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Regional Off-Grid Electrification Project REGIONAL OFF-GRID SOLAR MARKET ASSESSMENT AND PRIVATE SECTOR SUPPORT FACILITY DESIGN

REPUBLIC OF BENIN, REPUBLIC OF CABO VERDE, BURKINA FASO, CAMEROON, CENTRAL AFRICA REPUBLIC, REPUBLIC OF CHAD, REPUBLIC OF CÔTE D'IVOIRE, ISLAMIC REPUBLIC OF THE GAMBIA, REPUBLIC OF GHANA, REPUBLIC OF GUINEA, GUINEA-BISSAU, REPUBLIC OF LIBERIA, REPUBLIC OF MALI, ISLAMIC REPUBLIC OF MAURITANIA, REPUBLIC OF NIGER, NIGERIA, REPUBLIC OF SENEGAL, REPUBLIC OF SIERRA LEONE AND REPUBLIC OF TOGO

Context

Around 50 percent of population in the broader West African region including Sahel still lives on less than US\$2/day¹. Although there is some contrast between countries such as Liberia, Guinea-Bissau and Central African Republic where over 65 percent of population lives below US\$1.90/day compared to Mauritania with 11 percent – the general trend is grim with over 70 percent of this region's population living below US\$3.10/day. This region is also home to around 33 percent of the continent's population with around 17 percent of the land area. The region accounted for 28 percent of Africa's GDP in 2015.

Countries in the broader western African region including the Sahel face interrelated challenges of energy access, energy security and climate change mitigation² simultaneously. Electricity shortages in urban areas and lack of access to modern, affordable and reliable energy services in rural areas are interrelated with a variety of economic, social, environmental and political problems. The electricity systems in the region face challenges due to the growing gap between predicted demand, existing supply capacities and limited capital to invest. Less than 40 percent of the population in the Sahel and broader western African region has access to electricity. Significant energy access inequalities exist between urban and rural areas. Electrification rate of public institutions like schools and health centers is also very low.

Energy is considered a key factor in achieving sustainable development and poverty reduction in the region. Most client governments, donor governments and international organizations have recognized the importance of integrating renewable energy into development policies to promote sustainable development. Under the Multi-Tier Framework (MTF)³ of measuring energy access general solar home systems can meet the Tier 1 to 3 level of energy access, which is the typical consumption pattern of households in Sub-Saharan Africa. Specially designed PV systems for commercial and institutional use can provide higher level of access. Off-grid solar meets consumer energy needs more readily and represents an important first step on the energy access ladder.

Several broader West African countries including the Sahel countries are already tackling the issue of off-grid electrification to some degree in a wide variety of approaches such as concessions, franchising, Rural Electrification Agencies (REAs), Rural Electrification Funds (REFs), fee for

¹ The World Bank defines extreme poverty as living on less than US\$1.25 per day, and moderate poverty as less than \$2 a day

² Source: ECOWAS program on access to sustainable electricity services (EPASES) 2015-2020 in rural and peri-urban areas

³ Multi-Tier Framework for Measuring Energy Access (MTF) redefines energy access from the traditional binary count to a multi-dimensional definition as "the ability to avail energy that is adequate, available when needed, reliable, of good quality, convenient, affordable, legal, healthy and safe for all required energy services". That is, having an electricity connection does not necessarily mean having access to electricity under the new definition, which also takes into account other aspects, as for example reliability and affordability. Energy access is measured in the tiered-spectrum, from Tier 0 (no access) to Tier 5 (the highest level of access)

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service approaches, leasing, etc. On one hand countries like Senegal and Mali are example countries that have adopted private concessions to scale up mini-grids in rural areas. On the other hand, countries such as Nigeria and Ghana have achieved good results for rural electrification based on a government investment approach. There are advantages and disadvantages to each approach, and each may be better suited to one country or another depending on the institutional and legal situation of the country concerned. There are also a number of successful rural electrification programs in the region, such as the Ghana Electrification Scheme (2006-2020), or the initiatives of Mali's AMADER and Senegal's ASER. Several donors are interested in working in the region and are carrying out and planning several initiatives.

