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Regional Off-Grid Electrification Project

Development of implementation frameworks for private investment in the off-grid electrification of public institutions and to promote productive uses of electricity from standalone solar systems in Niger and Nigeria

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 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 rates of public institutions like schools and health centers are also very low. Government facilities, such as health clinics, schools, police posts, public offices, publicly managed market places, and water pumps, are critical to providing basic services to rural populations. In countries throughout Africa, many of these institutions are located far from the electric grid and rely on off-grid power sources to meet their energy needs. In recent years, efforts have been made to provide some of these institutions with off-grid solar electricity systems. These systems offer the promise of providing clean, renewable electricity; however, there is a high failure rate for these systems, often caused by lack of maintenance and good operational practices following installation.

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

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

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sustainable development. Under the Multi-Tier Framework (MTF)³ of measuring energy access general solar home systems can meet 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.

Recent innovations in efficient appliances are creating opportunities to use standalone solar systems for productive and income generation uses. In addition to solar water pumps, new appliances such as solar milling machine, solar chillers, solar egg incubation, solar milking machines, etc. are becoming available. This may open up a new era of sustainable development in rural areas, without waiting for grid electricity to arrive.

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 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

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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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 to electrify households are Lighting Africa/Lighting Global approved solar lanterns and standalone solar systems,
- The program will work with the Lighting Global Quality Assurance team to expand quality verified solar technology options to electrify public institutions, and promote productive uses through solar water pumping, solar mills, solar chillers, etc.,
- The countries covered will be all 15 members of ECOWAS plus Cameroon, Central Africa Republic, Chad, and Mauritania.

Off-grid solar systems offer the promise of providing clean, renewable electricity for public facilities. However, historically, there has been a high failure rate for these systems in many countries, often caused by lack of maintenance and good operational practices following installation.

To contribute to mitigate these challenges, ROGEP aims at promoting private involvement and investment for the off-grid electrification of public institutions across the region, and ECREEE intends to apply part of the proceeds for the implementation of solar PV pilot systems for public facilities in Nigeria and Niger to test the viability of the approach.

The pilot systems, in whose development ECREEE is collaborating with the Schatz Energy Research Center (SERC), funded by the Lighting Africa Program, and government partners in Nigeria and Niger, would also contribute to the development of a new Quality Assurance Framework for Institutional Solar Electricity Systems and a new approach for the procurement, installation, and long-term maintenance of off-grid solar electricity systems at health clinics, schools, police posts, public offices, municipal street lighting, and water pumps.

The new approach focuses on using performance data monitoring and long-term service contracts to ensure that a system is adequately maintained and continues to provide the expected level of service for the life of the system. The associated activities include field research, stakeholder engagement, and implementation of solar PV pilot systems for public facilities in Nigeria and Niger.

Objective and Scope of Work

Consultants are sought to develop implementation frameworks to (i) electrify public institutions through standalone solar system by involving the private sector, and (ii) promote productive uses of electricity through standalone solar systems.

The initial focus is for frameworks that can be immediately implemented in Niger and Nigeria to cover the on-going operations, maintenance, and replacement costs of the pilot projects to electrify public institutions and water pumps (productive uses). The broader focus is for frameworks that can be implemented in Niger and Nigeria to cover both the investment and on-going costs, with indications on their applicability and replicability across the whole target region of 19 countries, with appropriate local modifications.

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In designing the framework, the consultants should identify viable schemes tailored to the institutional, legal, financial, regulatory and policy arrangements of Niger and Nigeria, also taking stock and analyzing the applicability of different PPP mechanisms adopted locally and internationally to the specific national contexts.

The benefits and risks of the different viable schemes should be analyzed together with the financial mechanisms and models proposed to mitigate payment risk from public institutions to the private sector, and the most suitable implementation frameworks should be identified.

The consultants will report to and be guided by ECREEE, to ensure that the work done is fully coordinated with and complimentary to the pilot projects implementation and other market development work currently being undertaken. The work will also involve coordination with the team from the Schatz Energy Research Center, given SERC's role in developing quality standards and technical guidelines for the off-grid solar systems at public facilities, funded from the World Bank's Lighting Africa Program.

Output will be a written report for each country in their national language and in English and a written report with recommendations on how to apply the identified framework to the whole West African region in English. The reports will follow a format to be agreed upon, 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.

Detailed Scope

The consultants will make use and complement the already existing studies and information available in each country and internationally avoiding duplications.

