High level review of a pipeline of medium and large-scale renewable energy infrastructure projects in ECOWAS

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Document history and status

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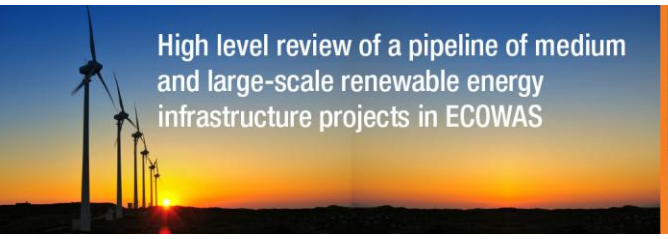


Executive Summary

ECREEE (the ECOWAS Regional Centre for Renewable Energy and Energy Efficiency) was inaugurated in July 2010 to promote and facilitate the uptake of renewable energy and energy efficiency within the 15 countries of the ECOWAS region, from Cape Verde in the west to Nigeria and Niger in the east.

As part of its work, ECREEE has established the 'ECOWAS Renewable Energy Facility' (EREI) to provide seed-funding to support to medium- and large-scale renewable energy projects in the region. Through this, the overall objective of EREF is to contribute to sustainable development in such areas.

One goal of this initiative is to support such projects in development and to facilitate their successful implementation, including the presentation of these projects to sources of capital finance such as commercial and development banks. The first element of EREI is the running of an Investment and Business Forum within the region, alongside a number of investment partners.

EREI has attracted a number of projects that are currently in development, across all of the ECOWAS countries, and covering a range of renewable energy technologies. All of the projects relate to the generation of electricity. Sinclair Knight Merz Limited (SKM) has been appointed by ECREEE to undertake a high level review of this pipeline of projects to support its engagement with the financing community, and as an input to the EREI Forum, to be held in Senegal in September 2012.

The review addresses various aspects of the projects, including their apparent development status, key risks in their development and implementation (including resource and technology risk issues), and – where possible given the information available – an estimate for the projects' cost of electricity production. The technologies included within the pipeline of projects include:

- Wind energy
- Bioenergy
- Hyrdo-electricity
- Solar photovoltaics

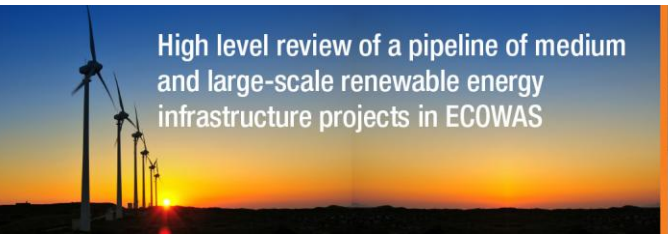
This report presents the findings of this high level review of 41 potential renewable energy projects across the ECOWAS region of West Africa.

The information available on these potential projects ranges from very limited information on a possible development concept but without any site or technology information, through to projects that have clearly been the subject of significant feasibility assessment.

As a consequence, we have categorised the possible projects into one of three categories:

- Those for which a full review can be undertaken and broad conclusions made. There are 16 such projects within the pipeline.
- Those for which we are able to provide some commentary and are able to provide a 'best guess' estimate for the levelised cost of electricity generation, but on which we cannot draw clear conclusions because of the lack of firm information or evidence. There are 18 such projects within the pipeline.
- Those for which only very high level comment can be made, as there is insufficient information to even provide a best guess of costs or performance. There are seven such projects within the pipeline.

Of the 16 projects on which we can draw broad conclusions, we would provide overall assessments as follows:



- On basis of the evidence provided to us, we would not consider any of the projects to yet be at a close-to-fully developed stage, with robust evidence of costs and risk management.
- We would consider all 16 projects to show evidence of commercial viability, albeit there are areas that need either further detailed information and supporting evidence, or require further development work to establish a commercially viable business model. We would note that some of these projects appear to be further advanced in development than others, and have some strong characteristics, but *all* have elements of uncertainty that need resolution before a bankable business case can be established. All of these 16 projects are therefore characterised as 'amber' (see Section 2.3 of this report), but with different strengths and weaknesses. More detail can be found in the main body of this report and in the appendices.

The 16 projects on which we can provide an overall high-level assessment are:

Working name of project	Technology	Country	Nominal capacity (MWe)*	Estimated LCOE** €/MWh	Estimated Capex*** €k/MWe	Traffic light overview
Monte Leao e Ruiz Vaz	Wind	Cape Verde	6.8	102	2410	
Brava wind	Wind	Cape Verde	0.5	117	1760	
Sao Vincente	Wind	Cape Verde	1.0	108	2990	
Akouedo	Biomass (landfill gas)	Côte d'Ivoire	8.5	114	3750	
Biokala	Biomass	Côte d'Ivoire	18.3	84	1650	
Sojiedo	Solar	Côte d'Ivoire	15	121	1600	
Tujereng	Wind	Gambia	4	133	900	
Prampam	Wind	Ghana	50	119	1470	
PV in Guinea Bissau	Solar	Guinea Bissau	9	248	3280	
Salthinho	Hydro	Guinea Bissau	18	50	3350	
Cocopa	Biomass	Liberia	0.2	198	3640	

Mein	Hydro	Liberia	1.5	106	2400	
Ross-Bethio	Biomass	Senegal	15	119	2530	
Sakal / Dagana	Solar	Senegal	20	220	2930	
Taiba Ndiaye	Wind	Senegal	125	150	1960	
Moyamba small hydro	Hydro	Sierra Leone	10	77	2340	

*rounded

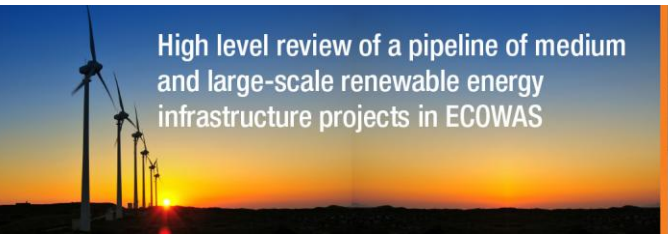
***excluding* any income from CDM or other supportive policy instrument

*** rounded to nearest €10k/MWe

It should be noted that for a number of the projects we have reviewed, there are references to documents that we have not had an opportunity to review. This additional information may provide more robust evidence to support some of the project assumptions, which would provide greater confidence in their commercial viability.

It should further be noted that, for those projects on which we received insufficient information to make an overall assessment, this does *not* mean that they are not commercially viable; it simply means that insufficient information is currently available on which to draw any conclusions. This may be because the projects are at a very early stage of development, but the proposed development may still represent a potentially successful project.

The review of this pipeline of projects has identified a number renewable energy projects in the ECOWAS region that, with further development to remove and mitigate risks and uncertainties, could prove to be commercially successful ventures.




Contents

1. Introduction

1.1. Background

ECREEE (the ECOWAS Regional Centre for Renewable Energy and Energy Efficiency) was inaugurated in July 2010 to promote and facilitate the uptake of renewable energy and energy efficiency within the 15 countries of the ECOWAS region, from Cape Verde in the west to Nigeria and Niger in the east, as shown below:

The objective of ECREEE is:

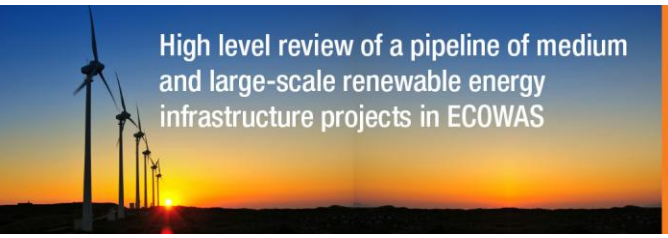
To create favourable framework conditions and an enabling environment for renewable energy and energy efficiency markets by supporting activities directed to mitigate existing barriers.

Ultimately, the work of ECREEE will contribute to sustainable economic development in the region through the provision of reliable low-carbon and commercially-viable energy from renewable resources, and through measures to ensure efficient and effective use of energy.

1.2. Context for this report

As part of its work, ECREEE has established the 'ECOWAS Renewable Energy Initiative' (EREI) to provide seed funding to support to medium- and large-scale renewable energy projects in the region. Through this, the overall objective of EREI is to support such projects in development and to facilitate their successful implementation, including the presentation of these projects to sources of capital finance such as commercial and development banks. To this end, the first element of EREI is the running of an Investment and Business Forum within the region, alongside a number of investment partners.

EREI has attracted a number of projects that are currently in development, across all of the ECOWAS countries, and covering a range of renewable energy technologies. All of the projects relate to the generation of electricity. Sinclair Knight Merz Limited (SKM) has been appointed by ECREEE to undertake a high level review of this pipeline of projects to support its engagement with the financing community, and as an input to the EREI Forum, to be held in Senegal in September 2012.




The review addresses various aspects of the projects, including their apparent development status, key risks in their development and implementation (including resource and technology risk issues), and – where possible given the information available – an estimate for the projects' cost of electricity production. The technologies included within the pipeline of projects include:

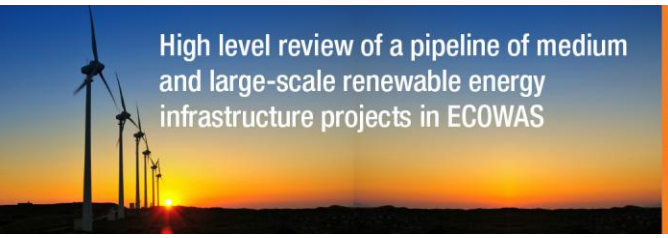
- Wind energy
- Bioenergy
- Hydro-electricity
- Solar photovoltaics

This report presents the findings of this high level review.

1.3. Structure of this report

Following this introduction, this report contains the following sections:

- **Methodology** – a brief description of the method we have used to undertake the review of projects.
- **Country commentary** – an overview of all the projects currently included within the pipeline, followed by a country-by-country summary of the projects and the institutional structures that exist to support the implementation of renewable energy projects.
- **Electricity network overview** – to provide a high level summary of the electricity network in ECOWAS region.
- **Conclusions** – key conclusions emerging from this review of projects.
- **Appendices** – containing standard pro-formas for all of the projects reviewed, broken down by each country within the programme. There is also an appendix that provides information on some of the CDM themes presented in this report. The final appendix is a glossary of terms used in this report.



2. Methodology

2.1. Data receipt

Our review of projects has been based on information gathered by ECREEE directly from project sponsors and government agencies.