The Sustainable Energy for All (SE4ALL) Action Agenda is supported in the broader western African region including the Sahel through ECOWAS. To provide universal access to electricity by 2030, ECOWAS has adopted an ECOWAS Renewable Energy Policy (EREP). The EREP was conceived to respond to the severe energy crisis in the member countries by exploring the vast renewable energy generation potential that exists in the region through the participation of private sector. This Policy was adopted by the 43rd Ordinary Session of the ECOWAS Authority of Heads of State and Government, which was held in Abuja, Nigeria, from 17 to 18 July, 2013. The policy also aims to assist the ECOWAS member states to develop appropriate regulatory frameworks for the promotion of renewable energy technologies and services, thus reinforcing regional integration in the renewable energy sector. ECREEE has also assisted Sahel states such as Mauritania and Chad in activities related to energy access. Furthermore, with the support of the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE), ECOWAS member states already developed national renewable energy action plans, SEforALL Action Agendas, policies and strategies.

In this context ECREEE, with the support of the World Bank, is launching a Regional Off-grid Electrification Project focused on enhancing shared capacity, institutions and knowledge, and to jointly increase electricity access to households, businesses and communities using modern off-grid electrification technologies in project countries.

- The program aims to complement the multiple existing initiatives.
- The technologies that will be supported by the program are Lighting Africa/Lighting Global approved lanterns and stand-alone solar systems, including solar water pumps.
- The countries covered will be all 15 members of ECOWAS plus Cameroon, Central Africa Republic, Chad, and Mauritania.

A consultancy firm is being retained to conduct market surveys in each of 19 countries in the target region, including the review of trade conditions for renewable energy equipment at regional and national level. The studies will characterize the off-grid market in terms of access, demand, private sector involvement and the role of local financial institutions in financing the off-grid energy sector. Based in these assessments consultants will then propose interventions to expand access to off-grid solar electricity in the region via support to the private sector.

Objective and Scope of Work

The objective of the assignment is to assess the market for off-grid solar systems, and recommend the most realistic market-based mechanism(s) that will lead to scaling up access using solar

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technologies supplied by the private sector. This will be accomplished through the completion of 4 tasks:

- i) Conduct assessments of the current state of access and the enabling market environment for each country, including the review of trade conditions for renewable energy equipment at regional and national level;
- ii) Describe and quantify demand and supply for solar lanterns, off-grid solar systems for households, private enterprises and public bodies for each country;
- iii) Assess the level, capability and willingness of existing financial institutions to provide financing to private off-grid solar companies for each country;
- iv) Based on i), ii), and iii) suggest mechanisms on how to incentivize the private sector and financial institutions to enter or expand off-grid solar in all 19 target countries. Suggestions on how to strengthen the enabling market environment towards a harmonized regional solar market will also be provided by the consultant.

Work will be done in close collaboration with ECREEE and the World Bank Team, drawing heavily on the resources of ECREEE. The successful firm should ensure assessments avoid duplication and make full use of all the existing studies and documents, including the RISE project data and the Climate Scope, as well as recently adopted National Renewable Energy Action Plans and SE4ALL Action Agendas in each ECOWAS member states. The EPASES (ECOWAS Programme on Access to Sustainable Electricity Services) program document, available at <http://www.ecreee.org/project/epases-ecowas-programme-access-sustainable-electricity-services> as well as the www.ecowrex.org contain relevant information that the Firm should be aware of before beginning this assignment.

Output will be a single written report [format to be provided at inception] for the region along with individual country reports (in the official language and in English) according to a standard format to be provided, and with a view to internal and external publication. Firms will also be expected to deliver a briefing session in PowerPoint format at the ECREEE headquarters in Cabo Verde. All data collected under this assignment will be formatted appropriately and delivered jointly to the reports under the forms of regional and country level data packages.

