that proposed guidelines for the rules and requirements for application for standardized baselines are in progress, thus the submission procedure may be revised in the future.

4.2 UPDATING PROCEDURES

The datasets used for establishing a standardized baseline for rural electrification should be updated every three years with the most recent data available, according to Annex 1 of the *Guidelines*. Most important for updating the standardized baseline is a consistent approach, meaning that the data delivery protocol, compiling methods, assumptions and relevant calculations should be documented and consistent between updates. A concept note by the CDM EB, *'Further revision of the standardized baseline regulatory framework'* states that proposed 'guidelines on data vintage and frequency of update of standardized baseline' are in progress to determine sector-specific updating procedures that take trends in the development of that sector, variability of the parameters used in the establishment of the standardized baseline, data availability and other sector-specific considerations into account. Future work on standardized baseline development should monitor developments on these intended revisions.

Once the most recent data is collected and used to update the standardized baseline, the next step will be the resubmission of the new datasets and updated standardized baseline to each DNA of the countries in the group for their approval, as well as the DNA's submission of the update to the CDM EB.

Finally, the CDM EB is preparing a concept note on 'the cost and efficiency of technologies' that states a database for the parameters needed on the efficiency of technologies and the cost of technologies will be developed to minimize the data requirements of a standardized baseline, which will streamline future updates of the standardized baseline.

[19] Procedure for the submission and consideration of standardized baselines - Version 02.0

[20] For a Party with 10 or fewer registered CDM project activities as of 31 December 2010, the assessment report may be omitted in up to the first three submissions of a proposed standardized baseline regardless of the sector for the Party. This exception shall not apply if the submission is made for a group of Parties.

[21] Further revision of the standardized baseline regulatory framework - Version 01.0

V. Effort for Standardized Baseline development and updating

Developing a standardized baseline and taking care of its regular updating for one country requires between 20 to 25 days of work per year over the first 20 years of standardized baseline development. The datasets used for establishing a standardized baseline for rural electrification should be updated every three years with the most recent data available.

Table 6 lists the various activities that are required for the establishment of a standardized baseline for a country or grouped standardized baseline, and the estimated effort associated with these activities in days of work. Table 7 provides an overview of the aggregates.

Table 6. Estimated cost of standardized baseline development and updates (Part I)

Task	Estimated effort per standardized baseline per country (Days of work)	Estimated effort per regional or grouped standardized baseline[22] (Days of work)	Responsible party	Comments
Needs Assessment	5-10	30-60	Baseline/MRV Consultant	First standardized baseline development
	Activities: Inquiries at utilities, government energy departments and other related institutions to locate sources for data collection and conducting surveys			
Country Surveys and off-grid data collection	30-40	180-240[23]	Baseline/MRV Consultant	First standardized baseline development and every 3 years
	Activities: Surveys to collect off-grid data/information for the establishment of the positive list and standardized baseline determination. The survey(s) should follow the latest CDM guidelines on surveys.			
Final Research, Calculations and Report drafting	15-20	45-60	Baseline/MRV Consultant	First standardized baseline development and every 3 years
	Activities: Data gap analysis, calculation and analysis required to define the positive list and the standardized baseline and drafting the standardized baseline report.			

[22] For the six selected countries.

[23] Knowing that diesel generators for scattered off-grid purposes more or less have similar features, it may be possible to sample diesel generators among a group of countries instead of per country.

Table 6. Estimated cost of standardized baseline development and updates (Part II)

Task	Estimated effort per standardized baseline per country (Days of work)	Estimated effort per regional or grouped standardized baseline[22] (Days of work)	Responsible party	Comments
Submission to the DNA(s)	1-2	1-2	DNA	First standardized baseline development and every 3 years
	Activities: Submission of the standardized baseline to the DNA(s) for their initial approval			
DOE assessment report and submission for EB approval[24]	10	20	DOE/DNA	First standardized baseline development and every 3 years
	Activities: Performing an assessment report on the standardized baseline establishment, quality of the data collection, processing and compilation to establish the proposed standardized baseline in accordance with the *Guidelines for quality assurance and quality control of data used in the establishment of standardized baselines*[25], submission of the standardized baseline together with the assessment report to the EB by the DNA(s).			
Updating	10-15	60-90	Baseline/MRV Consultant	Once every 3 years
	Activities: Updating the standardized baseline including check up on off-grid data/information in the host countries and performing new surveys when need be.			

A survey and sampling approach that is harmonized between countries may reduce costs associated with data collection. A grouped standardized baseline developed with regional coordination (e.g. possibly a collaboration among: DNA offices, UNFCCC East and West Africa Regional Collaboration Centers, UNDP, UNEP, World Bank, African Development Bank etc.) can benefit from these economies of scale.

Table 7. Off-grid power generation by diesel generators in the six selected countries

Task	Estimated effort per standardized baseline per country (Days of work)	Estimated effort per regional or grouped standardized baseline for six countries (Days of work)
Standardized baseline development (first time)	61 - 82	276 - 382
Standardized baseline updates (once every three years)	51 - 67	261 - 352
Standardized baseline for 20 years	20 – 25 days per year	90 – 125 days per year

[24] Accredited Designated Operational Entities (DOEs) at UNFCCC: http://cdm.unfccc.int/DOE/index.html

[25] Guidelines for quality assurance and quality control of data used in the establishment of standardized baselines – Version 01.0

VI Conclusions and recommendations

6.1 CONCLUSIONS

The development of standardized baselines can enhance a project's access to the CDM and make the outcome of the CDM registration, monitoring and verification process more predictable. Since a standardized baseline defines a baseline emission level with national endorsement it can also support the development and participation in future mechanisms under the UNFCCC.