The following tasks are foreseen for this assignment:

- Task 1: Describe the potential market of off grid electrification of the different types of public institutions in Niger and Nigeria;
- Task 2: Take stock and analyze current, past and planned PPP initiatives locally and internationally to electrify public institutions via off-grid renewable energy systems and the applicability to the local context on Niger and Nigeria;
- Task 3: Take stock of recent innovations in productive uses of standalone solar systems, specifically in agriculture and SME sector and their applicability to local context on Niger and Nigeria.
- Task 4: Analyze the institutional, legal, financial, regulatory and policy framework of Niger and Nigeria and identify viable tailored schemes for private sector involvement;
- Task 5: Assess the interest of local and international companies to invest in this type of projects under the different identified schemes;
- Task 6: Assess the interest of local and international finance institutions to finance this type of projects under the different identified schemes;
- Task 7: Suggest the most suitable implementation frameworks in Niger and Nigeria;
- Task 8: Provide recommendations on how to apply the identified frameworks to the whole West African region.

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Task 1: Describe the potential market of off grid electrification of the different types of public institutions and productive uses in Niger and Nigeria

The consultants will describe current energy access, electrification plans and future needs of off grid public institutions.

The analysis will also include the description of off grid institutions types and power demands, by making use of the Multi-Tier Framework (MTF) developed by the Global Tracking Framework of Sustainable Energy for All and adapting it to the local and national specificities, if required. The information collected during the field work carried out by ECREEE and SERC in Niger and Nigeria for the pilot projects, as well as the information from the on-going market assessment in all the project countries, will be made available to the consultants.

For each type of public institution, the consultants will provide an accurate estimation of the investment and operations, maintenance, and replacement costs.

Task 2: Take stock and analyze current, past, and planned PPP initiatives locally and internationally to electrify public institutions via off-grid renewable energy systems and the applicability to the local context on Niger and Nigeria

The analysis should include but not be limited to:

- (i) Approaches and models,
- (ii) Mechanisms and measures in place to ensure adequate resources for the maintenance and renewal of renewable energy infrastructure,
- (iii) Payment arrangements and risk mitigation approaches,
- (iv) Ownership models for the off-grid energy system equipment,
- (v) After-sales service delivery models,
- (vi) Degree and modality of private sector participation.

Task 3: Take stock of recent innovations in productive uses of standalone solar systems, specifically in agriculture and SME sector and their applicability to local context on Niger and Nigeria.

The consultant should map out the recent innovations of productive uses of standalone solar systems. In addition to solar water pumping being used for drinking water and irrigation, new appliances, such as solar refrigeration, solar milk chillers, solar egg incubation, solar milling machine, etc. are becoming available in some countries. Consultant will have to identify the availability of such technologies globally, which can be applied in Niger and Nigeria specifically in agriculture and SME sectors.

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The consultant will also identify the entry barriers that are blocking these technologies from entering the market in Niger and Nigeria and suggest how to provide a favorable ecosystem to let the people in Niger and Nigeria benefit from these recent innovations.

Task 4: Analyze the institutional, legal, financial, regulatory and policy framework of Niger and Nigeria and identify viable tailored schemes for private sector involvement

The consultants will analyze the relevant aspects of the frameworks in the two countries by reviewing relevant documentation and engaging in consultations with key public and private stakeholders, the management of the targeted facilities and the partners supporting them as well as, local authorities and local development organizations. Note that ECREEE will facilitate the interaction with the targeted facilities and identified stakeholders within its network; the firm is expected to complement this effort with their own contacts. The output of this task should be divided for electrifying public institutions and to promote productive uses of electricity.

The firm will assess how the facilities currently procure, manage and maintain the electricity related services and materials and the different actual and potential sources of income that could be used by the private sector to recover the investment and operations, maintenance, and replacement costs whose estimation will be done in the previous task, taking into consideration the capacity to pay of the facilities. All potential sources should be considered, including but not limited to final users' contribution, individual institution budget and revenues, and local, regional, and central government budgets. The consultants will also consider different business models i.e. institutional partnership model, rental/leasing model, distributor-dealer model, franchising model, etc. The relevance of technology advances such as remote monitoring, advance payment and PAYGO should be taken into consideration in this analysis.

The assessment must be based on interaction with relevant stakeholders and review of legislation and cannot be a theoretical exercise.

Based also on the outcomes of the previous task, the consultants will identify different viable schemes, where potential sources of income for the private companies to recover their investments exist, and analyze the benefits and risks as well as the financial mechanisms and models proposed to mitigate payment risk from public institutions to the private sector for each of them. The consultants should propose as much as possible schemes in line with the existing national frameworks, although they could propose required adjustments if deemed necessary. The recommendations of potential sources of income should take into consideration the institutional, legal, financial, regulatory, and policy arrangements of Niger, Nigeria and other local governments, such as the decentralization of the health sector.