Detailed Scope

The assessments will draw upon existing data and materials wherever possible, but original research is expected to complement this information. The analysis will also take gender aspects in consideration.

Task 1: Describe the current state of access and the enabling market environment for each country, including the review of trade conditions for renewable energy equipment at regional and national level;

1. Electricity Access - *Grid and off-grid*

- A) Map current and expected (in 5 and 10 years) electricity grid coverage and power generation in (including imports to) individual countries based on current situation and taking into consideration planned/expected grid expansion and mini-grids development. Compare maps of grid coverage with maps of population to determine

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areas as well as the percentage/number of households within those areas that: (i) have grid access now and would have access in the near future (5 years), and (ii) would have no grid access in the medium term. Within areas that have/would have grid access, highlight the percentage of households that would remain unconnected (though they live 'under-grid'). Within areas that would have no grid access, estimate number of people that have and could have in future access to off-grid and mini-grid electricity and map geographically, based on a least-cost analysis. This estimation will take into consideration key factors on national or regional population shifts (for example, economic development zones and urban migration) and other relevant map data (such as, roads, public buildings and others)

- B) Research the quality and level of solar equipment sales and distribution in country. In addition to other relevant parameters identified by the consultants, an estimation of the current market size and growth will be provided. This can be done, for example, by type of consumer, business models or system sizes, amongst other categories.
- C) Research the level of commercial, institutional and productive uses of off-grid solar systems, with a particular emphasis on sales and distribution of solar water pumping and irrigation in country. This research should also include an estimation of the productive uses of off-grid solar systems.

The maps datasets should be available in GIS format ready to be integrated in the ECOWREX Spatial Data Infrastructure <http://www.ecowrex.org/page/maps>. The metadata of all layers produced will be submitted to ECREEE to fill it into the ECOWREX metadata catalogue. ECREEE will provide the templates to fill the metadata.

2. National and regional Policy and regulation - *Regulation, government planning and key constraints*

Summarize strategies, action plans, and regulations (including VAT and import duties on solar equipment, quality and standard regimes and licensing) related to electricity access, renewable energy promotion, and decentralization to local governments.

Analyze the basic principles of ECOWAS from a trade point of view with an emphasis on energy i.e. common external tariff, custom union, free trade among countries, the energy Charter international treaty, the ECOWAS energy protocol of 2003, etc., describe and assess the current state of implementation and enforcement of trade policies and conditions for renewable energy equipment in the 19 selected countries individually and at regional level

Desk review should be complemented with consultations with key stakeholders including ministries and relevant agencies (ECREEE will provide guidance by group by country). The review will suggest the required enabling environment improvements and the best way to support the improvements with a regional approach.

Capacity building and technical assistance needs, as well as challenges to the implementation of off-grid solar solutions will also be assessed in each country as well as at regional level. As part of this point, the consultant will get feedback from the private

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sector to analyze what has triggered the activity of some companies or the reasons why big players have not yet expanded in the region. This point will also include a review of PPP laws, regulations or policies to promote private sector participation in the energy sector.

3. Government and Development Initiatives – *Context for the project*

For each country and also at a regional level describe planned, ongoing, and recently completed initiatives from government, donors, and NGOs, to provide households, schools, health centers, and productive users (including for irrigation) with solar systems and mini grid access. Document those initiatives and highlight key aspects including for both, households and public institutions: (i) approaches/models adopted/planned in those initiatives, (ii) mechanisms/measures in place to ensure adequate maintenance and renewal of solar infrastructure, (iii) extract lessons learned from the implemented/completed ones and quantify the results achieved to compare with ex-ante targets and draw design implications for the Regional Off-grid Electrification Project (iv) identify possible synergies between the Regional Off-grid Electrification Project and these initiatives.

When possible, the consultant will make use of the Prospectus approach used by the World Bank in other on-grid and off-grid access projects to develop this task. Consultants will also make use of World Bank's data on the RISE project and the Climate Scope. The World Bank will make this material available to the consultants.