- Not all countries in sub-Saharan Africa are equally suitable for the development of a standardized baseline. The amount of data available for standardized baseline establishment and additionality determination and the level of homogeneity in the off-grid power situation is sufficient in six countries: Mali, The Gambia, Kenya, Nigeria, Ethiopia and Tanzania. However, data quality in these countries should be verified, in particular in relation to the definition of off-grid. This confirms the need for further capacity building in sub-Saharan African countries to support broad development and application of baseline standardization.

- The approach used for standardized baseline development can differ from the approach employed by the CDM methodologies in which the standardized baseline can be applied. The approach for standardized baseline development can be based on the *Guidelines*, which in some cases may yield higher baseline emissions and subsequently higher emission reductions compared to the use of available methodologies.

- The main methodologies in which the standardized baseline for rural electrification can be applied are AMS-I.A. and AMS-I.L.

- Off-grid renewable technologies can easily be included in the positive list or where applicable refer to the microscale additionality tool to be deemed automatically additional. This is due to the high share of diesel generation in the energy mix for off-grid electricity generation.

- Developing a standardized baseline and its regular updating for one country requires between 20 and 25 days of work per year over the first 20 years of standardized baseline development and application. The figure for a regional or grouped standardized baseline development that includes six countries is between 90 and 125 days of work per year.

6.2 RECOMMENDATIONS

The following recommendations apply to the development of a standardized baseline for rural electrification with renewable energy in off-grid areas in countries in sub-Saharan Africa:

- The emission reduction potential of these projects may be optimized by using the calculation method provided in the *Guidelines* as basis for the calculation of the baseline emissions.

- The most suitable methodologies for the targeted rural electrification approach are AMS-I.A. and AMD-I.L. Standardized baseline development should therefore target these two methodologies as the main beneficiaries. However, the eligibility of the standardized baseline should be defined such that the applicability extends beyond these two methodologies, to include also CDM methodologies that will be adopted in future.

- In some cases, methodologies AMS-I.A. and AMS-I.L. may still offer larger baseline emission factors compared to a standardized baseline that is developed following the *Guidelines*. It is recommended to keep the use of the standardized baseline voluntary.

- Suppressed demand plays an important role for electrification projects in sub-Saharan Africa. In both methodologies AMS-I.A. and AMS-I.L., suppressed demand concepts are already sufficiently incorporated through the use of a counterfactual baseline scenario that is not necessarily based on historic consumption levels. The standardized baseline should apply a similar approach.

- Standardized baseline determination also requires defining a positive list of additional technologies. The technologies listed on such a list are automatically additional under certain conditions. The analysis shows that off-grid generation with small diesel generators is possibly the baseline technology in most of Africa and most renewable energy technologies can be included in the additionality positive list. In cases where the aggregated installed capacity of the off-grid technology is below 5MW, the application of microscale additionality tool should also be considered.

6.3 NEXT STEPS

- The opportunities for standardized baseline development in sub-Saharan Africa countries are largely defined by the availability of data. Therefore it is recommended to firstly ensure data availability and quality, including in the six countries that were shortlisted for standardized baseline development. In addition, DNAs from the other sub-Saharan Africa countries should be supported to implement field surveys and improve their data situation. This will allow for an expansion of the standardized baseline to include more countries at a later stage. By developing grouped standardized baselines for a number of countries in parallel, its development can benefit from economies of scale.

- Standardized baseline development can be implemented in two phases, starting with the six countries where initial data availability is proven, to be complemented in the second round with countries that succeed in collecting the required data before a certain deadline. The templates for data collection and approach defined in this study can guide countries with data collection, providing for the harmonization that is needed to allow for standardized baseline development in a large number of sub-Saharan Africa countries in parallel. In addition, a clear definition of off-grid is needed to ensure that data collection in different geographies is supported by consistent terminology.

- Finally, the DNAs from sub-Saharan Africa countries can use the development and application of standardized baselines to support harmonization of approaches on climate change mitigation in the region. A harmonized metrics for baseline establishment and additionality for electrification projects throughout the sub-Saharan Africa region can provide a basis for results-based-payments for climate mitigation activities. That would make the region more attractive to international climate finance and may provide a basis for the deployment of regional carbon mechanisms under any of the frameworks currently under development by the UNFCCC.

Annex I: Data availability screening

INITIAL DATA AVAILABILITY SCREENING

The results of the initial data availability screening are presented in Table 8.

Table 8. Initial data availability screening results[26] (Part I)

Nr.	Country	Population without access to electricity (millions)	National electrification rate %	Rural electrification rate %	CDM/PoA Projects in the pipeline[27]	Off-grid data availability for standardized baseline establishment? Yes/No/Probably	Selected for detailed analysis? Yes/No
1	Angola	11	40	8	5/1	No	No
2	Benin	7	28	7	0/0	No	No
3	Botswana	1.1	45	10	0/0	No	No
4	Burkina Faso	13	15	10	0/1	Probably	Yes
5	Burundi	N/A	N/A	N/A	3/3	Yes	Yes
6	Cameroon	10	49	14	4/0	No	No
7	Chad	N/A	N/A	N/A	0/3		No
8	Congo, Rep.	2.4	37	10	0/0	No	No
9	Côte d'Ivoire	9	59	32	6/4	No	No
10	DR of Congo	58	15	4	8/4	No	No
11	Eritrea	4	32	17	0/0	No	No
12	Ethiopia	65	23	11	3/4	Yes	Yes
13	Gabon	0.6	60	34	0/1	No	No
14	The Gambia	1.4	19	N/A	0/0	Yes	Yes
15	Ghana	10	61	35	7/10	Yes	Yes
16	Kenya	34	18	5	35/35	Yes	Yes
17	Lesotho	1.7	17	7	5/0	No	No
18	Madagascar	17	17	8	2/2	No	No
19	Malawi	13	9	2	0/12	No	No
20	Mali	12.6	27	N/A	2/0	Yes	Yes

[26] Data for population lacking access to electricity and electrification rates sourced from IEA, World Energy Outlook 2012 Electricity Database and Kappiah, M. "RE Regulations and Market Development in West Africa," (2012). "N/A" refers to a lack of data.

