

# **40MW SOLAR POWER PLANT PROJECT IN THE BONGO DISTRICT OF THE UPPER EAST REGION, GHANA**



## **ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT: ENVIRONMENTAL SCOPING REPORT**



MARCH 2018



**VOLTA  
RIVER  
AUTHORITY**

## VRA CORPORATE ENVIRONMENTAL POLICY STATEMENT

1. The Volta River Authority (VRA) is committed to ensuring continuous improvement of environmental performance that minimizes potential impacts of all its operations on the environment, in line with the principles of sustainable development, in addition to complying with national and international environmental protection regulations.
2. In respect of the above, VRA will:
  - a. Make environmental considerations a priority in all business planning and decision-making and comply with relevant national and international environmental protection regulations.
  - b. Take reasonable steps to mitigate the impact of its actions with regard to the development, operation and management of its assets.
3. VRA will thus pursue the following specific objectives:
  - a. Develop and implement Environmental Management Systems for all its business units to:
    - i. Assess environmental impact of processes, operations and products.
    - ii. Focus on pollution prevention and waste reduction.
    - iii. Ensure compliance with national/international environmental protection regulations.
    - iv. Set annual environmental targets to ensure continuous improvements.
    - v. Monitor and report on environmental performance as required to the appropriate stakeholders.
  - b. Ensure minimum environmental impact of VRA's projects and take adequate steps to mitigate any such anticipated adverse impacts as far as is practicable.
  - c. Promote environmental awareness and individual sense of responsibility among its employees through print material for distribution, safety meetings, and the corporate website which will continue to be updated, and provide adequate empowerment and training for personnel to perform environmental jobs satisfactorily.
  - d. Support research efforts on materials, products, processes and pollution reduction techniques that are directly related to its operations.
  - e. Contribute to the development of public policy and programmes that enhance environmental awareness and protection.
  - f. Promote open communication on environmental issues.
  - g. Undertake projects and programmes in collaboration with relevant agencies to preserve the Volta Lake resource, and reasonably restore/mitigate ecological imbalance caused by the creation of the lake.
  - h. Undertake projects and programmes to mitigate the impact on the livelihood of individuals and communities displaced or affected by VRA's developmental projects.
4. VRA shall design evaluation procedures for all processes that fall under this policy to ensure that these processes comply. Deficiencies, in the policy or in the evaluation procedure, shall be addressed as required.
5. Each employee of VRA is charged to exercise his or her responsibility on behalf of VRA to assure that the intentions of this Policy Statement are diligently carried out.

SIGNED:.....

**CHIEF EXECUTIVE**

REVISED DATE:.....

16/01/13

## REPORT DETAILS

<b>Title:</b>	Environmental Scoping Report for the proposed 40MW Bongo Solar Power Project
<b>Project Description:</b>	<p>This Scoping Report forms part of a series of reports and information sources that are being provided during the ESIA Process for the proposed project. In accordance with the EIA Regulations, the purpose of the Scoping Report is to:</p> <ul style="list-style-type: none"> <li>• Present the details of and need for the proposed project;</li> <li>• Describe the affected environment, including the planning context, at a sufficient level of detail to facilitate informed decision making;</li> <li>• Provide an overview of the ESIA Process being followed, including public consultation;</li> <li>• Identify and confirm the preferred activity and technology alternative;</li> <li>• Identify the key issues to be addressed in the impact assessment phase and the approach to be followed in addressing these issues; and</li> <li>• Draft the terms of reference, which will indicate the essential issues to be addressed in the environmental impact statement.</li> </ul>
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<b>Date:</b>	March 2018

**REPORT TITLE:** Environmental Scoping Report for the 40MW Bongo Solar Power Project in the Bongo District of the Upper East Region, Ghana  
**DATE:** March 2018  
**REPORT STATUS:** Final  
**PROPONENT:** Volta River Authority

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## ACRONYMS AND ABBREVIATIONS