The initial stage of our work was the receipt of data and information on the projects from the ECREEE team. This information took a wide array of forms, ranging from very sketchy one-sided descriptions of possible projects, through to detailed feasibility reports setting out locations, resources, technologies and costs. In all, 71 documents were received for review.

Data was gathered over a period of time, and involved a number of clarification and follow-up exchanges with the ECREEE project team. Initially, the information received was subject to an initial screening review that then led to the project categorisation described below (see Section 2.4), and it informed the design of the project assessment pro-forma (see Section 2.3).

In addition to information received from ECREEE, we also undertook a search for published information on the proposed projects, using sources such as publicly available UN databases. Where data and information on costs and/or performance were not available in the documentation provided by ECREEE or elsewhere, we have – where possible – established our own best estimates based on published resource information (for global and regional solar, hydro and wind resources) and based on our existing knowledge of similar projects and technologies. The source of any such 'best estimate' is provided in the detailed analysis on each project. The high level financial analysis we have undertaken on the projects (where such analysis has been possible) has been informed by publicly available benchmark parameters for projects using similar technologies and renewable energy resources, such as benchmark investment 'hurdle rates' – please see Section 2.5 of this report.

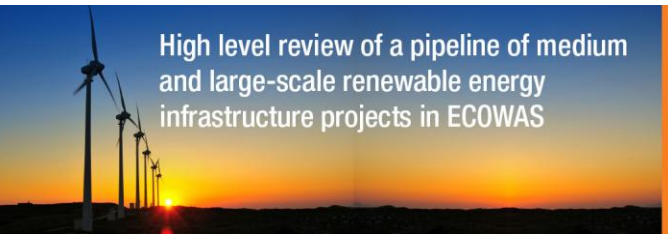
2.2. Basis of review

The focus for our work has been on the basic technical, structural and economic characteristics of the projects and on the conformance of the projects with generic investment criteria (such as the application of Equator Principles, where relevant, and the criteria associated with Clean Development Mechanism (CDM) investments). Our scope of work has *not* included consideration of the prospects for, and design of, any country-specific policy instruments that might exist that could influence the commercial viability of the projects (examples could include capital support programmes, fiscal (tax) interventions, or revenue support (such as feed-in tariffs), although we *have* considered the opportunities that might exist for CDM related income streams for the projects (see Section 2.6).

Where data have been available (or where we have been able to provide 'best guess' estimates for such data), we have derived an estimated levelised cost of electricity generation (LCOE). This coupled with the potential for CDM revenue, should then be set in the context of any policy instruments that may exist (or that may be in development), and the commercial terms in any power purchase agreements that may exist in that particular country, to assess a project's overall potential commercial viability.

Our review team has comprised:

- Technical specialists in biomass, solar, wind and hydro project development
- An environmental specialist, familiar with the environmental management requirements associated with projects of this type (and with the Equator Principles associated with financing)




- An electrical grid specialist, to provide a commentary on local grid issues for each of the projects, where information available.
- A energy economist to consider the basic economics of each of the projects and to estimate, where possible, a levelised cost of electricity generation
- A clean development specialist, to provide input on the opportunities for CDM income.

2.3. Assessment pro-forma

The principal outputs from our review are the project assessment pro-formas, which are presented in the appendices to this report.

Following initial screening of the information received from ECREEE, and in consultation with the ECREEE project team, we developed the design of a pro-forma in a spreadsheet format to enable us to capture key information on the projects, to provide commentary on the information received, and – where appropriate – to draw broad conclusions about the project against certain criteria using a 'traffic light' approach.

The design, content and format of the pro-forma were agreed with the ECREEE team before it was used to undertake the review of the 41 projects in the pipeline. This work comprised the initial stage of our activities.

The pro-forma includes:

- A simple review of the projects, highlighting key technical and economic characteristics, and highlighting key risks, using a standard structure to enable the reader of the reviews to understand the projects quickly and easily.
- Where we have data available on which to base such a calculation, an estimate of the levelised cost of electricity generation, based on cost, performance and expected project hurdle rates for that particular type of project/technology.
- A semi-qualitative system for drawing principal conclusions, in which projects are given a 'traffic-light' (red, amber, green) marking against the following criteria:
  - Basis of resource assessment
  - Selection of energy conversion technology
  - Environmental concerns
  - Potential for CDM revenues
  - Overall business model
  - Apparent status of project development.

The 'red', 'amber', 'green' assessments for each of these criteria are summarised as follows:

	Red	Amber	Green
Resource assessment	very weak basis for resource assessment	some evidence of site-specific resource assessment	robust assessment, based on reasonable site-specific data and appropriate methodology
Technology risk	high level of technology risk	sketchy or incomplete information on technology, or unfamiliar technology	proven technology with good information on process design and/or

		provider	installation/contractor
Environmental concerns	detailed ESIA required but not started or largely incomplete.	ESIA not yet approved but no major problems anticipated. Or, only low level ESIA required.	ESIA approved and environmental permit in place. Or, formal decision that ESIA not needed.
CDM potential	project not additional / project not eligible under CDM	application of CDM doubtful due to poor commercial viability or significant hurdles or barriers to CDM	additional & commercial potential/undergoing CDM review/CDM process begun
Business model	unrealistic business model	optimistic commercial assumptions	robust project model with commercially realistic assumptions
Project status	glint in the eye	early stage development, but project fundamentals established	well advanced project with clear programme/plan for implementation

The pro-forma design accommodates the different characteristics of different renewable energy technologies. For instance, the template for bioenergy projects considers feedstock/fuel supply to the project, whereas wind, hydro and solar projects do not need this to cover this aspect (as there is no 'feedstock' for these types of project).

2.4. Information quality categorisation

Early on in our review, we recognised that, at least for some of the projects, the information available from the sponsors was fairly limited. Given this, and in consultation with ECREEE, we developed a project categorisation that then dictated the level of detail we would be able to incorporate into the review.

The categories are described below:

Project category	Implications	Number of projects
Category '1'	**Category 1** projects have a reasonable level of information available. We are able to provide reasonable commentary on all aspects of the project, to provide an estimated LCOE and to provide a full 'traffic light' assessment.	16
Category '2'	**Category 2** projects have some information on a project, sufficient to enable us to identify a specific site and consider a particular type of technology, however there is very limited information on cost and performance. In these cases, SKM has provided its own best guess of possible costs and/or performance, based on the limited information available, in order to provide a rough estimated for a LCOE. Because of the limited information, however, we have not provided a full 'traffic light' assessment.	18

Category '3'	**Category 3** projects have very limited information, to the extent that it is not possible to identify a site, or understand the technology choice, or consider availability of resource. Given this, we have provided some limited commentary on the project, but have not been able to provide even a very rough estimate for the LCOE, nor have we provided a full 'traffic light' assessment.	7

2.5. Financial review

The financial review was undertaken to determine a lifetime levelised cost of electricity (LCOE) for each generation project for which sufficient data were available. The levelised cost of electricity is equivalent to the average price the output of the generating plant would have to be sold at to exactly repay the investor for capital costs (capex), O&M costs (fixed and variable) and any relevant fuel costs, with a rate of return equal to the discount rate.

To determine the LCOE all the costs incurred during the lifetime of the project are calculated and divided by the units of energy produced during the lifetime of the project, expressed as €/kWh. Since most of the costs or expenses and the sales revenue occur in a future time, then the time value of money and the risks of investment must be taken into account. This is done by determining the Present Value of these cash flows using an assumed discount rate.

The resulting LCOE is the minimum price at which energy must be sold for a generation project to break even – and so return a zero NPV. The formula for calculating the LCOE is shown below:

$$LCOE = \frac{total\ lifetime\ expenses}{total\ lifetime\ output} = \frac{\sum_{t=1}^{n} \frac{It + Mt}{(1+r)t}}{\sum_{t=1}^{n} \frac{Gt}{(1+r)t}}$$

Where:

It = investment cost (capex) in year t
Mt = operating costs in year t
Gt = generation output in year t
r = discount rate

Clearly the discount rate is a critical parameter in calculating the LCOE and so a key issue to be determined is the assumed value of discount rate adopted. In the calculation of LCOE, the discount rate used in the calculation is, in effect, the internal rate of return on a project given its capital and operating costs, assuming that the revenue the project receives equals the LCOE.

The discount rate used for any investment will take into account risk factors, economic fundamentals, the investor's portfolio and debt structuring. In business, the 'hurdle rate' for an investment is the minimum rate of return on a project that a company is willing to accept before starting a project, given the perceived risk of that project and the opportunity cost of forgoing other projects. A project with higher perceived risk will only be undertaken if its anticipated return exceeds the hurdle rate, including a risk premium assigned to the new project to reflect the higher risk perception.

A common method for evaluating a hurdle rate is to apply the discounted cash flow method to the project, as used in the net present value method outlined above. The hurdle rate determines how rapidly the value of the investment decreases out in time (is discounted) and is a significant factor in determining the payback period for the capital project when discounting forecast savings and spending back to present-day terms – the higher the discount rate the faster the payback period.

For our analysis we have undertaken an evaluation to determine the LCOE using differing discount rates for different technologies. The different discount rates are intended to reflect the generic hurdle rates that may apply to these investment options based on perceptions of technology risk. These 'intrinsic' technological risks include:

- the cost structure of the investment,
- construction lead times,
- the plant load factor,
- any previous successful deployment of the technology, and,
- the maturity of the technology.

Intrinsic technology risk can, to some extent, be controlled by the investor. In addition there are risks that are outside of the control of the investor – extrinsic market risks. Extrinsic market risks include:

- the political and governmental stability of the country in which the investment will occur,
- the regulatory and investment framework,
- government energy policy,
- demand growth,
- availability/withdrawal of subsidies and support, and,
- the future price of electricity and carbon (and their volatility).

We have not taken into account extrinsic risks in our determination of discount rates but have focused on technology risk.