[27] CDM / PoA project data sourced from UNEP RISO Pipeline, accessed Jun 19, 2013

Table 8. Initial data availability screening results[26] (Part II)

Nr.	Country	Population without access to electricity (millions)	National electrification rate %	Rural electrification rate %	CDM/PoA Projects in the pipeline[27]	Off-grid data availability for standardized baseline establishment? Yes/No/Probably	Selected for detailed analysis? Yes/No
21	Mauritius	0.01	99	99	3/0	No	No
22	Mozambique	20	15	2	4/0	No	No
23	Namibia	1.2	44	23	2/0	No	No
24	Nigeria	79	50	23	17/12	Yes	Yes
25	Senegal	6	54	32	6/8	Yes	Yes
26	South Africa	12	76	56	101/123	No	No
27	Sudan	28	36	28	3/0	No	No
28	Tanzania	38	15	4	11/6	Yes	Yes
29	Togo	5	28	8	1/4	No	No
30	Uganda	29	9	3	18/20	Yes	Yes
31	Rwanda	N/A	N/A	N/A	4/9	Yes	Yes
32	Zambia	11	19	2	5/6	No	No
33	Zimbabwe	8	37	11	1/0	No	
34	Other Africa	96	13	4	–	–	No
	Sub-Saharan Africa	**604**	**31.8**	**12.9**			

Sources: Sustainable Energy for All (SE4All) gap analyses[28]; Club ER[29]; IRENA fact data sheets[30]; data from relevant rural electrification agencies, utilities, the Alliance for Rural Electrification[31], the ECOWAS centre for Renewable Energy and Energy Efficiency (ECREE)[32], and earlier work by the consultants on rural electrification

Last column in Table 8 indicates which countries were selected for the detailed assessment. In total twenty one countries showed no off-grid data availability thus were not considered for further assessment.[33] Only twelve countries showed initial sign on off-grid data availability and were considered for detailed data availability assessment.

[28] Sustainable Energy for All website, Country Actions, visited July 2013

[29] Club ER ressources, visited July 2012

[30] International Renewable Energy Agency, publication and reports website, last visited July 2013

[31] Alliance for rural electrification website, last visited July 2013

[32] ECOWAS centre for renewable energy and energy efficiency website, last visited July 2013

[33] Please note that at this stage, data collection was mainly through desk research on publicly available information and communication through relevant contacts within countries' energy sector authorities where possible. Please see Annex for details.

Table 9. Detailed country analysis on countries that passed the initial data availability screening. (Part I)

Country	Total installed off-grid power capacity (MW)	Annual off-grid power generation (MWh)	Installed Thermal Off-Grid Capacity (MW)	Annual amount of fuel oil and/or diesel used for off-grid generation Litres	Portion of off-grid users that can be considered as households	Portion of off-grid power generated by conventional technologies such as captive diesel generators (%)	Sources
Kenya	19.62	308,000	18.92	22,955,367	80%	96%	• Kenya Power. Annual Report and Financial Statements 2011-2012. 2012 – p. 104. Email communication with REA
Tanzania	52.07	–	51.47	65,276,947	–	99%	• EWURA. Annual Report for the year ended 30th June 2010. 2010 – p. 22-23 • List of Tanzania's SPPs, Document as presentation
Uganda	28.49	–	3.00	3,804,756	–	11% (the result is not accurate due to lack of raw data on off-grid electrification)	• Office of the Primer Minister. Government annual performance report 2011/2012 • Zimmerman, Charles *et al*. East Africa Clean Energy Assessment. Confidential report prepared for USAID by Nexant, Inc under Contract No. EPP-I-04-03-00007-00. April 2011. and, • Uganda Grid Emission Factor (GEF) 2013, Climate Focus 2013
Rwanda	75	–	–	–	–	–	• EWSA. Energy Water Sanitation on the move, Issue 5. September-December 2012 – p. 10 • Zimmerman, Charles *et al*. East Africa Clean Energy Assessment. Confidential report prepared for USAID by Nexant, Inc under Contract No. EPP-I-04-03-00007-00. April 2011
Burundi	10.52	–	–	–	–	–	• Minister for Energy and Mines. Investment opportunities in Renewable Energy Burundi. 2012 – p. 22, 25 • Zimmerman, Charles *et al*. East Africa Clean Energy Assessment. Confidential report for USAID by Nexant, Inc No. EPP-I-04-03-00007-00. April 2011

Table 9. Detailed country analysis on countries that passed the initial data availability screening. (Part II)

Country	Total installed off-grid power capacity (MW)	Annual off-grid power generation (MWh)	Installed Thermal Off-Grid Capacity (MW)	Annual amount of fuel oil and/or diesel used for off-grid generation Litres	Portion of off-grid users that can be considered as households	Portion of off-grid power generated by conventional technologies such as captive diesel generators (%)	Sources
Ethiopia	37.38	–	31.23	39,607,520	–	84%	• Ethiopia Fact and Figures 2010 - EEPCO website as accessed on 25/2/2011: Facts and figures 2010
Nigeria	274.50	–	274.50	348,135,263	–	100%	• Detail Commercial Solicitors. Nigeria Power guide - volume 1. 2012 • Bureau of Public Enterprises. Electric power investors forum, presentation • Ecowrex website as accessed on July 2013
Ghana	3.20	–	–	–	–	–	• Ministry of Energy. National Energy Policy. 2009 • Ministry of Energy website as accessed on July 2013
Senegal	47.20		5.67	7,195,449	–	12% (the result is not accurate due to lack of raw data on off-grid electrification)	• Ecowas observatory for renewable energy and energy efficiency - July 2013 • Senelec website as accessed on July 2013
Mali	27.00	40,000	25.92	32,873,100	90%	96%	• African Development Bank - SREP Mali Investment Plan – Scaling up Renewable Energy. 2011 • Information from AMADER
The Gambia	13.10		13.10	16,614,105	-	100%	• NAWEC. 2011 Annual Report. 2011
Burkina Faso	–	–	–	–	–	–	• REEEP Policy Database - Burkina Faso 2013 • Reegle website as accessed on July2013

DETAILED DATA AVAILABILITY ASSESSMENT

Table 10 provides further details on the power situation in the 12 selected countries.

