Case Study: Role of the Utility in RE projects (off-taker): VRA (Ghana)

The VRA until 1999 supplied Ghana's electricity needs from hydro power generation from Akosombo and Kpong hydroelectric Power station all on the Volta River. In the nineties the increasing demand for electricity coupled with the effects of bad inflows resulted in load shedding. The domestic demand for electricity has been growing at an average of about 6.2% per annum over the past twelve years (1998 -2011). These growth rates are projected to continue in the mid-term.

The potential for exporting power to the neighbouring countries in West Africa sub-region would increase with the completion of the backbone transmission networks (e.g. the Coastal Backbone transmission network) of the West African power pool (WAPP).

To meet this increasing demand and mitigate the effects of poor inflows about 800 MW of thermal generation capacity has been installed between 1997 and 2009, with more under construction.

The increase in the thermal component has led to an increasing exposure to the risk of fuel price escalations, fuel supply risks (in the case of pipeline gas) and increased the carbon footprint of the power generated by VRA.

The Government of Ghana has formulated a Renewable Energy (RE) policy that seeks that 10% of Ghana's electricity needs by 2020 should come from RE. The Government has passed an RE law to provide the necessary legal and regulatory framework to promote the provision of energy including electricity from renewable sources. This law is, however, not operational because certain requirements (e.g. Feed-in-Tariff level) are still in preparation.

In line with Volta River Authority (VRA) Board Resolution 707 approving the VRA Renewable Energy Policy and Authorising the Chief Executive and his representatives to take steps to realise an RE policy, VRA management is proceeding to install 10 MW solar and between 100 150MW Wind power farms projects under the corporate Renewable Energy Programme. For the solar projects, four well suited sites were selected by VRA after an evaluation of radiation conditions, infrastructure and network access as well as preliminary network load centre appraisal. This project, known as the **"Solar Power Project Phase 1:** SPP1 is to be implemented in the communities of Navorongo in the Upper East Region, and Kaleo, Jirapa and Lawra, all in the Upper West Region of Ghana. The expected total power production capacity is distributed optimally among the locations. Navorongo will produce 2 MW, Kaleo will produce 4 MW, whereas 2 MW each will be installed at the two remaining locations, allowing each location some reserve for extension.

The power generated by the solar power generation units shall be boosted to 34.5kV by indoor high-voltage switch gear cabinet and finally access to the power grid through a 34.5kV overhead transmission line. Subsequently, all the PV Plants will be connected to the 34.5 MV network operated by the VRA subsidiary distribution company, NEDCo.

This means (for VRA) generating;

- Increased power availability.
- Increased generation capacity.
- Enhance VRA image as being 'Green'

- Contract and implementation of 2MW solar farm is on-going and COD is at mid December 2012.
- Preparation for the procurement and award of contract to implement 8MW solar farm proceding
- Feasibility studies for wind farm energy yield (up to 150MW) is awarded for one year studies
- Feasibility studies for Pwalugu (hydro up to 48MW) to be awarded by end of September 2012

PROJECT DESCRIPTION

The project aims to develop 10MW of PV plant capacity in Northern Ghana in the NEDCo areas of operation using CDM as a co-financing option. Additionally the technical and financial feasibility of deploying a Concentrating Solar Power (CSP) plant in the NEDCo areas would be examined and detailed specifications would be developed based on the findings of the feasibility study. Four sites in the environs of Kaleo (near WA), Lawra, Jirapa and Navrongo have been identified and have been acquired for a total of 10MWp PV plants.

PROJECT OBJECTIVES

The objectives are as follows:

- To develop & construct a10 MW PV plant in the NEDCo area of operation.
- To assess the technical and financial feasibility of developing Concentrating Solar Power (CSP) Plants in Ghana.
- To provide both training to VRA's planning, development and operational staff on Developing and operating solar power plants as well as integrating wind generation into our generation supply and expansion plans.
- To register the project as Clean Development Mechanism (CDM) project in order to utilise CDM proceeds for co-financing of the project.

SCOPE OF PROJECT

The scope of the project shall be as follows:

- Engage the services of a Consultant to act as VRA Owners Engineer.
- Selection of EPC contractors
- Land Acquisition & permitting for PV plants
- The design Procurement and construction of a 10 MW PV plant in the NEDCo area in 2 MW increments.
- To Develop a CDM Project Idea Note (PIN), project Design Document (PDD) and undertake the necessary steps to register the Project with the CDM board under the CDM mechanism.
- Training on PV plant development & design and generation planning and maintenance for VRA personnel.
- Undertake a study into the feasibility of developing a CSP in Ghana.
- Develop CSP plant specifications for future construction based on the findings of the feasibility study.