Recent studies undertaken for the UK energy market by OXERA and the UK Government (Department of Energy and Climate Change – DECC)[1] provide an assessment of the hurdle rates on a technology by technology basis, taking into account market and technological risks. The analysis conducted concluded that technological maturity was an important influence of risk perception of technology types – with technological maturity outweighing other intrinsic risks. Hydro, solar and onshore wind projects are considered to have relatively low technology risk options, whereas biomass is considered to be higher risk. The risk perception for hydro is supported by UNEP: *'large scale hydro is a well developed, long term, proven technology with low maintenance expenses and few operational risks or barriers. From a financing and risk management perspective, small scale hydro installations benefit from a general understanding of the technology.'*[2]

The discount rates assumed for this study are based on those assessed by OXERA and DECC for renewable technologies in the UK. A 'high' and 'low' assessment of the discount rate applied to each technology is made (Table 2-1). While we do *not* take into account extrinsic risk in our analysis, we used the 'high' discount rate to reflect the more challenging technology issues within the study countries of West Africa.

- **Table 2-1: Assumed Discount Rates (representing indicative 'hurdle rates' for investment)**

Technology	Risk perception	Discount rate %	
		Low	High
Onshore Wind	Low	7	10

[1] Oxera (April 2011) Discount Rates for Low-Carbon and Renewable Generation Technologies; DECC (October 2011) Consultation on proposals for the levels of banded support under the Renewables Obligation for the period 2013-17 and the Renewables Obligation Order 2012

[2] United Nations Environment Programme (2004) 'Financial Risk Management Instruments for Renewable Energy Projects'

Biomass	Medium	9	13
Solar PV	Low	6	9
Small hydro	Low	6	9

The approach outlined above provides the study with a consistent, logical and benchmarked approach to the investment appraisal of renewable technologies in West Africa.

2.6. Review of opportunity for CDM revenue

The approach outlined above describes how a basic LCOE has been estimated for the projects within the portfolio for which sufficient information is available or for which a high level estimate of costs and performance can be made. As stated above, this represents the price at which electricity would need to be sold for the project to break even. However, the projects within the ECREEE pipeline *may* be eligible for revenue from the CDM, which would effectively reduce the price at which electricity needs to be sold. Such projects in developing countries can produce saleable Certified Emission Reduction (CER) credits, each equivalent to one tonne of CO_2, which are traded on emissions trading schemes by entities in developed countries subject to emissions caps to meet Kyoto emissions reductions targets.

A CDM project must provide emission reductions that are additional to those that would otherwise have occurred. The projects must qualify through a rigorous and public registration and issuance process. We have assessed the potential for each project to benefit from CDM revenues and make an assessment of the revenue that might be available.

2.6.1. Qualitative Assessment

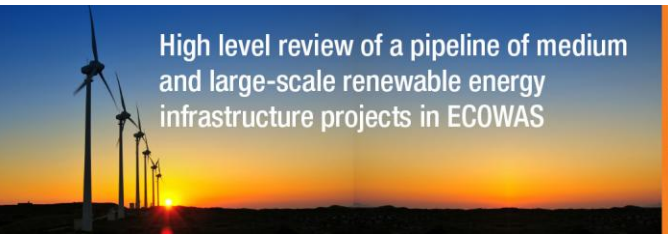
Initially, SKM reviewed the project documentation received from the ECREEE team, to extract relevant details relating to the scope, type and location of the project. This information was then supplemented by a search on the UNFCCC project repository database and the 'UNEP Risoe Centres' CDM pipeline database. As the majority of the ECREEE pipeline of projects is at the very early stages of conceptualisation, these resources were also used to shed light on what the landscape for CDM project development looks like within the different national settings of the ECOWAS region.

Additionality tests were based on the available project documentation, as well as the scale and type of the project. This was cross-referenced from very similar projects registered and validated under the CDM. In cases where the ECREEE project documentation was insufficient, validated CDM projects that mirror the proposed activities of the ECREEE project under review were used. The achievement or eligibility for the various additionality criteria are pre-defined by the UNFCCC rules. The additionality test is high-level and indicates what the probable basis for how the project would achieve additionality. A more detailed assessment would be needed should development of the project under CDM criteria be progressed. The additionality criteria (and coding used in the pro-formas) are set out in Appendix O.

The assessment of using a programmatic CDM approach was derived from the scale and type of the project and the realistic ability for this to occur given other activities in the country and/or region. 'Designated National Authority' (DNA) engagement was assessed based on project documentation and the two database resources indicated previously.

2.6.2. Financial Assessment

The estimated carbon reduction data provided in the detailed project reviews (the appendices this report) were generated using the following formulae in an excel based tool that takes into account national grid emissions factors, the type of projects (ie landfill gas flaring is treated differently from




other forms of renewable electricity generation, as it avoids methane and carbon dioxide, rather than just carbon dioxide):

Annual gross generation = capacity x capacity factor x hours per year

Annual GHG abatement = annual baseline emissions – annual project emissions

= (annual generation x grid emission factor) – (annual generation x project emission factor)

We then applied a discount factor to this estimate to offer a more realistic emissions reduction estimate, taking into account a project's parasitic load and 'carbon leakage' (carbon emissions that are generated from the ongoing operation of the plant). This factor is cross-checked with actual emissions reductions generated from registered and validated CDM projects to ensure a good level of accuracy.

The determination of CDM revenue for a project is based on the CO_2 avoided as a result of the project – and this assessment is based on the output of the plant and the carbon intensity of generation for each country evaluated. The estimated carbon intensity of each country is shown in Table 2-2; these estimates were agreed through the course of the work with the ECREEE project team.

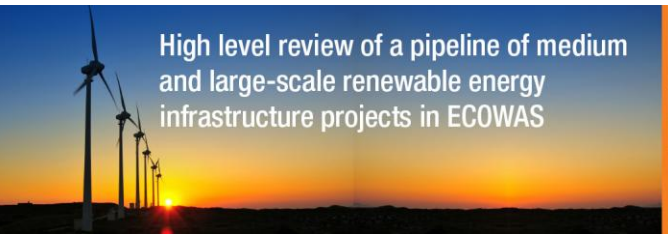
- **Table 2-2: Carbon intensity of grid generation**

Country	Carbon intensity (tonne of CO_2 (equivalent) per MWh of electricity)
Benin	0.777
Burkina Faso	0.540
Cape Verde	0.777
Côte d'Ivoire	0.670
Gambia	0.777
Ghana	0.396
Guinea Bissau	0.777
République de Guinée	0.777
Liberia	0.750
Mali	0.582
Niger	0.777
Nigeria	0.630
Senegal	0.702
Sierra Leone	0.777
Togo	0.336

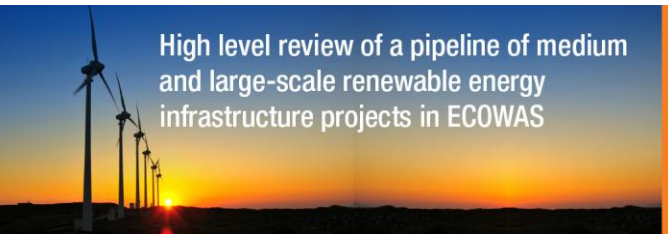
Estimated CDM revenues were generated by multiplying the yearly forecasted carbon reductions by a forecasted carbon price for the years to come. It should be noted that the price for carbon is extremely volatile and prone to fluctuations dependent on policies, mainly at the EU level. The price forecast we have used as an estimate was taken from a recent price forecast applied to a registered CDM project, as set out in Table 2–3 below.

- **Table 2-3: CER price forecast**

Year	Price forecast (Euros per tonne of CO_2 (equivalent))
2010	10.09
2011	11.27
2012	4.14
2013	5.00
2014	6.00
2015	7.10
2016	8.18
2017	9.25




2018	10.31
2019	11.36
2020	12.41
2021	13.46
2022	14.51
2023	15.56
2024	16.61
2025	17.66
2026	18.71
2027	19.76
2028	20.81
2029	21.86
2030	22.91
2031	23.96
2032	25.01
2033	26.06
2034	27.11
2035	27.11



3. Country commentary

3.1. Introduction

This section of our report presents a quick introduction to the projects included in this review, and provides a short country-by-country overview to describe the context for the development of such projects. Each sub-section provides a brief narrative of the overall political and institutional picture, with a particular focus on the opportunity for attracting CDM revenue.

The finance generated from CDM revenue is often, especially in the case of small-scale and high upfront CAPEX projects, a useful and important contribution to the realisation of a project. However, considerable rigour is required to ensure that this revenue is secured. The CDM process requires inputs from several diverse both geographically and technically stakeholders. A narrative of the process is available in this document in Appendix O.

3.2. Pipeline overview

We received information on 41 different projects/opportunities in the ECOWAS region, as follows:

Country	Technology	Number of projects
Benin	Bioenergy	1
	Hydro	1
	Solar	1
	Wind	1
Burkina Faso	Solar	1
Cape Verde	Solar	2
	Wind	3
Côte d'Ivoire	Bioenergy	2
	Solar	1
Gambia	Solar	1
	Wind	1
Ghana	Wind	1
Guinea Bissau	Hydro	1
	Solar	1
République de Guinée	Hydro	8
Liberia	Biomass	1
	Hydro	1
Mali	Hydro	1
	Solar	2
	Wind	1

Country	Technology	Number of projects
Niger	N/A	0
Nigeria	Hydro	3
Senegal	Biomass	1
	Solar	2
	Wind	1
Sierra Leone	Hydro	1
Togo	Solar	1

The projects in each of these countries are summarised below.

3.3. Benin

3.3.1. Projects

Four projects or development opportunities have been identified in Benin. They are briefly described below. Their full reviews are presented in Appendix A.

We would note that the information received on all of the projects in Benin is very high level. Two of the 'projects' are simply statements of intent for possible projects, or invitations to tender, without there being any site identified for such development.

Working name of project	Brief description	Nominal capacity (MWe)	Information sufficiency	Traffic light overview
Biomass in Benin	The Benin government is aiming to develop a demonstration biomass project using agricultural residues. No site has been identified yet. However, despite this, SKM has provided a 'best guess' estimate of LCOE based on the costs and performance of benchmark technologies.	5	2	N/A
Le Fleuve hydro	Hydro scheme on River Oueme at Beterou, comprising a dam creating a reservoir.	23.2	2	N/A
Solar in Benin	Very early stage invitation to tender for a 5 MWe solar scheme in Benin. No site information available.	5	3	N/A
Wind in Benin	Very early stage intent to develop up to 20MWe of wind capacity in Benin, but no sites identified yet. At resource mapping phase.	20	3	N/A

3.3.2. Country context for renewable energy

Benin is well placed to take advantage of the finance generated from CDM projects. It has a relatively large industrial sector consisting of some 300 firms dominated by a small group of energy intensive businesses. Benin's exposure to global oil prices is compounded as all fuel is imported into the country. The country has real challenges with rural electrification and in addition to this there is characteristically a very high energy waste in the household sector which accounts for 64% of total energy consumption. To mitigate these challenges Benin's aspirations related to the CDM market are to develop a network of small hydro plants and improve energy efficiency within the industrial sector.[3]

Benin ratified the Kyoto Protocol in 2002; it's (the 'Ministère de l'Environnement, de l'Habitat et de l'Urbanisme') has been proactive in establishing its sustainable development goals, encapsulated within the 'Strategy Document on the Reduction of Poverty' with targets set on 2015. These relate to achieving 'no negative impacts' to the environment, technology transfers to boost the economy and the development of clean technologies to remedy local poverty issues.