Table10. Detailed data availability assessment on 12 selected countries.

Country	Total installed off-grid power capacity (MW)	Annual off-grid power generation (MWh)	Annual amount of fuel oil and/or diesel used for off-grid generation (Litres)	Portion of off-grid users that can be considered as households (%)	Portion of off-grid power generated by diesel generation technologies (%)
Uganda	28.49	–	3,804,756	–	96%[34]
Burkina Faso	–	–	–	–	Not Available
Kenya	19.62	308,000.00	24,000,407	80%	96%[35]
Tanzania	52.07	–	65,276,947	–	99%[35]
Rwanda	0.75	–	–	–	Not Available
Burundi	10.52	–	–	–	Not Available
Ethiopia	37.38	–	39,607,520	–	84%[35]
Nigeria	274.50	–	348,135,263	–	100%[35]
Ghana	3.20	–	–	–	Not Available
Senegal	47.20	–	7,195,449	–	12%[34]
Mali	27	40,000.00	32,873,100	90%	96%[35]
The Gambia	13.10	–	16,614,105	–	100%[35]

[34] The rate within the country may be higher than 80% in practice, the calculated rate is based on the available data from sources that were not up to date and not necessarily had the statistics on all scattered off-grid power generators.

[35] This rate was collected from off-grid sources that often had different definitions for off-grid power generation (e.g. mini off-grid, isolated, captive, etc.) thus dedicated standardized baseline surveys are recommended for concrete results.

DATA QUALITY

The credibility of the sources of data used and the responsiveness of the in-country contacts has also been considered. Data used for the assessment in was considered credible if the following requirements were met:

- The data available is from 2012 or later,
- Data obtained is confirmed by relevant authorities in the country

For Kenya, Mali and the Gambia, the most recent off-grid data have been obtained from sources such as the latest published Annual reports from utility companies, direct correspondence from relevant authorities in the Ministries of Energy and Rural Electrification Authorities. Notably, consultants were informed that the Gambia intends to carry out a survey on the off-grid systems used in the country in order to capture data on the capacity and the types of generators that are run by private owners.

Tanzania, Nigeria, and Ethiopia's data are based on older reports from 2010 or earlier. The consultants have been in touch with officials in the relevant ministries and offices but have not been able to access more recent information.

It should be noted that although for these countries, national off-grid generation data was obtained from credible sources, the definition of the term 'off-grid' may not necessarily be consistent with that referred to in this assessment. While this assessment focuses on scattered diesel generation off-grid data, the information on off-grid generation obtained for a majority of the countries e.g. Kenya, The Gambia, Tanzania and Ethiopia most likely includes mini-grid or isolated grid power stations that are run as part of rural electrification initiatives. These power stations run primarily on diesel fuel. The collected data was presented in this assessment as proxy since data on off-grid scattered diesel generation is often non-existent and for the majority of these countries surveys will be necessary to obtain data that is accurate, credible and most recent.[36]

On the other hand data on kerosene for lighting is largely available. However off-grid lighting was excluded from the scope of the study since the study focuses on rural off-grid electrification.

[36] Taking Kenya as an example, although the country is fairly advanced in the East African region, for the inclusion of back-up generators in a CDM GEF calculation, a survey costing about USD 25k was needed since off-grid data –for scattered diesel generators- was not available.

OFF-GRID DEFINITION IN SUB-SAHARAN AFRICA

The definition of the term 'off-grid' may not necessarily be consistent with the one referred through this study. While the assessment focuses on scattered diesel generation off-grid data, the information on off-grid generation obtained for a majority of the countries e.g. Kenya, The Gambia, Tanzania and Ethiopia, most likely includes mini-grid or isolated grid stations that are run as part of rural electrification initiatives. These also are primarily run on diesel fuel. This data is presented for this assessment as proxy since data on off-grid scattered diesel generation is basically non-existent and a survey would be the best method to obtain this data. For example, despite Kenya being a fairly advanced country in the East African region, for the inclusion of back-up generators in a CDM GEF calculation, a survey costing about USD 25,000 was needed since off-grid data –scattered diesel generators- was not available.

On the other hand data on kerosene for lighting is largely available. However off-grid lighting has been excluded from the scope of the study since the study focuses on rural electrification in general. These off-grid lighting systems are usually a first step in replacing kerosene for lighting before rural electrification and/or solar home systems (i.e. where the house is wired), especially for households, but even many small businesses.

In summary, data on off-grid systems (scattered diesel generation) in sub-Saharan Africa countries is difficult to obtain and a survey would be the best option to obtaining data that is accurate, most recent and covers the correct categorization of off-grid systems.

RECOMMENDATIONS TO CONDUCT OFF-GRID SURVEYS IN AFRICA

For the establishment of a rural off-grid electrification standardized baseline in sub-Saharan Africa, the followings issues must be considered when implementing a survey to collect data. These remarks are based on previously gained experience during surveys implementation in Africa namely:

- Survey conducted as part of the monitoring requirement of a registered off-grid lighting project in Kenya - 2013
- Survey for the inclusion of off-grid back-up generator systems in the calculation of the grid emission factor in Kenya - 2011

Survey implementer

Depending on the nature and complexity of the survey, it might become necessary to hire a third party to implement the surveys. This generally leads to additional costs in the development of the project. Next, is to find a competent survey company with an understanding of requirements put in the CDM methodologies, guidelines, tools and/or standards. If the survey is not conducted by skilled experts, it may result in delays in the process and/or compromises on the outputs of the survey.