AC	-	Alternating Current
AFOLU	-	Agriculture, Forestry and Other Land Use
BSPP	-	Bongo Solar Power Project
COP	-	Conference of Parties
CSP	-	Concentrated Solar Photovoltaic
DC	-	Direct Current
DCP	-	Decommissioning and Site Closure Plan
ECG	-	Electricity Company of Ghana
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plans
EPA	-	Environmental Protection Agency
EPC	-	Engineering, Procurement & Construction
ESIA	-	Environmental and Social Impact Assessment
GHG	-	Greenhouse Gases
GhIE	-	Ghana Institute of Engineering
GhIS	-	Ghana Institute of Surveyors
GoG	-	Government of Ghana
GRIDCo	-	Ghana Grid Company
I&APs	-	Interested and Affected Parties
IAIA	-	International association of Impact assessment
IFC	-	International
IPP	-	Independent Power Producers
kV	-	Kilowatts
kWh	-	Kilowatt - Hour
LCO	-	Light Crude Oil
LI	-	Legislative Instrument
MTDP	-	Medium Term Development Plan
MW	-	Megawatts
NEDCo	-	Northern Electricity Distribution Company
NTS	-	Non-Technical summary
PAPs	-	Project Affected Persons
PHC	-	Population Housing & Census
PPP	-	Public Participation Process
PSESIA	-	Plan of Study for the ESIA
PURC	-	Public Utilities Regulatory Commission
PV	-	Photovoltaic Voltaic
REDP	-	Renewable Energy Development Programme
RoW	-	Right of Way
TNC	-	Third National Communication
ToR	-	Terms of Reference
UNFCCC	-	United Nations Framework Convention on Climate Change
VRA	-	Volta River Authority

## **EXECUTIVE SUMMARY**

The Volta River Authority (VRA) proposes to construct and operate a 40MW solar power plant and associated electrical infrastructure on a 0.5013 km<sup>2</sup> of land situated at the Asebga community in the Bongo District of the Upper East Region of Ghana. The project would involve the installation of ground mounted fixed axis Photovoltaic Voltaic (PV) panels which will tie into the national electricity grid. Basically, electricity from the solar power plant would be evacuated at 34.5kV voltage level and a sub-transmission line, of approximately 29 km with a wayleave of 15m, would be constructed from the solar power plant and would terminate on the 34.5kV bus at the Bolgatanga Substation, in the Bolgatanga Municipality also in the Upper East Region. The project is titled the “**40MW Bongo Solar Power Project**” (hereinafter referred as the “Project”).

The development of the project is part of the strategy to attain the 200MW target set for solar PV capacity in the Phase 2 of VRA’s Renewable Energy Development Programme (REDP), being implemented in line with the National Renewable Energy Act, 2011 (Act 832). The main outcome of the project will be an operational PV plant of 40 MW that would operate in a cost-effective manner and contribute to the local economy and the provision of quality electrical power.

Under the provisions of the Ghana Environmental Assessment Regulations, 1999 (LI 1652), power generation and transmission projects of this nature are categorized under environmentally critical projects for which an environmental authorisation is required from the Environmental Protection Agency (EPA). VRA has subsequently embarked on the process to seek environmental authorisation from the Environmental Protection Agency (EPA). The project was registered with the EPA in August 2017. The EPA has formally responded and directed VRA to prepare this Environmental Scoping report, which will outline the Terms of Reference (ToR) for decision making on the key and relevant issues to be considered in the ESIA Study. This scoping exercise has therefore been undertaken to help provide an indication of the ecological, social and economic impacts that may arise following the establishment of the solar power facility, based on which the terms of reference for the study, including the spatial and temporal boundaries for the ESIA, and has been defined for approval by the EPA.