OUTLINE DELIVERABLES (PROJECT OUTCOME)

An outline of the expected deliverable is listed below:

- PV plants with a total capacity of 10 MW including all the necessary manuals and documentation;
- Project Definition Document for CDM registration;
- CDM registration to utilise CDM as a co-financing source;
- Training program composed of classroom work and hands on experience, for VRA staff to be involved in planning and development of PV plants and planning generation to optimise the contribution of solar;
- Training for VRA staff who would operate and maintain the PV plant;
- Monitoring systems to connect to the VRA Remote RE monitoring & control centre.
- A database of Direct Normal Irradiation (DNI) measurement for selected sites in Northern Ghana.
- A feasibility study report recommending sites, Concentrating Solar power technologies, and deployment capacities for future deployment
- A detailed specification document for each site based on the recommended CSP technology for the site.

PROJECT BENEFITS

The Volta River Authority (VRA) has the opportunity to:

- Utilize solar as an additional source of generation to supply the increasing domestic and export demand.
- Take advantage of the Clean Development Mechanism as a co-financing to Develop low Carbon electricity generation
- Align VRAs Generation Capacity Development with Government of Ghana's Policy on Renewable Energy that seeks that 10 % of all electricity generation to come from renewable sources
- Meet any future renewable energy purchase obligations to be placed on NEDCo with VRA's owned RE plants;
- Develop the requisite skills required in solar plant development, design and operation to position the Authority to provide leadership and technical expertise for deployment of renewable based electricity generation in African;
- Improve its power supply security by diversifying it sources of power generation.
- Increase its power generation capacity without increasing the Authorities exposure to fuel supply risks and price escalations;
- Increase its power generation capacity whilst reducing the carbon foot print of the electricity generated.

FINANCIAL AND BUDGETARY REQUIREMENTS

The estimated total cost (2010 costs) for developing and implementing the 10 MW Solar Project is US$ 40.7 Million.

Item Description	**Cost in US $**
Project Implementation Cost	40,000,000.00
Project Development Cost	700,000.00
Total	**40,700,000.00**

VRA is therefore sourcing for adequate funds to enable the completion of the project on time, within cost and specifications.

CRITICAL SUCCESS FACTORS

The following factors are being perused for the success of the project:

- An adequate feed-in tariff that allows for full cost recovery
- Access to concessional/grant funding to reduce cost
- Technical reliability of technology adopted
- High quality delivery, construction & installation
- Effective integration into the electrical infrastructure
- Effective integration into electricity supply planning and coordination with system control center
- Knowledge transfer through training

CURRENT STATUS OF THE PROJECT

Lahmeyer International has been engaged as a consultant to undertake the engineering study for the project. Land has been acquired at four (4) sites in the Upper East and West Regions for the project. The 2 MW solar farm at Navorongo is on track and due for commissioning mid December 2012 (current year). One year Wind measurement contract has been awarded and would start shortly.

PROJECT OVERVIEW: NAVORONGO SITE

• Navrongo, Upper East Region of Ghana
• Latitude: N10° 53‘ 6“
• Longitude: W1° 5‘ 24“

• 1.9 MW
• 3.4 hectare
• Global radiation: 1,791 kWh/m²
• Specific yield: 1,500 kWh/kWp/a

- 2 MW total project cost: US$7,312,091.10 + GHC1,658,309.40 (approx. US$8,141,245.80 including contingency amount)
- Installed US$3.99/Wp
- LCOE US$0.2413/kWh

Expansion by 600kW
- Installed US$3.6/Wp
- LCOE US$0.2287/kWh

Since August 2011 when Navorongo was awarded to June 2012, the average Crystalline Silicon (C-si) module costs have dropped from US$1.4/Wp to US$0.89/Wp

for wholesale in China and from US$2.88/Wp to US$2.29/Wp on average for retail worldwide (SOLARBUZZ retail pricing)

During the same period, the cost for inverters has gone up from US$0.5/Wc to US$0.526/Wc. Costs for civil works have also gone up due to inflation.