Data collection

Regulations under the CDM often stipulate very specific data/information. Even in cases of general data requirement, the nature of CDM regulations entails prove, justification and references for each value used. An example is the Tool to calculate the emission factor for an electricity system that requires project developers who opt to include off-grid systems in the grid emission factor calculation, to conduct a survey to collect information on a number of parameters e.g. capacity, fuel type, technology etc. of the off-grid system. When Carbon Africa conducted this survey in Kenya, they found it difficult to prove for instance the capacity of the systems especially where the generator had undergone excessive maintenance and modification. Often, when dealing with scattered off-grid electrification for end users, information on electricity generation or fuel consumption in the past is difficult to obtain and therefore challenging to justify to the validators.

Challenges in Remote Areas in Africa

Remote rural areas are generally characterized by scattered population densities as opposed to densely populated areas where the grid electricity is available. This may pose a challenge in locating the interviewees for this survey. Other factors that could cause challenges are poor infrastructure (roads and communication networks) that is typical in most African rural areas. Language barrier could also pose a challenge where the interviewees may only understand their mother tongue.

Nature of the interviewees

Typical households in rural areas in Africa may not be able to afford diesel generators for their energy needs. Such systems may be affordable to high-end households and business owners, hospitals, industries and communication base stations. Getting access to some of these interviewees may be difficult especially the private homeowners or exclusive hotels. Some of the interviewees may fear that information from the survey may be used to cause negative publicity for them (that they are involved in GHG emissions). Some of the interviewees may also request for incentives in order to be interviewed, which could make the survey exercise a frustrating and expensive affair.

Frequency of the surveys

Considering all the challenges towards the implementation of surveys, the standardized baseline establishment and updates can become an expensive process in case regulations ask for frequent updates. Based on the *Guideline for the Establishment of Sector Specific Standardized Baseline*, updating should take place every three years. This means that a survey must be carried out once every three years which is a reasonable time frame.

Annex II: Country profiles

Table 11. Basic information on the 12 selected countries.

Nr.	Country	Region	Language	Sources and contacts
1	Burundi	East Africa	French	Therese Ndayisenga UNDP Contact
2	Ethiopia	East Africa	English	Alemayehu Tafesse Mengesha and Tegegn Zewdie (Ministry of Water and Energy)
3	The Gambia	West Africa	English	Kemo K. Ceesay (Ministry of Energy)
4	Ghana	West Africa	English	Mr. Abdussalam Yusuf, Kofi Agyarko (Energy Commission) Sandra Boateng (Ministry of Power) Julius Nkansah Nyarko and Salifu Addo (Ghana Energy Commission)
5	Kenya	East Africa	English	Faith Wandera (Ministry of Energy) , Henry Kapsowe (Utility Company) Caroline Kelly (Rural Electrification Authority)
6	Mali	West Africa	French	Cheick Oumar (CNESOLER), Ismael Touré and M. Agalassou Alassane (Malian Agency for the Development of Domestic Energy and Rural Electrification)
7	Nigeria	West Africa	English	Mr. Eli Bala and Mr. Abdussalam Yusuf (Nigerian Electricity Commission)
8	Senegal	West Africa	French	Ibrahime Niane (Director of Energy) Babacar Sarr (ENERTEC-SARL)
9	Tanzania	East Africa	English/ Swahili	Duncan Rusule and Paul Kikwele (Ministry of Energy) E. Lulobo (TANESCO)
10	Uganda	East Africa	English	Joseph Elangot (Ministry of Energy and Mineral Development)
11	Rwanda	East Africa	English/ French	Viateur MUGIRANEZA (Electricity Water and Sanitation) and Nacceur Hammami (Ministry of Infrastructure)
12	Burkina Faso	West Africa	French	Isidore Zongo (Ministry of Environment and Life Framework)

Sources: Data and literature research, interviews with relevant authorities in these countries, including staff from UNDP, the Ministries of Energy, Rural Electrification Authorities, Designated National Authorities (DNAs), Energy Regulatory Commissions. More contacts are provided in the Annexes.

Table 12. Country profiles and their registered carbon projects. (Part I)

Country	Profile	Registered PoA/regular CDM
Uganda	Uganda is an English-speaking nation located in East Africa, with about 29 million of its population without electricity access and a national and rural electrification rate of 9% and 3% respectively. From the detailed assessment, it was found that the country has an installed grid capacity of 985 MW, a total off-grid capacity of 28.49 MW and an installed thermal off-grid capacity of 3 MW. Thus, the portion of off-grid power generated by conventional technologies such as captive diesel generators is estimated at 11%. However, it is likely this portion is actually much higher, and further research would be needed to confirm the off-grid data.	1/12
Burkina Faso	The French speaking West African nation has an installed grid capacity of 252 MW with a national electrification rate of 15% and a rural electrification rate of 10%. Attempts to obtain information on the off-grid power capacity were unsuccessful, and considerable further research or surveys would be necessary to obtain the required data.	0/0
Kenya	This English-speaking East African nation has an installed grid capacity of 1691 MW and an off-grid capacity of approximately 19.62MW, based on the latest data from the utility, Kenya Power and the Rural Electrification Authority. The national and rural electrification rates in the country are 18% and 5% respectively. The portion of off-grid power generated by conventional technologies such as captive diesel generators was given as 96%. These are primarily off-grid systems that are run by the Kenya Power on behalf of the Ministry of Energy and the Rural Electrification Authority (REA). In the same time due to different off-grid definitions among energy expert in the country the real numbers can be different.	1/16
Tanzania	This English-speaking East African country has national and rural electrification rates of 15% and 4% respectively. Based on 2010 data obtained from the Tanzanian Energy Water Utilities Regulatory Authority (EWURA) report the total off- grid capacity was 52.07 MW while the installed thermal off-grid capacity was given as 51.47 MW. Thus the portion of off-grid power generated by conventional technologies such as captive diesel generators was found to be 99%. More recent figures would help improve the accuracy of this estimate, but surveys or significant further research would be necessary to retrieve them.	1/2
Rwanda	This Kinyarwanda, French and English-speaking East African nation has an installed grid capacity of 110 MW and is relatively active in the development of PoAs. Similar to Burkina Faso, attempts to obtain more information on off-grid power capacity in Rwanda proved futile. However, a 2012 brief by the Energy, Water and Sanitation Authority of Rwanda reported off-grid capacity was 0.75 MW and was primarily renewable energy . However, this would be drastically different from the situation in surrounding countries and further research would be needed to properly assess the portion of off-grid capacity and for the country to be included in the standardized baseline aggregation.	0/4
Burundi	Burundi is located in East Africa, with French and Kirundi as its official languages. The country has an installed grid capacity of 35.80 MW and an off-grid capacity of 10.52 MW. Similar to its neighbor Rwanda, information on the installed thermal off-grid capacity was not available and further study would be necessary for Burundi's inclusion in the group of countries for this standardized baseline.	0/0