A brief overview of the pre-construction activities, the project components and considering the construction, operation and maintenance, and decommissioning stages of these components as well as the alternatives considered has been indicated. In addition, a list of national policy, legal and administrative framework as well as VRA Corporate Polices and International best practice, that applies to the project has been indicated. It is expected that details of the project as well as of how the

legal requirements and norms apply to the project and should be complied with will be provided in the Main ESIA.

From the initial project description, it is anticipated that most significant impacts will occur within the Bongo District and its environs within the Upper East Region of Ghana. For this reason, the discussion of environmental baseline conditions, has been looked at within the context of the Bongo District. The study team undertook an initial review of websites, publications and other sources of information that contribute to an understanding of the conditions in the project environs. The information was obtained to establish the existing physical, biological and the socioeconomic environment conditions and legislative requirements pertaining to the project area and to highlight receptors sensitive to potential impacts. Most of the data on plant species, fauna, soils, water, geology, etc. were confirmed from interviews and existing documentations for the project area.

It is the requirement of the Ghana EIA process that an extensive consultation exercise is carried out to inform the local population, statutory bodies and local organisations and interested parties about the proposal. Stakeholder planning and analysis under this study identified three distinct stakeholder groups that should be consulted on during the EIA process. The groups are:

- Individuals and organisations associated with the proposed 40MW solar power generation plant site at Asegba.
- Individuals and organisations associated with the 29Km Sub-transmission line route.
- State agencies within the Bongo District, Bolgatanga Municipality as well as Upper East Region (generic consultees).

The process of stakeholder engagements begun in January 2014 following the identification of the project site and is to be continued throughout the project phases. From the various engagements, the communities and other stakeholders, including the state agencies, generally welcomed the plans to establish the proposed solar power project in the area. Since the project would not directly affect them in terms of pollution, the community members generally did not have any apprehension or reservation about the project. They nevertheless viewed the project as one that would create employment opportunities and small business/trade opportunities for the local population. As to be expected, these stakeholders raised a series of questions, comments and concerns. A record of all consultations and the response to consultee comments and issues raised during the stakeholder engagements prior to the release of the Scoping Report, together with responses from the ESIA team is provided.

VRA will publish a Scoping Notice on the project in any of the national newspapers to notify the public of this Scoping Report. When published, it is expected that all those with concerns, interests or special knowledge relating to potential environmental effects of the proposed undertaking are to contact or submit such concerns to the VRA or the EPA. Comments can be provided to the ESIA team at the address, tel./fax numbers or e-mail address provided below.

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All comments received following the release of the Scoping Report will be posted in the Draft ESIA Report. Again, such comments are to be reviewed and addressed as necessary and incorporated in the Draft ESIA report, so that those that have an impact on the project design, construction and operation are appropriately considered.

A key part of the Scoping Process is a preliminary identification and consideration of the ways in which the project may interact (positively and negatively) with environmental and socio-economic resources or receptors. These issues and impacts have subsequently been identified via initial site visit, the environmental status quo of the receiving environment, discussions with the project team, issues and concerns raised by key stakeholders during the initial consultation process, and available information about the environmental effects of similar solar energy developments.

The activities and issues to be considered and addressed during the various phases of the ESIA are summarised in the table below.

Phase of project	Solar Power Generation Plant And Associated Substation Site	Sub-Transmission Line Site
Construction phase	<ul style="list-style-type: none"> <li>• Climate Change Impacts</li> <li>• Air Quality &amp; Dust</li> <li>• Noise &amp; Vibration</li> <li>• Water Resources</li> <li>• Transport and Traffic</li> <li>• Waste</li> <li>• Visual &amp; Aesthetic Landscape</li> <li>• Archaeological, Heritage &amp; Cultural Structure</li> <li>• Land Quality</li> <li>• Land Use &amp; Agriculture</li> </ul>	<ul style="list-style-type: none"> <li>• Climate Change Impacts</li> <li>• Air quality &amp; Dust</li> <li>• Noise &amp; Vibration</li> <li>• Water Resources</li> <li>• Transport and Traffic</li> <li>• Waste</li> <li>• Visual &amp; Aesthetic Landscape</li> <li>• Archaeological, Heritage &amp; Cultural Structure</li> <li>• Land Quality</li> <li>• Land Use &amp; Agriculture</li> </ul>