Hurdles to CDM project development in Benin relate to a general lack of capacity within the host country DNA. Project developers and investors have found that insufficient access to information; the lack of reliable statistics and archives necessary for planning CDM projects; the small circle and general dispersed nature of CDM expertise, combined with the generally high upfront costs of elaborating and implementing CDM projects and the lack of financial and material resources allocated to the promotion of CDM projects, are all key barriers limiting realisation of projects in the market.

Benin's foray into the CDM project development has been positive, having started on the process for two solar projects and one energy efficiency project, albeit none of these has yet been registered and is receiving credits. Benin is looking to develop small and local scale projects to remedy energy waste – especially in the transport sector, stimulate a more rational use of energy by industry, and develop a network of small hydro plants throughout the country. The projects proposed to ECREEE and reviewed in this report are characteristic of this strategy: the small-scale hydro and solar projects will be key to realising Benin's goals and the extra revenue generated through CDM would considerably improve the viability of these projects.

3.4. Burkina Faso

3.4.1. Projects

One project has been identified in Burkina Faso. It is briefly described below. Its full review is presented in Appendix B.

Working name of project	Brief description	Nominal capacity (MWe)	Information sufficiency	Traffic light overview
Yaho PV / diesel	Small solar-diesel hybrid project.	0.3	2	N/A

3.4.2. Country context for renewable energy

Burkina Faso ratified the Kyoto Protocol in 2005. Since then they have partnered with the UNDP who have identified the potential for around 15 million tonnes of CO_2 mitigation opportunities

[3] http://www.unido.org/fileadmin/import/47141_Benin_English_Summary.pdf

between now and 2015 in the five main sectors of the country: agriculture, forestry, waste, energy and transport – with the greatest potential in the forestry sector.

Burkina Faso's DNA for CDM is the 'Secrétariat Permanent du Conseil National pour l'Environnement et le Développement Durable'. So far, CDM project registration has been unsuccessful, but there *has* been some project development activity with five projects having prior consideration for the CDM relating to cook stoves, reforestation, methane recovery and thermal energy.[4]

Barriers to successful CDM project development and investment in Burkina Faso include institutional incapacities, relationships and practices to promote CDM projects, ie a lack of an enabling environment, limited knowledge of ways to access carbon finance amongst DNA members, the public and private sectors, local investment banks and business institutions, limited financing options to cover up-front project capacity needs and a lack of information and analysis relating to GHG opportunities. Burkina Faso has had five projects considered for CDM, although none has yet entered the development 'pipeline'. These projects have mostly related to biomass, methane recovery and reforestation. The small-scale nature of the project proposed to ECREEE follows the general approach that Burkina Faso has had in developing CDM projects, however it would be the first venture into a clean technology such as solar PV.

3.5. Cape Verde

3.5.1. Projects

Five projects have been identified in Cape Verde. They are briefly described below. Their full reviews are presented in Appendix C.

The information provided is at a very high level, and there are some significant gaps. However, through our existing knowledge of similar projects in Cape Verde, we are aware of the high wind resource potential, so for the wind prospects we have completed a 'category 1' assessment. The high resource potential makes the projects potentially attractive, albeit there appears to be significant development work needed still to confirm costs and constraints to implementation.

Working name of project	Brief description	Nominal capacity (MWe)	Information sufficiency	Traffic light overview
Achada da Cidade Velha solar park	Solar park to be developed in two phases - first phase of 3MWe and second phase of 6MWe.	9	2	N/A
Salamansa solar park	Solar park of approx 4500 PV panels. No site or technology information provided, but a LCOE has nevertheless been estimated.	1	2	N/A
Monte Leao e Ruiz Vas windfarm	Windfarm development of 8 no. V52 wind turbines 1 to 2 km south to southeast of Rui Vaz, approximately 15 km NW of Praia.	6.8	1	

[4] http://web.undp.org/africa/africaviewpoint/2009-march.pdf

Brava wind	Installation of single 250kW turbines at two different locations on the island of Fogo	0.5	1	
Sao Vincente wind	Installation of 3 no. 330 kW turbines on Mindelo.	0.99	1	

3.5.2. Country context for renewable energy

Cape Verde is a relatively politically and economically well developed state, achieving middle-income country status in 2007. The archipelago ratified the Kyoto Protocol in 2006, and subsequently developed a well-defined sustainable development strategy which stems from its 'five pillars' in its second 'Growth and Poverty Reduction Strategy'. Cape Verde's economy is increasingly reliant on tourism and as such has a real challenge in meeting and securing future demand on its grid.

Cape Verde's DNA (the National Direction of Environment) has so far been reasonably proactive in addressing the opportunities offered through the CDM. The finance directed through the CDM are being considered by the DNA and are set to play an important part in securing supply and making wind competitive with other methods of power generation such as diesel.

Key challenges facing Cape Verde are the natural dispersions of expertise associated with an archipelago of ten separate islands. Additionally, a key challenge to the implementation of wind farm technology is that there are no domestic suppliers and therefore all technology must be imported. Cape Verde is no longer classified as a 'Least Developed Country' by the UNFCCC; sale of CERs generated from CDM projects will therefore have to seek markets outside of the EU ETS compliance market – this recent policy change may have somewhat dampened the business modelling of such renewable energy projects which depend on CDM revenue to incentivise development.

Cape Verde currently has a single bundled large-scale wind power project at the validation stage in Santiago, Sal, Sao Vicente and Boa Vista. This project demonstrates the potential for this type of bundled or ‘programmatic’ approach to be applied in the small-island state. The islands have a growth path which will be largely dependent on renewable technology to both meet rising demand and reduce dependency on imported natural resources. There is a very high potential for the projects proposed to ECREEE to be bundled into a single CDM project both for the wind and solar projects, if further projects are forecast to be developed it makes senses to opt for a Programmatic CDM approach to be applied.

3.6. Côte d’Ivoire

3.6.1. Projects

Three projects have been identified in Côte d’Ivoire. They are briefly described below. Their full reviews are presented in Appendix D.

All three projects appear relatively well developed (compared with other projects). All have some gaps in information, and identifiable risks, which are described in the pro-formas in the appendix. It is notable that there is a range of technologies being developed in Côte d’Ivoire (landfill gas, biomass and solar).

Working name of project	Brief description	Nominal capacity (MWe)	Information sufficiency	Traffic light overview
Akouedo landfill and landfill gas	Landfill capping followed by landfill gas collection and use in gas engines.	8	1	
Biokala biomass	Biomass power generation using residues generated in the growth and production of palm oil and also some residues from rubber.	18.27	1	
Sojiedo solar park	15 MW located on a small 2.5 Ha site, divided in 15 x 1 MW units with an incorporated transformer for each unit.	15	1	

3.6.2. Country context for renewable energy

The Côte d'Ivoire is still recovering from over ten years of domestic violent conflict which still affects the political and social stability within the state. Ratifying the Kyoto Protocol in 2007, it is only quite recently that CDM project development has been able to begin with the EU embargo being lifted in 2011 aiding bi/multilateral partnerships.

Côte d'Ivoire's DNA (the National Agency for Environment) has been successful in pursuing thirteen carbon reduction projects, three of which have successfully been registered under CDM and issuing carbon credits. Côte d'Ivoire is no longer classified as a 'Least Developed Country' by the UNFCCC; sale of CERs generated from CDM projects will therefore have to seek markets outside of the EU ETS compliance market.

Although Côte d'Ivoire has been relatively successful in the market, the country still suffers from the suite of challenges faced by most countries in a similar position. Governmental administrative bottle-necks and unawareness of the opportunities presented by the CDM by financial institutions constrain but do not completely halt project development. An overstretched and/or under resourced DNA also results in a general lack of capacity.

Côte d'Ivoire has a relatively carbon-intensive grid with a high emission factor and this, combined with its high development potential for clean and renewable technology, places it well to take advantage of the finance offered through the CDM market. Faced with institutional bottle-necks, development in this market has been gradual, but the high potential and growing capacity is encouraging. Côte d'Ivoire also has an increasing volume of Programmatic (PoA) CDM activity relating to household energy efficiency, demonstrating that structures are in place to service these complex projects. The Akouedo landfill gas project is now a registered project (Feb 2011) having been previously replaced at validation. The Biokala project is currently at the validation stage with its documentation open to public comment, crediting of the project is forecast for 2015. The solar project proposed to ECREEE is the country's first venture into technology other than that associated with landfill gas and biomass.

3.7. Gambia

3.7.1. Projects

Two projects have been identified in Gambia. They are briefly described below. Their full reviews are presented in Appendix E.

Working name of project	Brief description	Nominal capacity (MWe)	Information sufficiency	Traffic light overview
Birkama solar park	A solar park to be developed on a 65 Ha in the Greater Banjul area.	20	2	N/A
Tujereng windfarm	Windfarm in a coastal area 2.5 km southwest of Tujereng. Some uncertainty in turbine selection and configuration.	4	1	

3.7.2. Country context for renewable energy

Gambia ratified the Kyoto Protocol in 2001, and has since been fairly dormant in terms of engagement with the policies/mechanisms emanating from the international negotiations.

The Gambia's DNA (the Ministry of Forestry and the Environment) has currently a single carbon reduction project in its portfolio (associated with biomass), receiving prior consideration in March 2012. Capacity and expertise is mainly associated with forestry, with very little resources or experience with CDM.

A lack of capacity and engagement with CDM makes negotiating its procedural complexities a real challenge and a genuine barrier to CDM project development. The DNA presently appears to lack sufficient capacity to provide efficient support to CDM project developers and investors. Furthermore, engagement with clean/renewable technologies is sparse, with focus mainly orientating around forest preservation. A rising fiscal deficit and burgeoning poverty level also constrain investment.