Table 12. Country profiles and their registered carbon projects. (Part II)

Country	Profile	Registered PoA/regular CDM
Ethiopia	Based on 2010 data provided by the Ethiopian Electric Power Corporation (EEPCO), the country's installed grid capacity was 2059.58 while the off-grid capacity was 37.38 MW. The portion of off-grid power generated by conventional technologies such as captive diesel generators was calculated to at 84%. More recent figures would help improve the accuracy of this estimate, but surveys or significant further research would be necessary to retrieve them.	0/1
Nigeria	The West African English speaking nation has the largest population in Africa, as well as the largest total population without access to electricity out of the countries in the assessment. However, it has relatively high national and rural electrification rates of 50% and 23% respectively and a high installed grid capacity of 8644 MW. The thermal off-grid capacity was estimated to be 274.50. The country however has a very high dependence on off-grid back-up generator systems used to supplement the utility in case of grid downtime. Including these back-up generators, the off-grid capacity is approximately 8000 MW . The potion of off-grid power generated by conventional technologies such as captive diesel generators was given as 100%. The consultants' attempts to obtain more accurate information were not successful, and further confirmation of these numbers by Nigerian energy industry representatives would be necessary to include the country in the standardized baseline aggregation.	1/10
Ghana	The West African English speaking nation boasts high national and rural electrification rates of 61% and 31%. Kofi Agyarko, the Chief of Energy Efficiency and Climate Change at the Energy Commission of Ghana reported an even higher national electrification rate of 72%. From the detailed assessment, the total off-grid capacity was obtained as 3.20 MW. Further research would be necessary to determine the capacity of thermal off-grid systems.	1/2
Senegal	The country's national and rural electrification rates are 54%. Its annual electricity generation from captive fossil fuel generators was reported as 34,790 MWh. This translated to 5.67 MW capacity and with the total off-grid systems capacity given as 47.2 MW, the portion of off-grid power generated by conventional technologies such as captive diesel generators was given as 12%, much lower than expected. The consultants have been in touch with the company ENERTEC-SARL Environnement, Energies Renouvelables et Nouvelles Technologies who are looking into providing more accurate data.	0/4
Mali	Mali is French speaking and located in West Africa. Information from Ismael Touré, the Director of Rural Electrification in Mali, indicated that the portion of off-grid power generated by conventional technologies such as captive diesel generators was 96% (25.92/27 MW), and the annual off-grid generation was estimated as 40,000 MWh.	0/1
The Gambia	This West African English-speaking nation has an installed grid capacity of 85 MW and 13.10 MW off-grid power capacity. This figure from the Kemo Ceesay, the Gambia's Director of Energy, covers only the six government owned stations, which are all run using fossil fuel, so the portion of off-grid power generated by conventional technologies such as captive diesel generators reported as 100%. The Director of Energy also said that the government hopes to conduct a survey in order to capture information on the privately owned off-grid systems, thus it is possible more accurate data will be available in the future.	0/0

Annex III: Countries' contacts for data collection

Table 13. Contacts established for the country that passed the initial data availability screening (Part I)

Country	Organization	Name	Title	Email	Further analysis necessary?	Justification
Burundi	UNDP	Therese Ndayisenga		therese.ndayisenga@undp.org	N	No credible data from Utility and no information from contacts. Portion of off-grid captive generators from preliminary assessment is 0%.
Ethiopia	Ministry of Water and Energy	Alemayehu Tafesse Mengesha	Head Environmental impact Assessment and Social Development Office	alemayehu_tafesse@yahoo.com or atafesse@nilebasin.org	Probably yes	Detailed assessment gives the portion of off-grid captive generators as country 84%. However we do not have access to credible data from Utility and no information from contacts.
Ethiopia	Ministry of Water and Energy	Yetna			Probably yes	Detailed assessment gives the portion of off-grid captive generators as country 84%. However we do not have access to credible data from Utility and no information from contacts.
Ethiopia	Ministry of Water and Energy	Tegegn Zewdie	Director - Alternative Energy Technology Promotion and Dissemination Directorate	teg732@yahoo.com	Probably yes	Detailed assessment gives the portion of off-grid captive generators as country 84%. However we do not have access to credible data from Utility and no information from contacts.
Ghana	Energy Commission of Ghana	Kofi Agyarko	Chief (energy efficiency and climate change	agyarkok@energycom.gov.gh kofiayarko@gmail.com	N	No information from the detailed assessment. Additionally the country's focus to rural electrification has been more on grid extension as confirmed by ERC Ghana. We were informed that the country has high electricity access (72%) and captive power is insignificant.
Ghana	Environmental Protection Agency	Emmanuel Tachie-Obeng	Senior Programmes Officer	eobeng@epaghana.org	N	No information from the detailed assessment. Additionally the country's focus to rural electrification has been more on grid extension as confirmed by ERC Ghana. We were informed that the country has high electricity access (72%) and captive power is insignificant.