Phase of project	Solar Power Generation Plant And Associated Substation Site	Sub-Transmission Line Site
	<ul style="list-style-type: none"> <li>• Ecology</li> <li>• Community, Health, Safety &amp; Security</li> <li>• Socio-economic and local community impacts, including compensation</li> </ul>	<ul style="list-style-type: none"> <li>• Ecology</li> <li>• Community, Health, Safety &amp; Security</li> <li>• Socio-economic and local community impacts, including compensation</li> </ul>
Operation phase	<ul style="list-style-type: none"> <li>• Climate Change Impacts</li> <li>• Water Resources</li> <li>• Visual &amp; Aesthetic Landscape</li> <li>• Community, Health, Safety &amp; Security</li> <li>• Socio-economic and local community impacts</li> </ul>	<ul style="list-style-type: none"> <li>• Climate Change Impacts</li> <li>• Transport and Traffic</li> <li>• Visual &amp; Aesthetic Landscape</li> <li>• Archaeological, Heritage &amp; Cultural Structure</li> <li>• Land Quality</li> <li>• Land Use &amp; Agriculture</li> <li>• Ecology</li> <li>• Community, Health, Safety &amp; Security</li> <li>• Socio-economic and local community impacts</li> </ul>
Decommissioning phase	<ul style="list-style-type: none"> <li>• Transport and Traffic</li> <li>• Air quality &amp; Dust</li> <li>• Noise &amp; Vibrations</li> <li>• Community, Health, Safety &amp; Security</li> <li>• Wastes</li> </ul>	<ul style="list-style-type: none"> <li>• Transport and Traffic</li> <li>• Air quality &amp; Dust</li> <li>• Noise &amp; Vibrations</li> <li>• Community, Health, Safety &amp; Security</li> <li>• Wastes</li> </ul>

The Plan of Study for the ESIA which sets out the process to be followed in the ESIA Phase in line with the Ghanaian EIA Regulations LI 1652 of 1999 has been provided. The plan is based on the outcomes of the Scoping Phase (to date) and provides the Terms of Reference (TOR) for the key issues and impacts identified as well as the stakeholder engagements that will be undertaken.

In line with standard Environmental Impact Assessment (EIA) practice, the impact assessment shall cover the direct effects and any indirect, secondary cumulative, short, medium and long-term, permanent and temporary, positive and negative effects of the development during construction, operation and decommissioning. The likely significance of the impact shall be based on the following:

- the identification and prediction of the magnitude of any impact on a receptor (e.g. human beings, community facilities etc) or environmental resource (elements of the existing natural or built environment which are essential, or of value, to the functioning of human or natural systems) because of the project, and
- the identification of the importance (/sensitivity) of that receptor or environmental resource.

The ESIA Team will collate all the gathered and generated information and data into an ESIA Report and submit same toward the acquisition of an environmental permit. The process and outputs of the Environmental Assessment is intended to meet the formal requirements of Ghana’s EPA and will be therefore structured in line with the revised format for ESIA Reports released by the Ghana EPA in 2016. The format will be as follows:

### **COVER PAGE**

- Name of Company/Proponent
- Title of Report
- Name of Consultant (s)
- Month and year of submission

### **SIGNATURE PAGE**

- Leader Team of Consultant
- Name: Signature
- Acceptance and declaration by Proponent
- Name Signature

The text will be presented under the following headings:

- Non-Technical Executive summary
- Introduction
- Policy, Legislative and Administrative Requirements
- Description of proposal and alternatives
- Description of existing environment/baseline
- Stakeholder consultation
- Impacts identification and significance
- Mitigation and enhancement measures
- Provisional Environmental Management Plan
- Reclamation/Decommissioning
- Conclusion

The ESIA report will also include a Table of Contents, a Glossary of Terms and Abbreviations and a Reference List and Annexes. The ESIA report will provide maps, figures and process diagrams to facilitate understanding of the descriptive elements of the report. The font style will be Size 12 of Times New Roman, with a 1.5 spacing and printed on both sides.

