

Section 3
TERMS OF REFERENCE (TOR)

**ENABLING FRAMEWORKS FOR INVESTMENT IN ECOWAS FOR THE
IMPLEMENTATION OF THE WEST AFRICA CLEAN ENERGY CORRIDOR
ACTION PLAN**

**Capacity Development on Planning and Operation of Power Grids with High Shares of
Variable Renewable Power**

I. Background

The International Renewable Energy Agency (IRENA) is an inter-governmental organisation, mandated by member states around the world to promote the widespread and increased adoption, and sustainable use of all forms of renewable energy. This concerns all forms of energy produced from renewable sources in a sustainable manner, which include bioenergy, geothermal energy, hydropower, ocean, solar, and wind energy.

The energy system in West Africa is faced with a number of interrelated challenges: low energy access, insecure energy supply, and growing environmental degradation. The installed power generation capacity of the region is in the order of 16 GW comprising of 32% of hydro and 68% of thermal capacity, which covers only 37% of the power demand. Only 42% of ECOWAS population have access to electricity, which drops down to single digits in rural areas.

The power system in West Africa is confronted with the challenges arising from the supply deficit and thus growing demand is unmet. Furthermore, the region faces the difficulty of raising sufficient funds internally or attracting outside investors willing to incur the high perceived risk in the electricity sector in the region. Overall, unreliable power holds back the region's industrial development and has a negative impact on productive activities. Transmission and distribution losses are at around 40%, increasing electricity tariffs significantly. The cost of providing backup power handicaps productive industries and blackouts reduce annual economic growth in Africa by around 2%.

The region has vast renewable energy potential to cover the unmet power demand and reach the universal access to electricity while supporting the region's transition to a low carbon growth path. In that regard, in July 2013 the ECOWAS Authority of Heads of State and Government adopted the ECOWAS Renewable Energy Policy (EREP) that aims to increase the share of renewable energy in the region's overall electricity mix to 35% in 2020 and 48% in 2030 (excluding large hydro, to 10% and 19%, respectively). The EREP is complemented with the ECOWAS Energy Efficiency Policy (EEEP) that targets to implement measures that would make available 2000 MW of power generation capacity through efficiency gains and in the long term, more than double the annual improvement in energy efficiency, compared to 2010 levels.

With a view to supporting the creation of a regional power market, IRENA, in collaboration with ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE), West African Power Pool (WAPP), and ECOWAS Regional Electricity Regulatory Authority (ERERA), has initiated the West Africa Clean Energy Corridor (WACEC) initiative. Building on the ongoing efforts in the region, including, those of UEMOA, AfDB, and other development partners such as GIZ and USAID, WACEC will promote the development of utility scale renewable power and its integration to the West African power systems.

As endorsed by the ECOWAS Energy Ministerial in December 2016, the WACEC's implementation plan is built on the five pillars of (i) Zoning and Resource Assessment to identify sites for renewable power generation in areas with high resource potential and suitable transmission routes; (ii) National and Regional Planning to fully consider cost-effective renewable power options; (iii) Enabling Frameworks for Investment to open markets and reduce financing costs; (iv) Capacity Building to plan, operate and maintain power grids and markets with higher shares of renewables-based electricity; and (v) Public Information and Awareness Raising on how the corridor can provide secure, sustainable and affordable energy.

In March 2017, the Energy Ministers at the Specialized Technical Committee on Energy, Transport and Tourism of the African Union recommended the Member States to integrate the concept of the Clean Energy Corridors, which includes WACEC for the West Africa region, into their national renewable energy and climate change agendas as well as the process of creation of a sustainable and low-carbon power markets. This was included in the concluding declaration, which will be presented to the African Heads of States for endorsement.

The capacity building activities on vRE grid planning and operation will be based on earlier work conducted by WAPP and ECREEE with the support of GIZ and USAID. This involved the development of training materials for an introductory course on vRE grid integration in English and French as well as trainings of trainers and first trainings of regional power utilities held at VRA Academy in Ghana and Centre des Metier de l'Electricité (CME) in Côte d'Ivoire. These centres are considered by WAPP and the Association of Power Utilities of Africa (APUA) as centres of excellence for the West African region.

II. Rationale

With a view to diversifying the regional power mix through an accelerated penetration of renewables as set out in the EREP, there is a need to strengthen skills in order to create the necessary conditions for an effective development and implementation of renewable energy projects on the ground. These skills include, amongst others, the capacity to plan and operate power grids with higher shares of variable renewable power.

Under the implementation of the WACEC, IRENA, together with the key regional institutions, intends to support the strengthening of the capacities of the relevant stakeholders of the ECOWAS power sector through series of tailor-made capacity building activities.

III. Objective and scope of the work

The main objective is to reinforce the capacities of utilities, grid operators and other relevant stakeholders in the planning, designing, operation and management of their power grids with higher shares of variable renewable power generation in the ECOWAS region by:

- assessing the needs for capacity building on the planning and operation of power systems with high shares of variable renewable power generation across the region;
- developing and implementing training programmes to meet the needs identified

IV. Expected Outcomes

This project is expected to contribute to an improved understanding of the requirements for the planning, designing, operation and management of power grids with variable renewable power generation, based on the best practices from the region and beyond.