Table 13. Contacts established for the country that passed the initial data availability screening (Part II)

Country	Organization	Name	Title	Email	Further analysis necessary?	Justification
Ghana	Ministry of Power	Sandra Boateng		sandraboatengsampong@yahoo.com	N	No information from the detailed assessment. Additionally the country's focus to rural electrification has been more on grid extension as confirmed by ERC Ghana. We were informed that the country has high electricity access (72%) and captive power is insignificant.
Ghana	Ghana Energy Commission	Julius Nkansah Nyarko		jnkansah-nyarko@energycom.gov.gh	N	No information from the detailed assessment. Additionally the country's focus to rural electrification has been more on grid extension as confirmed by ERC Ghana. We were informed that the country has high electricity access (72%) and captive power is insignificant.
Ghana	Ghana Energy Commission	Salifu Addo		addos@energycom.gov.gh	N	No information from the detailed assessment. Additionally the country's focus to rural electrification has been more on grid extension as confirmed by ERC Ghana. We were informed that the country has high electricity access (72%) and captive power is insignificant.
Kenya	KPLC	Henry Kapsowe	Mechanical Engineer, Off-grid power stations	hkapsowe@kplc.co.ke	Y	Credible data from Utility available. Contacts are also responsive.
Kenya	KPLC	Onesmus Maina	Mechanical Engineer, Off-grid power stations	OMaina2@kplc.co.ke	Y	Credible data from Utility available. Contacts are also responsive.
Kenya	Ministry of Energy	Faith Wandera	Assistant Director of Renewable Energy	fahamala@yahoo.com	Y	Credible data from Utility available. Contacts are also responsive.

Table 13. Contacts established for the country that passed the initial data availability screening (Part III)

Country	Organization	Name	Title	Email	Further analysis necessary?	Justification
Kenya	REA	Caroline Kelly	Assistant officer Renewable Energy	ckelly@rea.co.ke	Y	Credible data from Utility available. Contacts are also responsive.
Kenya	REA	Peninah Karomuh	Environmental scientist	wambuipesh@yahoo.com	Y	Credible data from Utility available. Contacts are also responsive.
Mali	UNDP	Aida Mbo Keita	Country Officer	aida.mbo-keita@undp.org	Y	Detailed assessment gives 96% for the portion of off-grid power generated by captive generators. Information was from a credible source (SREP investment plan) as well as information from AMADER.
Mali	UNDP	Abdoulaye Bayoko		abdoulaye.bayoko@undp.org	Y	Detailed assessment gives 96% for the portion of off-grid power generated by captive generators. Information was from a credible source (SREP investment plan) as well as information from AMADER.
Mali	CNESOLER (National Center of Solar Energy and Renewable Energy)	Cheick Oumar	Director		Y	Detailed assessment gives 96% for the portion of off-grid power generated by captive generators. Information was from a credible source (SREP investment plan) as well as information from AMADER.
Mali	Malian Agency for the Development of Domestic Energy and Rural Electrification	Ismael Touré	Director		Y	Detailed assessment gives 96% for the portion of off-grid power generated by captive generators. Information was from a credible source (SREP investment plan) as well as information from AMADER.
Mali	Amader	M. Agalassou Alassane	Director Rural Electrification	agalassou@amadermali.net	Y	Detailed assessment gives 96% for the portion of off-grid power generated by captive generators. Information was from a credible source (SREP investment plan) as well as information from AMADER.

Table 13. Contacts established for the country that passed the initial data availability screening (Part IV)

Country	Organization	Name	Title	Email	Further analysis necessary?	Justification
Nigeria	Nigerian Electricity Regulatory Commission	Mr. Abdussalam Yusuf	Manager of Rural Electrification	ayusuf@nercng.org or yibrahim@nercng.org or Abdussalamyusuf@yahoo.com	Probably yes	Although detailed assessment gives 100% for portion of off-grid power generated by captive generators, there were no responsive contacts.
Nigeria	Nigerian Electricity Regulatory Commission	Mr. Eli Bala	Director of Renewable Energy	elijedere@yahoo.co.uk	Probably yes	Although detailed assessment gives 100% for portion of off-grid power generated by captive generators, there were no responsive contacts.
Nigeria	Environmental Accord Nigeria.	Ibrahim Salau	Director	salau@envaccord.com	Probably yes	Although detailed assessment gives 100% for portion of off-grid power generated by captive generators, there were no responsive contacts.
Rwanda		Jean Ntazinda		ntazinda@gmail.com	N	Detailed assessment gives the portion of off-grid captive generators as 0%. Although this may not be the actual case, it indicates that data is difficult to obtain. The contacts have been generally unresponsive. Those that did get back could not provide the data.
Rwanda	Electricity Water and Sanitation	Viateur Mugiraneza	Manager of Carbon Credits	viator_mug@yahoo.fr	N	Detailed assessment gives the portion of off-grid captive generators as 0%. Although this may not be the actual case, it indicates that data is difficult to obtain. The contacts have been generally unresponsive. Those that did get back could not provide the data.
Rwanda	Ministry of Infrastructure	Gerard Hendriksen	Senior Energy Advisor	gerard.hendriksen@gmail.com	N	Detailed assessment gives the portion of off-grid captive generators as 0%. Although this may not be the actual case, it indicates that data is difficult to obtain. The contacts have been generally unresponsive. Those that did get back could not provide the data.