It is expected that the ESIA Study will be completed for the issuance of an environmental authorisation latest by November 2018. It should be noted that the schedule could be revised during the ESIA Process, depending on factors such as the time required for decisions from authorities.

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## CHAPTER 1 : INTRODUCTION

### 1.1. THE PROJECT

The Volta River Authority (VRA) proposes to construct and operate a 40MW solar power plant and associated electrical infrastructure on a 50.5013 km<sup>2</sup> of land at Asebga<sup>1</sup>, in the Bongo District in the Upper East Region of Ghana. The project would involve the installation of ground mounted single axis Photovoltaic Voltaic (PV) panels which will tie into the national electricity grid. Basically, electricity from the solar power plant would be evacuated at 34.5kV voltage level and a sub-transmission line, of approximately 29 km with a wayleave of 15m, would be constructed from the solar power plant and would terminate on the 34.5kV bus at the Bolgatanga Substation, in the Bolgatanga Municipality also in the Upper East Region. The project is titled the “*40MW Bongo Solar Power Project*” (hereinafter referred as the “Project”).

### 1.2. THE APPLICANT

The VRA was established on April 26, 1961 under the Volta River Development Act, 1961 (Act 46) of the Republic of Ghana with the mandate to generate, transmit and distribute electricity. Based on various amendments to the VRA Act<sup>2</sup>, VRA’s current mandate has now been largely restricted to generation of electricity and distribution of electricity in the northern parts of the country. VRA as at February 2018 had an installed electricity generation capacity of 2,456MW, out of the national installed capacity of 4381MW, and this is from two hydroelectric plants, one solar power plant and six thermal power plants.