V. Detailed description of the work

The technical assistance to be conducted by the consulting entity will mainly target power system operators and utilities, while the consulting entity will work closely with the IRENA, WAPP and ECREEE in the implementation of the assignment as described in these Terms of Reference.

The consulting entity is expected to develop a technical offer with an appropriate methodology and specific work plan that will ensure the achievement of the assignment's objective **within an implementation period of 6 months**.

Before starting the assignment, the consulting entity will be required to attend a briefing meeting, with IRENA and the ECOWAS counterparts, to be held in the region and for which the participation of the consulting entity will be covered by IRENA. All outputs under the assignment will be both in English and French. All reports, working papers or other documents prepared for IRENA must conform to IRENA/OECD style requirements. These requirements are outlined in IRENA's style guide, which together with other guiding documents will be given to the consulting entity at the beginning of the assignment.

The project will focus on **two tasks**:

Task 1: Capacity development for utilities and grid operators on planning and operating power grids with high shares of variable renewable power (vRE) generation in West Africa

This task aims to identify the needs for adapting the practices to plan, design, operate and manage the secure and efficient functioning of the power grids while hosting expected high shares of VRE. Based on a set of identified priority areas, trainings for strengthening the capacities of the system operators will be organized separately for Francophone and Anglophone countries of the ECOWAS region.

This task will comprise of 2 sub-tasks, as follows:

Sub-task 1: The consulting entity will conduct a scoping analysis systematically identifying, mapping and summarizing operation and planning practices, available infrastructure (including to control and monitor in real time the operation of the power system), and performance of the power systems in terms of quality and costs of operation. The assessment will identify good practices and potential gaps and opportunities across the region for an efficient and reliable operation with the higher shares of variable renewable resources expected to be integrated to the power grids in the short and mid-term. This sub-task shall be done through interviews and desk research of the regulation and operational procedures as well as existing studies on each country. Projects and trainings and other linked activities carried out or organized by development partners related to the expansion and operation of the grids should also be included in this assessment. As a first output of this subtask, a summary of the operational and planning practices and performance indicators will be provided. Additionally, the main output expected of this subtask will be the identification of the priority areas for training and for development of future support programmes.

Sub-task 2: The consulting entity shall design the technical content, including the material, of two 5-day¹ training workshops (one in French and one in English) for the utilities of the 15 ECOWAS countries, addressing the priority areas identified in subtask 1. The content of the training should be an add-on to the existing material available at VRA Academy and CME and also encompass any relevant work conducted by IRENA and other partners on the topic.

The training material and contents should cover priority aspects related to the planning of the secure operation of the grid like the impact of variable renewable power on system operation and reliability, grid planning studies and methodologies, technical regulations and codes to facilitate planning and operation building on the existing material. Operational aspects like scheduling of generators, provision of ancillary services such as load regulation, spinning reserve, non-spinning reserve, replacement reserve, and voltage control and stability of the grid, the use of forecast of variable renewable power production to support the system operation, and the required infrastructure and software tools should also be considered.

The consulting entity will also be responsible, under the supervision of IRENA, for delivering the trainings (presentations, moderation of discussions) and compiling the workshop documentation, including summary and conclusions. The consulting entity will also be required to suggest few options for countries from Africa or otherwise with good experience in integrating high shares of variable renewable energy in the grid for a study tour.

The trainings will be organized for around 30 – 40 participants² from the 15 ECOWAS countries. One of them will be held in French and one in English, thus the training material should be made available in both languages.

IRENA and the ECOWAS counterparts will be responsible for the selection of the venue and the date for the trainings, the invitation of the speakers and participants for the workshop and the associated costs (rental of venue, travel costs, catering and accommodation of participants).

Task 2: Design of a follow-up programme

Following the workshops and the identification of priority areas, the consulting entity will support IRENA in designing a follow-up programme that will define:

- Scope and methodology for the follow up programme;
- Support methods: on line forums, on site, by email, etc.;
- Estimated duration of the follow up program;
- Final conclusions incl. results monitoring: along with IRENA and all the institutions and stakeholders involved in the workshops the results will be evaluated.

IRENA and the ECOWAS counterparts should follow up on the changes/action plans that the utilities will implement in the short-to-medium run.

VI. Expected Deliverables and Timeline

The two above-listed tasks are to be completed by end 2018 as per the following timeline:

¹ To be confirmed after consultation with all the key stakeholders

² Approx. 2 participants from each of the 15 ECOWAS countries country as well as approx. two representatives per training institution, as well as regional training institutions and relevant stakeholders

	Deliverable	Timeline³
i	Scoping report on the skills and priority areas for developing systems that can operate securely and efficiently with variable renewable energy generation across the ECOWAS region	by 28.02.2018
ii	1 series of two 5-day workshops for addressing the priority areas on the operation and planning of the operation of power grids with high shares of renewables	by 31.04.2018
iii	Suggestions of possible host countries for a study tour	by 28.02.2018
iv	Design of a follow-up programme	by 31.05.2018

³ The timeline is subject to changes depending on the start date of the project, with prior consent of IRENA.