Table 13. Contacts established for the country that passed the initial data availability screening (Part V)

Country	Organization	Name	Title	Email	Further analysis necessary?	Justification
Rwanda	Ministry of Infrastructure	Nacceur Hammami	Renewable Energy Advisor	nacerhammami@gmail.com	N	Detailed assessment gives the portion of off-grid captive generators as 0%. Although this may not be the actual case, it indicates that data is difficult to obtain. The contacts have been generally unresponsive. Those that did get back could not provide the data.
Rwanda	REMA	Yves Tuyishime	Carbon Market & CDM Investment promotion officer	yvest0@gmail.com	N	Detailed assessment gives the portion of off-grid captive generators as 0%. Although this may not be the actual case, it indicates that data is difficult to obtain. The contacts have been generally unresponsive. Those that did get back could not provide the data.
Rwanda	REMA	Janvier Kabananiye	Renewable Energy & Energy Efficiency Promotion Officer	eng.kabananiye@gmail.com	N	Detailed assessment gives the portion of off-grid captive generators as 0%. Although this may not be the actual case, it indicates that data is difficult to obtain. The contacts have been generally unresponsive. Those that did get back could not provide the data.
Senegal	ENERTEC-SARL	Babacar Sarr		bsarr@enertec-sarl.com	N	Detailed assessment gives the portion of off-grid captive generators as 12%. Although this may not be the actual case, it indicates that data is difficult to obtain.
Senegal	UNDP	Alioune		Alioune Badara Kaere alioune.badara.kaere@undp.org	N	Detailed assessment gives the portion of off-grid captive generators as 12%. Although this may not be the actual case, it indicates that data is difficult to obtain.
Tanzania	The United Republic of Tanzania Ministry of Energy (REA)	Duncan Rusule	Social and Environment Officer	drusule@rea.go.tz , drusule@yahoo.co.uk	N	Although detailed assessment gives the portion of off-grid captive generators as 99% the data referred to is 2010 data from the Energy Regulator. Contacts were generally unresponsive.

Table 13. Contacts established for the country that passed the initial data availability screening (Part VI)

Country	Organization	Name	Title	Email	Further analysis necessary?	Justification
Tanzania	TANESCO	E.Lulobo		e.lolubo@tanesco.co.tz	N	Although detailed assessment gives the portion of off-grid captive generators as 99% the data referred to is 2010 data from the Energy Regulator. Contacts were generally unresponsive.
Tanzania	TANESCO	Patrice Tsakhara		patrice.tsakhara@tanesco.co.tz	N	Although detailed assessment gives the portion of off-grid captive generators as 99% the data referred to is 2010 data from the Energy Regulator. Contacts were generally unresponsive.
Tanzania	Ministry of Energy	Paul Kikwele		kiwele@mem.go.tz	N	Although detailed assessment gives the portion of off-grid captive generators as 99% the data referred to is 2010 data from the Energy Regulator. Contacts were generally unresponsive.
The Gambia	UNDP	Almamy	UNDP Programme Analyst	Almamy Camara almamy.camara@undp.org	Y	Detailed assessment gives the portion of off-grid captive generators as 100%. Although this may not be the actual case, since privately owned units have not been included, we are informed that the government plans to conduct a survey on this information. We also have a responsive contact.
The Gambia	Ministry of Energy	Kemo k. Ceesay	Director of Energy - Ministry of Energy	kceesay@gmail.com	Y	Detailed assessment gives the portion of off-grid captive generators as 100%. Although this may not be the actual case, since privately owned units have not been included, we are informed that the government plans to conduct a survey on this information. We also have a responsive contact.

Table 13. Contacts established for the country that passed the initial data availability screening (Part VII)

Country	Organization	Name	Title	Email	Further analysis necessary?	Justification
Uganda	Ministry of Energy and Mineral Development Uganda	Joseph Elangot		jelangot@energy.go.ug	N	No credible information available (11% as the portion of power generated by convectional technologies such as captive diesel; which is most likely not the case). Contacts have been unresponsive.
Uganda	Ministry of Water and Environment Climate Change Unit	Chebet Maikut	Principle Programme Officer, Mitigation	chmaikut@yahoo.com	N	No credible information available (11% as the portion of power generated by convectional technologies such as captive diesel; which is most likely not the case). Contacts have been unresponsive.
Uganda	Uganda Bureau of Statistics	Peter Oplo		peteramoding@yahoo.com	N	No credible information available (11% as the portion of power generated by convectional technologies such as captive diesel; which is most likely not the case). Contacts have been unresponsive.
Uganda	Ministry of Energy Resource Division	Monica		advisoremsuug@energy.go.ug	N	No credible information available (11% as the portion of power generated by convectional technologies such as captive diesel; which is most likely not the case). Contacts have been unresponsive.
Uganda		Charles		c_beeka@yahoo.co.uk	N	No credible information available (11% as the portion of power generated by convectional technologies such as captive diesel; which is most likely not the case). Contacts have been unresponsive.
Uganda	GIZ	Hommers Ina	GIZ	ina.hommers@giz.de	N	No credible information available (11% as the portion of power generated by convectional technologies such as captive diesel; which is most likely not the case). Contacts have been unresponsive.

Table 13. Contacts established for the country that passed the initial data availability screening (PartVIII)

Country	Organization	Name	Title	Email	Further analysis necessary?	Justification
Uganda	UNDP	Martha	UNDP	martha.bbosa@undp.org	N	No credible information available (11% as the portion of power generated by convectional technologies such as captive diesel; which is most likely not the case). Contacts have been unresponsive.
Uganda	Energy Resources Development	James Baanabe	Acting commissioner Energy resource development	baanabe@energy.go.ug	N	No credible information available (11% as the portion of power generated by convectional technologies such as captive diesel; which is most likely not the case). Contacts have been unresponsive.
Uganda	Electricity Regulatory Authority	Mbaga Tuzinde		m.tuzinde@era.or.ug	N	No credible information available (11% as the portion of power generated by convectional technologies such as captive diesel; which is most likely not the case). Contacts have been unresponsive.
Burkina Faso	Ministry of Environment and Life Framework	Isidore Zongo	Executive Secretary (DNA)	isidorez@yahoo.com	N	No information from the detailed assessment and no fruitful contacts.

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