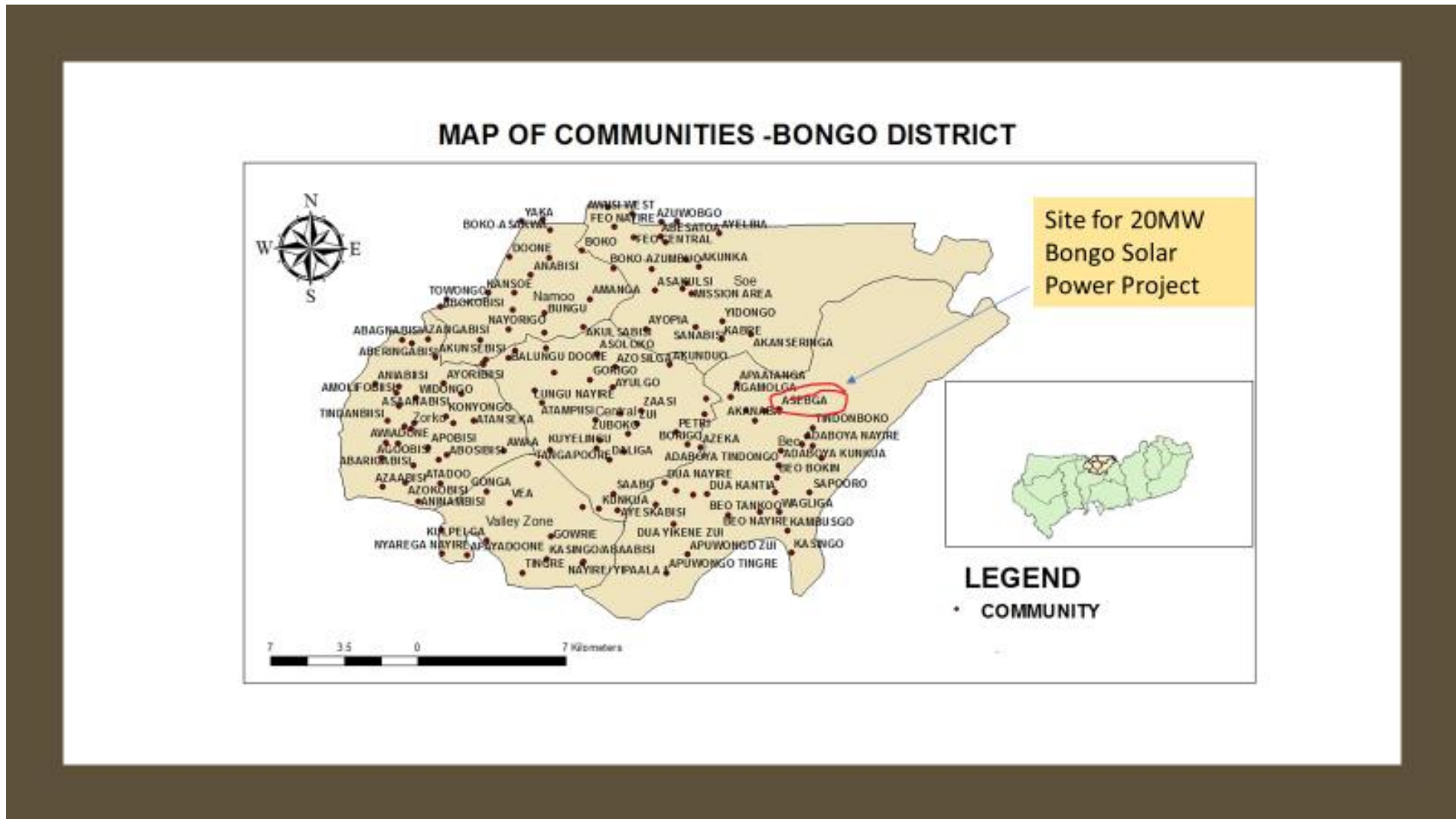
Following the amendment, the transmission function of VRA has been hived off into an entity, designated Ghana Grid Company (GRIDCo) while the VRA's distribution agency, the Northern Electricity Department (NED), has been transformed into the Northern Electricity Distribution Company (NEDCo), a stand-alone, wholly-owned, subsidiary of VRA. VRA reaches its customers in Ghana and neighbouring countries through GRIDCo. VRA's regulated customers are the Electricity Company of Ghana (ECG) for the southern part of Ghana and to its subsidiary company, NEDCo for the northern part.

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<sup>1</sup> See Figure 1.1 for Map showing the location of Asegba Community Within the Bongo District

<sup>2</sup> Volta River Development (Amendment) Law, 1987, PNDC 171 / Volta River Development Amendment Act 2005 (Act 692)

Figure 1-1: Location of Asegba Community within the Context of the Bongo District



Source: 2014-2017 Medium Term Development Plan for the Bongo District

Bulk sales are also made to de-regulated customers (mining/industrial companies) as well as import/export of power with Communauté Electrique du Benin – CEB – Togo and Benin, Compagne Ivoirienne d’électricité - CIE – La Cote d’Ivoire and Sonabel (Burkina Faso).

### 1.3. PROJECT RATIONALE

The Government of Ghana (GoG) has launched an “energy economy” initiative, which required that 10% of Ghana’s electricity needs should come from Renewable Energy sources by 2020. Subsequently, GoG passed the Renewable Energy Act (Act 832) in November 2011 to provide the necessary legal and regulatory framework for promoting the provision of energy including electricity from renewable sources. The objective of this Act is to promote the sustainable development and utilization of renewable energy resources for electricity and heat generation; consequently, increasing the proportion of renewable energy in the total national energy mix. The support for the law is also guided by the need to address climate change, as well as the rationale that Ghana has a range of renewable resources and that renewable applications are in fact the least-cost energy service in many cases - and more so when social and environmental costs are considered.