Task 5: Assess the interest of local and international companies to invest in this type of project under the different identified schemes

By interviewing a range of private sector companies, the firm will assess:

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- A. the appetite of private companies to enter into this business, the complementarity with other business activities, and the conditions they would require;
- B. the barriers and risk perception compared with service provision to households and businesses and expected returns;
- C. the financial and risk mitigation needs of the private sector to participate and recover their investments.

The assessment should be conducted with consultations with key stakeholders. ECREEE will provide contacts of some local companies in each country that the firm is expected to complement with its own contacts.

The consultants will also analyze the technical and financial capacities of local companies to participate in this kind of business, both to electrify public institutions and to promote productive uses of electricity.

Task 6: Assess the interest of local and international finance institutions to finance this type of projects under the different identified schemes

By interviewing a range of finance institutions, the firm will assess:

- A. the appetite of finance institutions to enter into this business;
- B. the risk perception compared with financing the service provision to households and businesses and the differential requirements in terms of collaterals, interest rates, etc.;
- C. the risk mitigation instruments they would require to engage in financing.

The assessment should be conducted with consultations with key stakeholders. As noted above, ECREEE will provide contacts of some finance institutions that the firm is expected to complement with its own contacts.

Task 7: Suggest the most suitable implementation frameworks in Niger and Nigeria

Based on the work done in tasks 1, 2 3, 4, 5 and 6, the consultants should conduct further analysis and, based on additional interactions with public institutions, including the Ministries in charge of the facilities, the donors, the local governments, local authorities, the management of the targeted facilities (health centers, schools, agribusiness operators, etc.), propose delivery models, financial mechanisms and implementation arrangements for the promotion of an enabling market ecosystem to incentivize the private sector and financial institutions to enter market-based solutions for the electrification via off-grid renewable energy systems of the different types of public institutions and productive uses in Niger and Nigeria.

The implementation frameworks should incorporate:

- Mechanisms to ensure long term maintenance and replacement of key components over at least 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, leasing, outsourcing of maintenance, regional concessions;

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- Fee collection strategies and their enforcement, taking into consideration also the social acceptability of service curtailment or interruption;
- 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;
- Governance and institutional arrangements: based on an institutional analysis, suggest government agencies, financiers (development/commercial banks, micro-finance institutions), and private sector players that can play key roles in the proposed delivery models. This may involve suggesting examples of institutions;
- Technical assistance activities to public and private sector and financial institutions to support the sector development;

The consultants will have to provide a detailed action plan regarding payment of the on-going operations, maintenance, and replacement costs of the pilot projects. In addition, the consultants will have to provide a broader plan for frameworks that can be implemented in Niger and Nigeria to cover both the investment and on-going costs in the longer term.

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

To facilitate progress to implementation and based on their wide-ranging discussions, the consultants should also provide a prioritized list of companies from the private sector, ranked as to capacity and interest to engage in further discussions in Niger and Nigeria.

Task 8: Provide recommendations on how to apply the identified frameworks to the whole West African region.

The firm will provide recommendations on their applicability and replicability across the whole target region of 19 countries, with appropriate local modifications, during ROGEP's implementation phase.

Recommendations will include the structuring of a regional financing facility to stimulate the private sector to participate in projects to electrify public institutions via off-grid renewable energy solutions.

The firm, in coordination with ECREEE and SERC, will look for relevant stakeholders' input through public consultation on the first draft of the final report.

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, interviews, and consultative meetings with individual stakeholders by phone and in country.

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Deliverables and timeline

The assignment will be carried out over a 23 weeks 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 2	15%
Draft country reports	Week 10	20%
Final version of the country reports (including inputs from national workshops)	Week 14	25%
First draft of the final report	Week 16	15%
Final version of the final report (including inputs from public consultation and all necessary annexes and a final presentation)	Week 21	20%
Final presentation	Week 23	5%

The inception report and final report should be submitted in English, while the report for each country should be submitted in the national language and in English.

Qualifications

The assignment requires an experienced consulting firm capable of deploying experienced teams in both countries and who are capable of interacting and communicating effectively in French and English, with central and local government officials, private sector, banking sector, and development agency representatives. Interested consultant firms should clearly demonstrate their experience in

- Assessing off-grid renewable energy markets, particularly for public institutions and productive uses, in developing countries including Sub-Saharan African countries and West Africa in particular;
- Working in the electricity sector, in particular off-grid, in Nigeria and Niger;
- Engaging face to face with the public, commercial, and banking sectors in multiple countries;
- Establishing PPP frameworks in Sub-Saharan African countries and West Africa in particular;
- Developing sustainable and effective delivery models to significantly scale up a market-based dissemination of off grid renewable energy 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 business development for off-grid renewable energy access and private sector and public private partnership structures;
- Technical expert on standalone solar systems;
- Expert in financing of off-grid renewable energy businesses.

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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.