Task 2: Off-grid solar PV market assessment covering demand and supply.

Demand – Households

- i. Determine/assess and map the market for off-grid solar solutions for households by providing estimates of market size and mapping areas that could be economically appropriate. To do so, different business models will be considered, for example regular/monthly payment fee of households to an operator for maintenance and renewal of equipment or the rent-to-own model.
- ii. Segment the potential market from a geographical, demographical, socio-economical and behavioral point of view.
- iii. For each segment estimate current expenditures on kerosene, candles, and battery charging for lighting to be used as a minimum estimate of willingness to pay for better lighting and equivalent electrical services. The analysis should also consider the gain in consumer surplus from lighting substitutions and other global environmental externalities.
- iv. For each segment determine affordability of Lighting Africa/Global-approved off-grid solar solutions among different consumer tiers in off-grid areas through different business models, taking into consideration the real market prices disaggregated into their components i.e. equipment' and logistic costs, taxation, cost of finance, expected return, etc. Determine the level of implication of the products' purchase and estimate users' capacity to pay monthly fees for maintenance (under pay-as-you-go business models), based on an evaluation of users' expenditures that can be replaced by off-grid solar PV (e.g.: diesel for generators, batteries for lighting, etc.) or an estimation of electricity requirements (covering both DC and AC powered appliances).

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- v. Analyze each segment in term of size, accessibility, economic attractiveness, thus identifying the relevant commercial market.
- vi. Identify the main characteristics of the segment of the market already making use of purchased off-grid solar solutions and how they got access to the products.
- vii. Characterize the procurement process for off-grid solar solutions for households, including, but not limited to, the identification of the users and the buyers, the needs to be satisfied and the drivers (including status symbol).
- viii. Determine/ assess the perception and interest of the potential and current customers of the off-grid solar products in absolute terms as well as in comparison with other alternatives i.e. connection to the grid, mini-grids, kerosene, candles, etc.
- ix. Assess the awareness of potential consumers regarding quality systems on, for example, the benefits, selling points or how to identify them.

Demand - Institutional/community users

- i. Determine the size of the potential market for institutional uses including water pumping, health centers (particularly those providing service to women, such as for example maternal health clinics), secondary/elementary schools, public lighting networks, and administrative buildings, with an emphasis on major institutional user types.. For example, health centers with no grid electricity connection can be categorized into small dispensaries, health centers of type 1 and 2, etc., and according to how energy-related needs (lighting, ventilation, refrigeration) are met: use of diesel generators or gas for vaccine refrigerators. Estimate current expenditures and describe how institutional users pay for energy costs, whether locally and/or through allocated budget.
- ii. Estimate users' capacity to pay monthly fees for maintenance (under pay-as-you-go business models), based on an evaluation of users' expenditures that can be replaced by off-grid solar PV (e.g.: diesel for generators, gas for vaccine refrigerators, batteries for lighting, etc.) or an estimation of electricity requirements (covering both DC and AC powered appliances).
- iii. Assess successes and failures of experiences to promote adequate maintenance and renewal of solar infrastructure and private sector's participation.

Demand- Productive Uses

- i. Following the methodology adopted for the institutional users, the consultant will also determine the size and key characteristics of the market for productive uses, estimate current/future demand, and determine appropriate technologies.
- ii. Characterize the demand from Micro and Small Enterprises, including farmers and the agriculture supply chain.
- iii. Characterize the demand from solar irrigation and water supply.