VRA in line with the National Renewable Energy Act, 2011 (Act 832), has embarked on a Renewable Energy Development Programme (REDP) with the following objectives:

1. Promote renewable energy as a means of reducing VRA’s exposure to fuel price volatility and fuel supply risks;
2. Promote the use of renewable energy in VRA’s corporate residential and non-residential facilities as well as those of the Authority’s subsidiaries to reduce the cost of energy utilities in those facilities; and
3. Diversify VRA’s generation portfolio in a sustainable manner while maintaining a low carbon footprint.

To achieve the objectives set out in the VRA RE Policy, the Renewable Energy Development Programme (REDP) was formulated. The VRA REDP sets a 5-10 years’ Renewable generation capacity target, taking cognisance of the local and export demand and the system constraints and is being rolled out in two (2) phases as shown in Table 1-1.

Table 1-1: VRA Renewable Energy Development Programme

REDP	Solar Power Project	Wind Power Project
Phase 1	<p>a. 2.5 MW Navrongo Solar Power Plant in the Kassena Nankana East District of the Upper East Region and the plant has been operational since May 2013.</p> <p>b. 12MW Solar (8MW Kaleo, 4MW Lawra) in the Upper West Region. Engagement of EPC Contractor ongoing</p>	<p>a. 76 MW Wind Power Project -1 (Anloga, Srogbe, Anyanui in Volta Region)</p> <p>b. 76.5MW Wind Power Project -2 (Wokumagbe and Goi in Greater Accra Region)</p> <p>Feasibility Study, including ESIA, for WPP1 and WPP2 are ongoing and are expected to be completed by close of June 2018.</p>
Phase 2	200MW Solar Power project to be built in different phases (40MW Bongo Solar Power Project forms part of this target).	200MW Wind Power Project, with the following sites in mind as wind measurements have been completed: <ul style="list-style-type: none"> <li>a) Amoamo South in the Kintampo South District</li> <li>b) Amoamo North in the Kintampo South District</li> <li>c) Nsutapong in the Upper Manya Krobo District</li> <li>d) Gambaga in the East Mamprusi District</li> </ul>

The target of phase 1 of the REDP is to develop about 14.5MW of solar photovoltaic (PV) plants and 150MW of wind power plants. Currently, VRA has constructed a 2.5MW solar PV plant in Navrongo, in the Upper East region of Ghana. VRA plans to construct an additional 12MW of solar PV capacity in the Upper West Region of Ghana. These projects would enable VRA meet its solar PV capacity target in the first phase of the REDP. The capacity target of Phase 2 of the REDP is to construct about 200MW of solar PV capacity that would be developed in blocks of 20MW - 50MW each and about 200MW of wind power.

The development of the 40MW Bongo Solar Power Project is part of the strategy to attain the 200MW target set for solar PV capacity in the Phase 2 of the REDP. The main outcome of the project will be an operational PV plant of 40 MW that would operate in a cost-effective manner and contribute to the local economy and the provision of quality electrical power.

#### **1.4. PROJECT’S BENEFITS**

In Ghana the industrial facilities and power generation facilities are mainly centered in a small part of the Country. Renewable power plants can be distributed around the country based on resource availability. This allows for increased Physical security and distributions of wealth and income by

having jobs spread all around the country. The Bongo PV power project in particular and the REDP in general seek to foster sustainable low carbon energy provision, provision of jobs in local communities and global partnerships that ensure that the projects should have some form of local content during development and operation.