Very little activity associated with carbon reduction projects has been witnessed. One project relating to biomass has attempted the beginning of the registration process. That said, the projects proposed to ECREEE are very encouraging. With support and capacity building services provided to the host country's relevant government department, such projects could be important for Gambia.

3.8. Ghana

3.8.1. Projects

One project has been identified in Ghana. It is briefly described below. Its full review is presented in Appendix F.

Working name of project	Brief description	Nominal capacity (MWe)	Information sufficiency	Traffic light overview
Prampam windfarm	Windfarm using Vensys 90 or Nordex 2.5 turbines, close to Prampam.	50	1	

3.8.2. Country context for renewable energy

Ghana ratified the Kyoto Protocol in 2003 and has since substantially promoted the establishment of the CDM focal point (the DNA) within the country. Ghana's political stability and rapid economic growth, especially within the region, make Ghana a relatively attractive prospect for commercial development, ranking 63rd globally in the 'Ease of Doing Business' index.[5] Ghana is no longer classified as a 'Least Developed Country' by the UNFCCC; sale of CERs generated from CDM projects will therefore have to seek markets outside of the EU ETS compliance market.

Ghana's DNA focal points reside in the 'Environmental Protection Agency, Ministry of Environment, Science & Technology' and 'Ministry of Environment, Science and Technology'. The governance structures in Ghana have slowly been aligning, aided through capacity development partnerships with GTC (German Technical Cooperation) and CD4CDM (Capacity Development 4 Clean Development Mechanism). Project development has however been delayed until recently due to internal incapacity and bureaucratic delays on the focal point of the DNA.[6]

Internal policies for energy efficiency, maintaining forest cover and strategies for forestation, as well as desires to maintain the relative greenness of their grid, have in fact confronted many of the barriers typical of the region in terms of sentiment for such projects. The difficulty in obtaining private capital (especially for smaller projects) and the lack of procedural expertise for the developing of the CDM Project Design Documents (PDDs) also need to be strengthened.

Ghana has forged ahead in recent years with four projects at the validation stage and one project submitted for registration, with another sixteen receiving prior consideration. These projects relate to GHG destruction, landfill gas flaring and energy efficiency. Ghana's governance structure has been relatively proactive, and importantly appears to be able to commit the resources required in terms of supporting the DNA to develop the capacity needed to efficiently process such projects. Ghana has been very active in developing Programmatic CDM relating to solar PV, methane avoidance, landfill gas and energy efficiency. The wind project proposed to ECREEE is robust and fits with a seemingly recent move in the Ghanaian CDM project development market for renewable technologies to be a part of the mix.

3.9. Guinea Bissau

3.9.1. Projects

Two projects have been identified in Guinea Bissau. They are briefly described below. Their full reviews are presented in Appendix G.

Both of these projects appear to be reasonably well advanced in development. The hydro project, however, is based on old data, and the solar project needs further work, particularly on land availability and solar resource assessment.

[5] http://www.doingbusiness.org/rankings/
[6] http://www.oeko.de/oekodoc/577/2006-135-en.pdf

Working name of project	Brief description	Nominal capacity (MWe)	Information sufficiency	Traffic light overview
Saltinho hydro	A dam across the River Corubal at Saltinho to a maximum height of 15m, creating a reservoir with a head drop of up to 13m.	18	1	
Guinea Bissau PV solar	Ground mounted PV scheme comprising 148 500 PV panels (100 x 165 lines of 9 PV in series)	9	1	

3.9.2. Country context for renewable energy

Guinea Bissau ratified the Kyoto Protocol in 2005. Prone to flooding and heavily dependent on the exploitation of natural resources within the country and on imports of oil, CDM poses real opportunities to the country. A weak political and economic situation made worse by a recent coup d'état has however made project development extremely challenging.

Guinea Bissau's DNA focal point resides in the 'Secretaria de Estado do Ambiente e Desenvolvimento Durável', currently inactive, lacking the necessary expertise and capacity and without a firm focus on CDM.

The lack of political stability, exacerbated by a coup d'état in April 2012, has had a detrimental effect worsening public economic deficits and causing rising inflation. The typical barriers relating to a lack of clear, empowered and strong governance structures as well as the physical infrastructure of Guinea Bissau make investment and project development in CDM projects a difficult challenge.[7]

Guinea Bissau has no CDM or other carbon reduction project activity. At this stage Guinea Bissau would be a very difficult market to develop CDM projects, with political unrest and possible sanctions from the ECOWAS pending. The projects proposed to ECREEE though, are (on paper) positive, and would be strong candidates for consideration of the CDM.

3.10. République de Guinée

3.10.1. Projects

Eight projects have been identified in République de Guinée. They are briefly described below. Their full reviews are presented in Appendix H.

The information for *all* of these projects dates from the early 1980s. We believe that the costs base for these prospective projects have been presented to us in money of the day (ie early 1980s). This means that the high level LCOE calculations will *significantly* understate the actual LCOE, if the projects were to be developed now.

[7] http://unfccc.int/resource/docs/natc/complete_nc2.pdf

Working name of project	Brief description	Nominal capacity (MWe)	Information sufficiency	Traffic light overview
Singuega hydro	Hydroelectric scheme on the River Makona	18	2	N/A
Morissanko hydro	A hydroelectric scheme on the River Niger involving the construction of a dam to create a head drop of 25m	100	2	N/A
Kogbedou hydro	A hydroelectric scheme on the River Milo involving the construction of a dam to create a head drop of 30m	16.5	2	N/A
Korafindi hydro	A hydroelectric scheme on the River Fatala involving a dam to create a head drop of 75m, with potential for additional irrigation.	100	2	N/A
Souapiti hydro	A hydroelectric scheme on the River Konkoure involving the construction of a dam to create a head drop of 130m.	508	2	N/A
Gozonguezia hydro	A hydroelectric scheme on the River Diani involving the construction of a dam to create a head drop of 40m.	48	2	N/A
Balassa hydro	A hydroelectric scheme on the River Bafing involving the construction of a dam to create a head drop of 29m.	181	2	N/A
Nonga hydro	A hydroelectric scheme on the River Makona involving the construction of a dam to create a head drop of 18m.	8	2	N/A

3.10.2. Country context for renewable energy

République de Guinée was an early mover for Kyoto Protocol ratification, having ratified the agreement in 2000. Its economy is heavily dependent on mining and the focus of the DNA is geared to this end. The country is currently undergoing a democratic transition with national reconciliation and structural reforms being the political focus. Economic growth is varied but holding at around 5% of real GDP, however this is offset by rising unemployment and a 21% inflation rate.

République de Guinée's CDM focal point (the Ministére du Developpement Durable et de l'Environnement) has been present on many issues relating to biodiversity and endangered species, however it is evident that the expertise and focus of the ministry is elsewhere apart from CDM.

The public and private sector have greatly suffered in République de Guinée from a lack of political and institutional stability leading to a deprived economic and financial governance – worsening budget deficits and a deterioration of state authority are a consequence of this. On paper, the

country is well placed to take advantage of the finance offered through CDM, however key governance structures are not conducive to CDM's proliferation at this moment in time, procedural complexity and unreliable infrastructure discourage investment.

République de Guinée has so far had three proposals submitted for DNA consideration, three of which (relating to landfill gas flaring and hydropower) have only achieved prior consideration and have not gone through to the project development stage. The projects submitted to ECREEE fit with previous project proposals, and would be key in satisfying the energy needs of the mining concessions within the country.

3.11. Liberia

3.11.1. Projects

Two projects have been identified in Liberia. They are briefly described below. Their full reviews are presented in Appendix I.

Both appear to be reasonably well advanced. We would consider the biomass project to have some technology risk, and may be challenging at such a small scale; the hydro project appears to have some gaps in terms of environmental impacts.

Working name of project	Brief description	Nominal capacity (MWe)	Information sufficiency	Traffic light overview
Cocopa biomass	Small biomass project in a rubber plantation, fuelled by wood chip from the felling of rubber trees.	0.2	1	
Mein hydro	Run of river scheme using a low weir across the Mein River above the Upper Kpatawee Falls to be developed in two phases.	1.5	1	

3.11.2. Country context for renewable energy

Liberia is in transition from post-conflict reconstruction to medium-term growth and poverty reduction. It is preparing its second medium-term growth and development strategy for 2012-2017, in line with a long-term strategy that envisions becoming a middle-income country by 2030. Liberia ratified the Kyoto Protocol in 2002; with the country's long-term growth focused on resource extraction and essentially in a state of re-building, there exists a real opportunity for new clean, renewable and efficiency technology to play a part in this nation-building phase.

Liberia's CDM focal point (the Environmental Protection Agency of Liberia) has so far been relatively successful with CDM project development. Issuance success and the efficiency of the process have been proven through the registration of the first project in the country. The CDM governance structures are also relatively robust with strong partnerships with the UNDP and UNEP as well from the GEF.

Liberia's challenges are typical of the region, however strong capacity building partnerships with the relevant UN organisations are proving positive. The country is still recovering from a deeply detrimental civil war; Liberia is seeking reconstruction through high volumes of foreign direct investment in its natural resource extraction industries.

Liberia has one CDM project registered and issuing credits (a landfill gas scheme), with another project receiving prior consideration (a renewable wood fired power plant). The projects proposed to ECREEE fit well with the other successful CDM projects developed within Liberia both in terms of their type and scale.

3.12. Mali

3.12.1. Projects

Four projects or development opportunities have been identified in Mali. They are briefly described below. Their full reviews are presented in Appendix J.

It is notable that there is a range of technologies included in Mali.

Working name of project	Brief description	Nominal capacity (MWe)	Information sufficiency	Traffic light overview
DNE Hydro projects	A network of seven mini and micro hydro sites across Mali. No specific sites identified. Nevertheless SKM has provided a best estimate of the LCOE based on [limited information provided].	21.6	2	N/A
Bamako solarpark	Prospect for a solar park in Bamako district. Actual sites yet to be identified	40	2	N/A
Gao solarpark	Hybrid PV diesel project.	20	2	N/A
Tombouctou wind	Windfarm 20 km for Tombouctou. Technology uncertain, but could be 4 no 275kW turbines.	1.1	3	N/A

3.12.2. Country context for renewable energy

Mali is the largest country in the ECOWAS region. Until very recently, Mali could be characterised as amongst the most politically and socially stable countries in the region, but it was subject to a coup d'état in March 2012. The northern territory defined as 'Azawad' by the occupying rebels is host to at least two projects proposed to ECREEE.