Supply

- i. Characterize the commercial market in solar equipment by looking, for example, at local and international trading companies, energy service companies, opportunistic suppliers, assembler and manufacturer and subsidized programs whether through NGOs or

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- corporates. This will include the analysis of market shares, business models, financing strategies and import strategies.
- ii. Assess leading companies in solar energy established in East Africa and their interest and capacity to enter in new markets in West Africa. For companies operating in small and fragile countries, identify the reasons for a higher risk tolerance.
 - iii. Describe the stakeholders with the higher market share in term of resources, business volume , finance situation, other services and products, etc.
 - iv. Characterize the current market in term of equipment's qualities, particularly assessing the market share of Lighting Africa- approved systems.
 - v. Identify the main entry barriers for new actors to the market.
 - vi. Describe the current solar equipment and products' supply chains in the different targeted countries and the existing distribution channels of such products, or 'energy as a service' by companies and/or NGOs and their maintenance. Estimate the penetration of quality-verified products and generic products Identify the key competitive factors for solar off-grid products i.e. quality, price, advertisement, after-sale service, access to finance, etc.
 - vii. Identify the current stage of the solar off-grid products life-cycle (PLC) i.e. introduction, growth, maturity, reduction.
 - viii. Identify the different distribution channels currently being used and estimate their shares and the margin of each intermediary.
 - ix. Describe the role of non-standard market players in the solar sector. For example, amongst other potential players, the role of mobile phone companies should be explored to understand i) their retail agents/shops network, ii) whether they sell charging equipment iii) their interest in partnerships to extend charging (with and without pay-as-you-go), iv) availability of mobile money.
 - x. Assess the availability and level of local competences/skills for business development, installation and maintenance and capacity building needs in each country and suggest the best way to deliver them with a regional and national approach.
 - xi. Identify viable business models and existing barriers to private investment in public institutions' electrification
 - xii. If market does not exist, or is not robust enough, explore what can contribute to market uptake.

The supply side assessment should be conducted with consultations with key stakeholders (ECREEE will provide contacts of some local companies by country that the firm is expected to complement with its own contacts). Data, information and experiences from the ECOWAS Renewable Energy Mentorship Facility, managed by ECREEE, IRENA, CERMI and 2iE should be analyzed. The ECOWAS association of renewable energy professional has to be consulted too.

. The Consultant has to engage with international associations i.e. GOGLA, Alliance for Rural Electrification (ARE) as well as recognized international companies who's of-grid solar business has not yet developed in West Africa, to understand their interest, points of view and recommendations on the market in the region.

The supply side assessment should lead to the identification of barriers/risks faced by key players and recommendation of mitigation measures that can be picked up during the project implementation.

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For all data collected under task 2, the consultant shall ensure that the data collected can be reused and made available to relevant key stakeholders under the form of regional and national data packages to be delivered jointly with the reports. For data that can be geo-referenced, the consultant is required to create specific GIS data layer, and so in addition to the tabular datasets that may have been collected. The data shall be made available in a machine-readable format, with complete and structured metadata, and comply with the World Bank Access to Information Policy - notably in regards to personal information.

Task 3: The role of financial institutions in the provision of commercial and/or consumer financing to the solar sector

- i. Provide an overview of the financial market by country covering for example, but not limited to, commercial, social (MFIs), development finance institutes (DFI), export credit agencies (ECA) and credit union
- ii. Describe the current commercial lending environment including interest rates, collateral requirements and liquidity. How accessible is this to companies involved in solar and mini grids?
- iii. What is the level of lending for off-grid solar across the countries? what are the main barriers? Describe any programs or pilots in detail including a SWOT analysis if relevant. Assess the level of awareness, capacity and interest to lend to the solar off-grid industry.
- iv. Provide an assessment of the experience and suitability of major local financial institutions to act as an implementing agent for a financing facility. including the financial institutions operating regionally or in multiple countries.

Task 4: Propose models to incentivize and support the Private Sector and Financial Institutions to expand off grid solar solutions and to harmonize a regional market to achieve universal access

Based on the work done in tasks 1, 2 and 3 the consultant should propose financing modalities for a variety of business models (for households and public institutions and implementation arrangements for a regional financing facility to stimulate the private sector solar companies on a country by country basis.