Ratifying the Kyoto Protocol in 2002, it has achieved relatively developed and supportive institutional infrastructure to support the development of low carbon technology projects. Furthermore, a well defined CDM approval procedure has been set up and its sustainability goals are well defined.

Mali has an established Designated National Authority in the 'Agence de l'Environnement et du Développement Durable' (AEDD) based in Bamako. Capacity has been built within the DNA through joint partnerships with the UNEP and World Bank Community Development Carbon Fund helping identification of project opportunities.

Mali is faced with some of the worst social indicators in the world having a 64% poverty ratio, being ranked 178 out of 182 countries in 2007, therefore providing limited human capital. However

despite this Mali has seen positive economic growth and has a clear strategy for rural electrification.

Mali has achieved registration and issuance of one project relating to a large scale hydro project (Félou Regional Hydropower Project), as well as prior consideration of two other projects relating to industrial gases and biomass. The projects proposed to ECREEE are on paper robust and ideal projects for CDM consideration, the geographical division of Mali into a north and south territory however present difficulties for the DNA especially in relation to governance over the occupied northern territory.

3.13. Niger

3.13.1. Projects

There are currently no projects identified in Niger within the ECREEE pipeline at the time of this review.

3.13.2. Country context for renewable energy

Niger ratified the Kyoto Protocol in 2004 and developed its national inventory of GHG emissions as part of Niger's first National Communication in 2000, leading to a national strategy action plan to be formed in 2002. Niger's sustainable development goals are encapsulated within the 'Strategy for the Reduction of Poverty' and the 'Strategy for Rural Development' documents.

Niger has an established National Authority in the 'Secretariat Executif du CNEDD, Cabinet du Premier Ministre' based in Niamey. Niger has been proactive in holding stakeholder CDM workshops including administration, private sector and civil society personnel.[8]

Barriers to Niger's CDM project development are associated with a general lack of recognition and awareness to the mechanism. Specific barriers related to a lack of institutional structures, procedural complexity, difficulty of project developers being able to obtain the necessary information, inadequate genuine national expertise and the inefficiency of the administrations responsible for approving and considering projects.

Niger has achieved registration and issuance of one project relating to a plantation scheme and another under prior consideration associated with a 20MW solar PV park.

3.14. Nigeria

3.14.1. Projects

Three projects have been identified in Nigeria. They are briefly described below. Their full reviews are presented in Appendix K.

No cost information has been provided for these schemes. Also, the scope of work associated with all three of these prospects is very uncertain, so it is not possible to even present a best guess for their capital cost requirements; so no LCOE estimates are provided in the appendix.

[8] http://www.unido.org/fileadmin/import/48450_Niger_English_Summary.pdf

Working name of project	Brief description	Nominal capacity (MWe)	Information sufficiency	Traffic light overview
Ikere Gorge hydro	Complete rehabilitation and expansion of existing hydro plant from 6 MW to 8MW plus additional access works and transmission	8	3	N/A
Oyan Gorge hydro	Rehabilitation of existing plant, repair of dam and additional transmission works. No costs provided, and cannot be readily estimated due to the very uncertain scope of dam repair	12	3	N/A
Tiga hydro	New hydro power station downstream of existing dam by diverting the Tiga reservoir original main penstock.	10	3	N/A

3.14.2. Country context for renewable energy

Nigeria ratified the Kyoto Protocol in 2004, and has since been relatively very active in the CDM project development market with focus on energy efficiency, biomass, landfill gas and fossil fuel switch projects. Nigeria has been vocal and proactive at international conferences and, within the ECOWAS region, has generally took the lead in this market.

Nigeria has an established national authority in the 'Federal Ministry of Environment'. Nigeria has successfully registered five projects now issuing carbon credits with another ten in the pipeline, and a further eighteen have been given prior consideration of the CDM, giving a total of thirty-three being either developed or in the process. Nigeria is no longer classified as a 'Least Developed Country' by the UNFCCC; sale of CERs generated from CDM projects will therefore have to seek markets outside of the EU ETS compliance market.[9]

Barriers to CDM development in Nigeria relate generally to an inadequate knowledge base, lack of support services and a myriad of other problems indicating a general lack of institutional capacity. Financial and government bottlenecks are real problems facing project development, with financial institutions reluctant to bankroll long-term projects, and government institutions favouring carbon-intensive technologies and not embracing the development of clean technologies.

The creation of awareness and funding appears to be the most critical constraints that must be removed if CDM projects are to be successfully implemented in Nigeria. That said, Nigeria has a well established conducive CDM institutional infrastructure, albeit with some inefficiencies. Nigeria has been very active in the Programmatic CDM project development market, having two schemes registered and six in the pipeline related to household energy efficiency. The projects proposed to ECREEE are promising, they are a step away from the usual type of projects but they do fit with the sort of medium-scale projects present within the country.

[9] http://www.unido.org/fileadmin/import/29634_RAFI_reportNigeria.pdf

3.15. Senegal

3.15.1. Projects

Four projects or development opportunities have been identified in Senegal. They are briefly described below. Their full reviews are presented in Appendix L.

Again, there is a range of technologies presented. The three 'category 1' projects appear to be well advanced in development, although each has areas that would be considered to be risks that need to be carefully considered in the next stages of development. There is uncertainty as to the scale of the Taiba Ndiaye windfarm.

Working name of project	Brief description	Nominal capacity (MWe)	Information sufficiency	Traffic light overview
Ross-Bethio biomass	Biomass gasification project using locally produced biomass residues as feedstock, including Typha reed (weed) and rice husks	15	1	
Ziguinchor solar park	Hybrid PV diesel project, but no technology identified yet.	10	2	N/A
Sakal / Dagana solar park	PV panels installed on a tracking system in order to follow the sun during the day. 1 or 1.5 MW modules.	20	1	
Taiba Ndiaye windfarm	Split site installation to the west of Taiba Ndiaye town. The first (northern) site is 75 MW and the second (southern) 50MW.	125	1	

3.15.2. Country context for renewable energy

Senegal, one of the earliest to ratify the Kyoto Protocol, accepted the Protocol in 2001. Since 2001 the country has realised the potential offered through the carbon market to finance the development of its electricity grid.

Senegal's DNA focal point (the Direction de l'Environment et des Etablissements Classés) has been very proactive in the region and has forged ahead with project development. Relatively efficient and with a clear focus and direction on climate change project development, the country is well placed to play host and take advantage of the CDM. Senegal has also been active in developing Programmatic CDM schemes having four projects in the pipeline related to energy efficiency and lighting.

Apart from the barriers typical of the region, Senegal has recently witnessed a rise in political unrest with the recent elections posing a challenge to the country's democracy. Unemployment also remains a crucial problem, which has slowed economic recovery in recent years.

Senegal has currently ten projects in the CDM process, one of which was replaced at validation and is now in the development pipeline, three which are now registered and have either been issued or will be requesting issuance and the remainder which have received prior consideration. Projects are mostly associated with biomass energy and landfill gas flaring, however more recently wind projects have began to enter the pipeline. The projects proposed to ECREEE follow this

trend, and are very interesting prospects that could benefit from the finance offered through the CDM. The solar projects are currently an unexplored territory for Senegal from a CDM point of view, but which should be explored. The Taiba Ndiaye project is currently a registered project (Feb 2012), with issuance of credits forecasted for September 2013.

3.16. Sierra Leone

3.16.1. Projects

One project has been identified in Sierra Leone. It is briefly described below. Its full review is presented in Appendix M.

Working name of project	Brief description	Nominal capacity (MWe)	Information sufficiency	Traffic light overview
Moyamba small hydro	Low head run of river scheme with concrete weir, power house, auxiliary power house, booster station and transmission line.	10	1	

3.16.2. Country context for renewable energy

Sierra Leone ratified the Kyoto Protocol in 2006, and has since been relatively absent from involvement in the CDM project development market. Despite progress both politically and economically, Sierra Leone's social indicators remain amongst the lowest in the world.

Sierra Leone's CDM focal point is the Meteorological Department. The DNA lacks a clear focus on the opportunities provided by CDM although the department clearly has some residual expertise; however this is under resourced and underdeveloped.

As with many of the countries in the region, Sierra Leone continues to face challenges with its governance structure, although there are active moves to strengthen them and make them more transparent and robust.

Sierra Leone currently has a single project at the validation phase related to bagasse power. The CDM project development market in Sierra Leone is very small at this stage; however the proposed project to ECREEE is an interesting opportunity.

3.17. Togo

3.17.1. Projects

One development opportunity has been identified in Togo. It is briefly described below. Its full review is presented in Appendix N. The documentation received indicates that it is actually not a real 'project' yet – it is an invitation to tender for the possible development of a solar project in Togo, although no actual site has been identified yet.

Working name of project	Brief description	Nominal capacity (MWe)	Information sufficiency	Traffic light overview
Togo solar	Very early stage invitation to tender for a 5 MWe solar scheme in Benin. No site information available.	5	3	N/A

3.17.2. Country context for renewable energy

Togo ratified the Kyoto Protocol in 2004, and has since been active in gradually building capacity within their CDM focal points, especially in partnership with the UNDP. Improvements to the country's electricity grid through renewable technology are being explored with carbon finance a consideration being taken into account in conjunction with supporting mechanisms such as the CDM and new market mechanisms.

Togo established a DNA under the 'Ministère de l'Environnement et des Ressources Forestières' (MERF). The DNA has identified the growth areas for CDM projects in the energy and forestry sectors, but their respective potentials have not yet been evaluated. The UNDP has assisted the building of capacity within the Togo DNA, with CDM being identified as a key way of financing renewable energy. However, the DNA procedural processes are still lengthy, delaying project registration and development.[10]

A typical lack of expertise, leading to extensive lead times when the project is submitted for DNA approval and consideration, makes project development lengthy and unattractive. Financial institutional structures are also an issue, with private capital and local business struggling to realise the opportunities afforded through such projects therefore making large scale development challenging.

Togo has so far had three small-scale projects under consideration of CDM, two of which (relating to cook stoves and efficient lighting) are still at the proposal stage; the third (also relating to efficient lighting) has opened for comments at the validation stage. Togo has also been active in developing Programmatic CDM work schemes, having four projects in the pipeline related to household energy efficiency. The projects proposed to ECREEE are typical of the pipeline of projects emanating from Togo, and as such demonstrate a genuine direction by the country in this theme.