Delivery models and financial mechanisms and arrangements should have limited reliance on concessional funding and seek to be as commercial as possible to be sustainable over time. They should also incorporate:

- Mechanisms to ensure long term maintenance and replacement of key components over a 10 year period;
- Existing initiatives and how to complement them;
- Long term sustainability of supply chain to reduce risks for market distortions;
- A variety of operator models such as PAYGO, outsourcing of maintenance, regional concessions;
- Types of financing products, if required for market uptake (credit lines, subsidies, guaranties, etc.) in the proposed operational model to all the stakeholders in the supply and demand chain;

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- Considerations for the update of quality products;
- Governance and institutional arrangements: based on an institutional analysis, suggest Government agencies, financiers (development/commercial banks, micro-finance institutions), private sector players that can play key roles in the proposed delivery models. This may involve suggesting examples of institutions;
- Technical assistance and capacity building activities to public and private sector and financial institutions to support the sector development and improve the enabling environment;
- Opportunities for regional efficiencies should be discussed and presented. e.g. single implementing agent bank, incentivizing companies to expand regionally, etc.
- Marketing approaches and activities to be conducted for market promotion.

Countries with markets with similar characteristics will be grouped and regional and sub-regional approaches will be proposed to increase the effectiveness and efficiency of the initiative.

The consultant is expected to present key contents of the report at a final workshop in each country for validation. Relevant feedback from workshop participants will be incorporated in a final report that the firm will submit.

Methodology

The specific methodology for this assignment will be developed and included in the technical proposal submitted by the consultant. It is expected that the assignment will include a range of methods including document review, field survey, interviews and consultative meetings with individual stakeholders. Stakeholders should include representative of women groups, female-led SMEs, female farmers, female-headed households, maternal health clinics, and girl boarding schools.

Deliverables and timeline

The assignment will be carried out over a 5 month period. The table below shows expected deliverables, suggested timeline, and payment schedule (10% will be paid upon contract signature and the remaining as indicated in the table).

Deliverables	Timeline from contract effectiveness	Payment
Inception report	Week 4	15%
Progress report Tasks 1 and 2	Week 7	15%
Progress report Tasks 3 and 4	Week 10	15%
First draft of the final report (including design options)	Week 17	25%
Final version of the report (including all necessary annexes and a final presentation)	Week 21	15%
Final presentation	Week 22/23	5%

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The inception report and progress report should be submitted in English, while the first draft of the final report, and final report for each country should be submitted in both the official language and English.

Qualifications

The assignment requires an experienced consulting firm capable of deploying experienced teams in multiple countries simultaneously who are capable of interacting and communicating effectively in French, English and/or Portuguese, depending on the countries, with central and local government officials, power utility management, private sector, financial sector and development agency representatives. Interested consultant firms should clearly demonstrate their experience in

- Market research
- Assessing off-grid solar PV market in developing countries including Sub-Saharan African countries and West Africa in particular;
- Analyzing trade conditions for energy equipment
- Engaging face to face with the commercial, mobile telecom and financial sector in multiple countries;
- Developing sustainable and effective delivery models to significantly scale up a market-based dissemination of off grid solar solutions.

While the consultant firm has the responsibility of proposing the team composition, the tasks in the assignment will require the involvement of at least:

- Seasoned Team Leader with significant experience in off-grid/mini-grid solar PV access and able to communicate effectively in the national language and English;
- Off-grid solar PV market assessment expert who was involved in at least 2 major assignments related to solar PV market assessment;
- Off-grid solar expert who was involved in at least 2 assignments related to Off-grid solar project identification and design;
- Financing expert with knowledge of consumer finance and ideally solar PAYGO models;
- Institutional development Expert.
- Expert on solar energy applied to productive uses and agriculture;
- Experts on the household and institutional sectors, particularly of the Western African region;
- Expert on assessments of gender specificities in the energy sector

Consultant firms are strongly encouraged to tap into locally-based expertise, as appropriate, to contribute to enhance local capacities and facilitate the implementation of follow-up activities. The CVs of proposed staff should clearly demonstrate the relevant experience of each team member by task assigned.