3.18. Portfolio overview – estimates of LCOE

As set out in Sections 2.5 and 2.6, where possible we have provided a high-level estimate of the LCOE of the projects in the pro-formas contained in the appendices to this report. As explained in Section 2.4, this has only been possible where the developers have provided information on capital cost, operating cost and project output, or where there is sufficient information provided to enable us to present a very high level estimate of such parameters based on our own knowledge and understanding of such projects (ie 'Category 1' or 'Category 2' projects). There are 34 projects in the portfolio for which this has been possible. These high-level estimates are summarised in the table below, showing the 'basic' LCOE for the project and the effect that possible receipt of CDM revenues might have on LCOE. Please note that these estimates are very high level, and in some cases are based on very limited information. They should be considered as indicative only.

[10] http://www.tg.undp.org/domprio/envi_ener.htm

Working name of project	Country	Estimated LCOE (€/MWh)	Estimated potential CDM revenue (€/MWh)	Estimated impact of CDM on LCOE* (€/MWh)
Biomass in Benin	Benin	117	10.7	106
Le Fleuve hydro	Benin	91	12.8	78
Yaho PV/diesel	Burkina Faso	308	5.3	303
Achada da Cidade Velha	Cape Verde	268	7.8	260
Salamansa	Cape Verde	255	10.9	244
Monte Leao e Ruiz Vas	Cape Verde	102	8.5	94
Brava	Cape Verde	117	8.4	109
Sao Vincente	Cape Verde	108	8.3	100
Akouedo	Côte d'Ivoire	114	8	106
Biokala	Côte d'Ivoire	84	7.5	77
Sojiedo	Côte d'Ivoire	121	11.2	112
Birkama	Gambia	238	11.6	226
Tujereng	Gambia	133	11	122
Prampam	Ghana	119	3.9	115
Saltinho	Guinea Bissau	50	12	38
Guinea Bissau PV solar	Guinea Bissau	248	7.8	240
Singuega**	Guinée	52	12.1	40
Morissanko**	Guinée	42	11.9	30
Kogbedou**	Guinée	132	11.9	120
Korafindi**	Guinée	72	12.1	60
Souapiti**	Guinée	19	11.3	8
Gozonguezia**	Guinée	35	11.2	24
Balassa**	Guinée	31	10.9	20
Nonga**	Guinée	86	11.6	74
Cocopa	Liberia	198	6.3	192
Mein	Liberia	106	11.3	95
DNE Hydro projects	Mali	189	4.9	184
Bamako	Mali	269	5.3	264
Gao	Mali	254	5.4	249
Ross-Bethio	Senegal	119	8.4	111
Ziguinchor	Senegal	189	7.3	182
Sakal/Dagana	Senegal	220	9.8	211
Taiba Ndiaye	Senegal	150	7.2	143
Moyamba	Sierra Leone	77	9.9	67

*In effect, this is a high level estimate of the price that needs to be paid for the project's output, to enable the project to achieve a reasonable commercial return assuming the project is able to secure CDM revenues.

** The information for *all* of these projects dates from the early 1980s. We believe that the costs base for these prospective projects have been presented to us in money of the day (ie early 1980s). This means that the high level LCOE calculations will *significantly* understate the actual LCOE, if the projects were to be developed now.

4. Electricity network overview

4.1. Introduction

The main energy sources (mixed thermal/hydro systems in the region) are unequally distributed and this calls for new forms of renewable sources (solar, wind, biomass and hydropower) particularly in the remote areas where the nearest grid infrastructure is usually unreliable and overloaded. According to a recent UN Report,[11] about 60% of people live in sparsely populated rural areas in Africa where access to electricity becomes a major issue for concern. Currently only 30% of the population in the West African Power Pool (WAPP) countries are supplied with electricity.[12]

The transmission and distribution systems of these countries are underfunded and are stretched, with many transformers and substations close to or exceeding their design rating. This has led to poor availabilities and very high levels of losses. Losses are partly technical, though non-technical losses primarily due to theft are thought to be high as well.

The transmission lines are usually very long, thus requiring the installation of capacitor banks at low voltage levels to improve the power factor and reduce reactive power flows. Likewise reactor banks are needed at high voltage levels to absorb reactive power flows. The main voltage risk areas are: north of Togo and Benin, parts of Mali, Senegal and Burkina Faso. The VHV transmission network (330 kV and 225 kV) is recent and is in good state but the HV (161 kV and 90 kV) network is relatively old and highly loaded; it suffers from poor maintenance.

Burkina Faso, Côte d'Ivoire, Ghana, Togo and Benin are operated synchronously due to their interconnection at 330 kV, 225 kV and 161 kV, whereas Nigeria and Benin are similarly interconnected but not yet synchronised. Senegal and Mali are interconnected at 225 kV. These interconnections may give rise to inter-area oscillations when small signal stability calculations are carried out.

It is important to remember that the connection of renewable generation can raise the fault levels on existing transmission networks, due to the fault contributions from the renewable generators themselves, to values beyond the capacity of existing switchgear. Already, there are short circuit problems in southern Nigeria, Ghana (around Tema) and Côte d'Ivoire (around Abidjan). These are attributed to the generation projects in the areas.

A general assessment of the state of the electrical infrastructure in the participating countries is described below.

4.2. Benin and Togo

The electricity in Benin is governed by a joint agreement with Togo. The electricity demand is mainly supplied from Côte d'Ivoire and Ghana via the southern 161 kV double-circuit link, which has a capacity of 150 MW. The generation is concentrated mainly in the south but the main part of the load is there too. The electricity markets of Togo and Benin are significantly smaller than those of the neighbouring countries and it is expected that they will continue to be net importers of electricity in the foreseeable future. There are forty-two transmission lines above 63 kV; sixty-four transformers and three shunts.

[11] United Nations – World Bank (2011), World development indicators, http:data.un.org
[12] West African Power Pool – Update of ECOWAS Master Plan (Vol. 1) - Sept 2011, pp 7/163

4.3. Burkina Faso

The country has been identified as a favourable area for the development of solar technologies.[13] The transmission network has long lines and several different voltage levels. There are forty transmission lines above 33 kV; seventy-six transformers and nineteen shunts.

4.4. Côte d'Ivoire

Electricity in Côte d'Ivoire is produced by mainly hydro/thermal plants. It is estimated that nearly 55% of the produced energy is for residential consumption; private and public services (15%) and industries (30%). There are seventy one transmission lines above 90 kV; forty-four transformers; eight shunt capacitors and five shunt reactors.

4.5. Gambia

The network is currently isolated from the rest of the WAPP transmission system and the load growth is severely limited by the availability of supply. There are only ten transmission lines (nine at 33 kV and one at 11 kV); twelve transformers and no shunt.

4.6. Ghana

The transmission network is considered very important in the region because of links to Côte d'Ivoire, Togo and Benin; Ghana typically exports surplus generation to these countries too. The generation is concentrated mainly in the south whereas the load is in the north. The economy of the country is growing as well as its population; it faces a major challenge of providing reliable energy. Nigeria supplies Ghana with natural gas but recent technical problems in Nigeria has reduced the level of gas available to the country. There are eighty-two 66 kV transmission lines above 69 kV; ninety-nine transformers; twenty nine shunts.

4.7. Guinea Bissau

The load growth is limited by the degradation of its quality of supply though there is a substantial mining demand. There are only two 30 kV lines, four transformers and no shunt.

4.8. République de Guinée

There are twenty-four transmissions (above 15 kV); thirty-seven transformers; one capacitor and three reactor shunts.

4.9. Liberia

The recent civil war devastated the electricity infrastructure particularly in the rural areas. It has been reported that the electricity access rate is below 10%; very few customers are connected to the network. There are four 66 kV transmission lines; four transformers and no shunt.

4.10. Mali

The country has been identified as a favourable area for the development of solar technologies.[14] Its distribution network is concentrated mainly in the south-west. There are twenty four kV transmission lines above 33 kV; forty seven transformers and no shunt.

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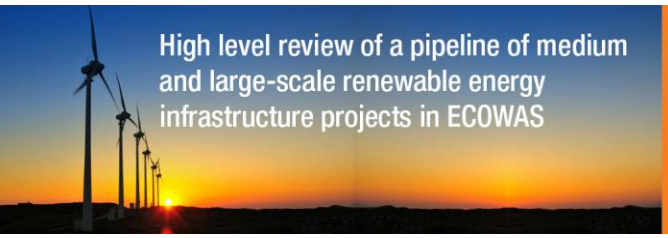
[13] West African Power Pool – Update of ECOWAS Master Plan (Vol. 1) - Sept 2011, pp 29/163
[14] West African Power Pool – Update of ECOWAS Master Plan (Vol. 1) - Sept 2011, pp 29/163



4.11. Nigeria

Nigeria is the largest electricity market within the region. The low state of power generation calls for increased generation as well as diversifying beyond the predominantly thermal and hydro stations to include other forms of renewable sources. Nigeria's thermal plants are generally old, and poorly maintained with low plant availabilities. Also the main hydro station at Kianji was constructed in 1968 and suffers from lack of maintenance and overhaul. The existing 330 kV and 132 kV transmission network in the country suffer from prolonged and frequent outages. However a 760 kV super grid is envisaged to reinforce the interconnections at 330 kV with their neighbouring countries. There are one hundred and ninety one transmission lines above 132 kV; two hundred and eighty six transformers and eighteen shunts.

4.12. Senegal

According to the ECOWAS Master Plan, 25% of the 90 kV network is more than 30 years old. There are twenty four transmission lines above 90 kV; thirty six transformers and no shunt.

4.13. Sierra Leone

The civil war lasting for nearly ten years devastated the electricity infrastructure particularly in the rural areas. The electricity production is very low. It has been reported that the electricity access rate is less than 1% in the rural areas and less than 10% of the entire population has access to electricity. There are six transmissions above 161 kV; nine transformers and six reactor shunts. The demand of electricity is primarily urban. There are six transmission lines above 161 kV; nine transformers and six shunt reactors.

5. Conclusions

SKM has provided a high level review of 41 potential renewable energy projects across the ECOWAS region of West Africa.

The information available on these potential projects ranges from very limited information on a possible development concept but without any site or technology information, through to projects that have clearly been the subject of significant feasibility assessment.

As a consequence, we have categorised the possible projects into one of three categories:

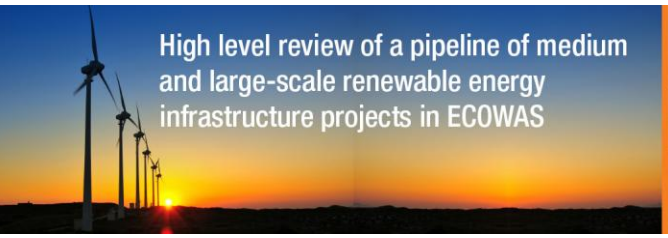
- Those for which a full review can be undertaken and broad conclusions made. There are 16 such projects within the pipeline.
- Those for which we are able to provide some commentary and are able to provide a 'best guess' estimate for the levelised cost of electricity generation, but on which we cannot draw clear conclusions because of the lack of firm information or evidence. There are 18 such projects within the pipeline.
- Those for which only very high level comment can be made, as there is insufficient information to even provide a best guess of costs or performance. There are seven such projects within the pipeline.

Of the 16 projects on which we can draw broad conclusions, we would provide overall assessments as follows:

- On basis of the evidence provided to us, we would not consider any of the projects to yet be at a close-to-fully developed stage, with robust evidence of costs and risk management.
- We would consider all 16 projects to show evidence of commercial viability, albeit there are areas that need either further detailed information and supporting evidence, or require further development work to establish a commercially viable business model. We would note that some of these projects appear to be further advanced in development than others, and have some strong characteristics, but *all* have elements of uncertainty that need resolution before a bankable business case can be established. All of these 16 projects are therefore characterised as 'amber' (see Section 2.3 of this report), but with different strengths and weaknesses. More detail can be found in the main body of this report and in the appendices.

The 16 projects on which we can provide an overall high-level assessment are:

Working name of project	Technology	Country	Nominal capacity (MWe)*	Estimated LCOE** €/MWh	Estimated Capex*** €k/MWe	Traffic light overview
Monte Leao e Ruiz Vaz	Wind	Cape Verde	6.8	102	2410	
Brava wind	Wind	Cape Verde	0.5	117	1760	
Sao Vincente	Wind	Cape Verde	1.0	108	2990	
Akouedo	Biomass (landfill gas)	Côte d'Ivoire	8.5	114	3750	




Biokala	Biomass	Côte d'Ivoire	18.3	84	1650	
Sojiedo	Solar	Côte d'Ivoire	15	121	1600	
Tujereng	Wind	Gambia	4	133	900	
Prampam	Wind	Ghana	50	119	1470	
PV in Guinea Bissau	Solar	Guinea Bissau	9	248	3280	
Salthinho	Hydro	Guinea Bissau	18	50	3350	
Cocopa	Biomass	Liberia	0.2	198	3640	
Mein	Hydro	Liberia	1.5	106	2400	
Ross-Bethio	Biomass	Senegal	15	119	2530	
Sakal / Dagana	Solar	Senegal	20	220	2930	
Taiba Ndiaye	Wind	Senegal	125	150	1960	
Moyamba small hydro	Hydro	Sierra Leone	10	77	2340	

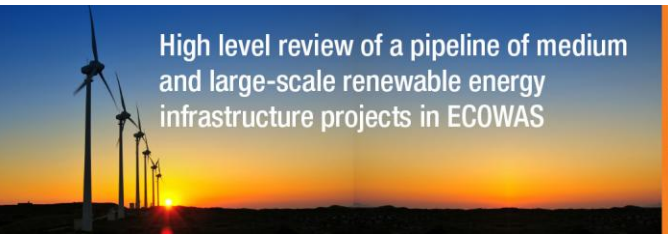
*rounded

***excluding* any income from CDM or other supportive policy instrument

*** rounded to nearest €10k/MWe

It should be noted that for a number of the projects we have reviewed, there are references to documents that we have not had an opportunity to review. This additional information may provide more robust evidence to support some of the project assumptions, which would provide greater confidence in their commercial viability.

It should further be noted that, for those projects on which we received insufficient information to make an overall assessment, this does *not* mean that they are not commercially viable; it simply means that insufficient information is currently available on which to draw any conclusions. This may be because the projects are at a very early stage of development, but the proposed development may still represent a potentially successful project.



SINCLAIR KNIGHT MERZ SKM

The review of this pipeline of projects has identified a number renewable energy projects in the ECOWAS region that, with further development to remove and mitigate risks and uncertainties, could prove to be commercially successful ventures.

6. Appendices

Appendices A to N are compiled as zip file and attached to this report.

Appendix O CDM considerations

The CDM process

Projects are first identified by a 'project proponent' and subsequently the appointed project developer will begin the CDM 'cycle'. In the first instance this requires a 'Project Idea Note' (PIN) to be drafted, this details the scope, type and location of the project; the expected emissions reductions; the host country context and how the project will meet the sustainable development goals of the country. This is then submitted to the host country Designated National Authority (DNA) – a host country government ministry or department – for approval, if successful, a 'letter of no objection' or 'letter of approval' is then submitted by the DNA to the developer and the project development can then go ahead – this is essentially the first hurdle.

A detailed 'Project Design Document' (PDD) is then generated. This includes the identification of the methodology to be used (prescribed by the UNFCCC) in assessing the baseline and project emissions as well as the outline of the methodology to be used for the ongoing monitoring, measuring and verification of the emissions reductions. The document also establishes the arguments and justification for how the project is 'additional'. This is absolutely key to the success of the project; additionality means that a) the project wouldn't have gone ahead in the absence of the extra CDM revenue, b) that the project displaces another more likely project that has higher emissions and, c) prior consideration of the CDM must be ensured to prove that the CDM is key and serious consideration in project development.

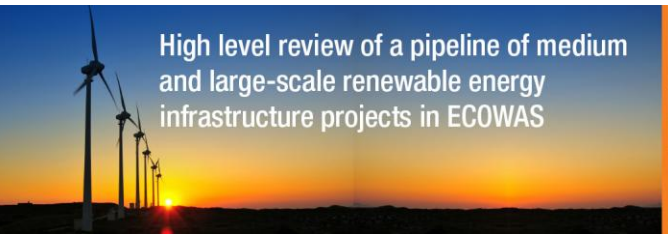
The PDD is then submitted for validation by the 'Designated Operational Entity' (DOE); this involves an audit of the PDD and accompanying calculations. At this stage the project then enters what is referred to as the 'pipeline'. The PDD is made public and the DOE's report is made publically available for comment for 30 days. If successful the project developer then requests 'registration' of the project from the CDM Executive Board (a panel of appointed experts). This is a crucial point in the cycle, the DOE can ask for a correction; give a negative/terminate validation or reject validation, the developer can also replace the project at validation or withdraw the project. In such cases, the project registration phase is not achieved and the CDM cycle is halted. Is validation is successful and registration is achieved a period of monitoring and verification of the project is undergone to assess in reality the emissions reductions of the project. Certification of the project is then requested; following this the project enters the 'issuance' (of CDM credits) and 'forwarding takes place (transfer of the credits into the project participants account from the CDM registry.

Key to this process and the minimisation of costs to the project proponents and project developer is an efficient, supportive and experienced DNA. The inexperience, under-resourcing and incapacity of this body has often been a major hurdle to successful project development and consideration of development in notoriously 'bad' countries. In country legal expertise and financial institutional structures are also major challenges faced when developing CDM projects.

Additionality assessment

As mentioned above, one of the important criteria in assessing CDM eligibility is to look at 'additionality'. Where information has been made available, we have considered each of the projects within the ECREEE pipeline against different elements of this additionality criterion, as described briefly below:

AUTOMATIC [Au]: Certain grid-connected renewable electricity generation technologies are automatically considered as additional. These including the following grid-connected renewable electricity generation technologies with an installed capacity up to 15MW:




- Solar technologies (photovoltaic and solar thermal electricity generation);
- Off-shore wind technologies;
- Renewable energy is the primary technology and its installed capacity is less than or equal to 5MW.

INVESTMENT BARRIER [Ib]: A financially more viable alternative to the project activity would have led to higher emissions. Best practice examples include, but are not limited to, the application of investment comparison analysis using a relevant financial indicator, application of a benchmark analysis or a simple cost analysis (where CDM is the only revenue stream such as end-use energy efficiency). It is recommended to use national or global accounting practices and standards for such an analysis.

ACCES TO FINANCE [Af]: The project activity could not access appropriate capital without consideration of the CDM revenues. Best practice examples include, but are not limited to, the demonstration of limited access to capital in the absence of the CDM, such as a statement from the financing bank that the revenues from the CDM are critical in the approval of the loan.

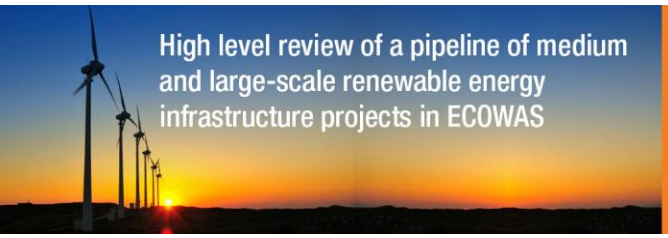
TECHNICAL BARRIER [Tb]: A less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions. Best practice examples include, but are not limited to, the demonstration of non-availability of human capacity to operate and maintain the technology, lack of infrastructure to use the technology, unavailability of the technology and high level of technology risk.

PP/CP BARRIER [Pcp]: Prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions. Best practice examples include, but are not limited to, the demonstration that project is among the first of its kind in terms of technology, geography, sector, type of investment and investor, market etc.

OTHER BARRIERS [Ob]: These can include:

- Institutional barriers or limited information, managerial resources,
- organizational capacity,
- or capacity to absorb new technologies

These considerations are included within the pro-formas found in Appendices A-N.



Appendix P Glossary of terms

CDM	Clean Development Mechanism
CER	Certified Emissions Reduction
DNA	Designated National Authority
DOE	Designated Operational Entity
ECOWAS	Economic Community of West African States
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EIA	Environmental Impact Assessment
EREF	ECOWAS Renewable Energy Facility
EREI	ECOWAS Renewable Energy Investment and Business Initiative
ESIA	Environmental and Social Impact Assessment
EU ETS	European Union Emissions Trading Scheme
FDI	Foreign Direct Investment
GEF	Global Environment Facility
GHG	Greenhouse gases
LCOE	Levelised cost of electricity (energy)
MWe	Megawatt (electric)
MWh	Megawatt hour
PDD	Project Design Document
PIN	Project Idea Note
UNEP	Unite Nations Environment Programme
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change