The benefits that the country will enjoy from implementing the solar power project includes:

### **1.4.1. Environmental Benefits**

The key environmental benefits will be the reduction of fossil fuels consumed by the existing thermal generation facilities, with the consequential reduction of CO<sub>2</sub> and other greenhouse emissions from the Natural Gas/Light Crude Oil (LCO) generators. Given the low greenhouse gas emissions from solar power, increasing its adoption is an essential strategy in efforts to combat climate change at an individual and national level. Solar energy is clean, renewable (unlike gas, oil and coal) and sustainable, helping to protect our environment. It does not pollute our air by releasing Carbon Dioxide, Nitrogen Oxide, Sulphur Dioxide or Mercury into the atmosphere like many traditional forms of electrical generation do. Therefore, solar energy does not contribute to global warming, acid rain or smog. It also actively contributes to the decrease of harmful greenhouse gas emissions. Solar plants operate silently, have no moving parts, do not release offensive smells and do not require fuel. More solar panels can easily be added in the future when the demand for more power grows.

### **1.4.2. Economic Benefits**

Beyond initial installation and maintenance, solar energy is free, and therefore reduces the exposure of the electricity power price to imported fossil fuels. In addition, one of the biggest advantages of the project is the ability to avoid the politics and price volatility that is increasingly characterizing fossil fuel markets. Thus, the key economic benefits include a generated power price from the solar facility that is independent from the price of crude, the up-skilling of the Ghanaian labour force and the contracting of a local civil construction companies and labourers. Solar energy systems are virtually maintenance free and will last for decades. Once installed, there are no recurring costs. Solar energy supports local job and wealth creation, fuelling local economies.

### **1.4.3. Employment Benefits**

There will be employment opportunities created for the local labour force during the construction with the attendant invaluable up-skilling of both the local labourers and client's workers. Up skilling of the workforce in construction and operation of renewable energy technologies, and training provided to

employees will provide individuals with a skill set that will be highly desirable throughout the industry sector in Ghana, increasing potential opportunities available to such individuals and shall contribute to sustainable socio-economic development

### **1.4.4. Political and Social Benefits**

The project will illustrate the country's commitment to renewable energy generation as well as being a flagship project for the country's commitment to renewable energy generation. The success of this project will raise the confidence of investors and aid agencies to develop further solar and other renewable projects in Ghana. Ultimately this will increase the proportion of renewable energy generated indigenously and significantly reduce the dependence on imported fuel.

In addition, the development of the solar plant at Asegba offers the opportunity for a new industry in the Bongo District. Existing levels of employment are low within the project area and the wider site locality and any employment associated with the project will be the single biggest opportunity outside of the advantages expressed above. Electricity available in Northern Ghana are transmitted over long distances from the south where over 99% of power generation is produced. This is capital intensive and result in transmission loses. The siting of the project in the Upper East Region in Northern Ghana will minimize the cost of transmission and transmission loses as well. Therefore, the presence of these power plants will improve electrification. The location of the plant would allow it to improve voltages in the locality and can be configured with some minor modifications to ensure local agro based industries improved reliability of power. This will attract businesses and services that otherwise would have been difficult to bring to these communities.

## **1.5. ENVIRONMENTAL SCOPING**

### **1.5.1. Rationale**

Under the provisions of the Ghana Environmental Assessment Regulations, 1999 (LI 1652), power generation and transmission projects of this nature are categorized under environmentally critical projects for which an Environmental Permit is required from the Environmental Protection Agency (EPA). The Environmental Impact Assessment (EIA) Guidelines for the Energy Sector, Volume 1, dated September 2011, also indicates that ground mounted PV power plant/system, either stand-alone, hybrid or grid-tied with total surface area of array exceeding twenty (20) hectares requires the preparation of an Environmental Impact Assessment Report.



The environmental authorization process entails the registration of the proposed project with the EPA followed by a scoping assessment of the project to predict potential significant environmental and social impacts and generation of draft Terms of Reference (ToR) for decision making and final conduct of an Environmental and Social Impact Assessment (ESIA)<sup>3</sup>. The scoping process is supported by a review of relevant background literature on the local area. Through this comprehensive process, the environmental assessment can identify and focus on key issues requiring further assessment during the EIA Phase.

In broad terms, the objectives of a scoping process are to:

- Confirm the process to be followed and opportunities for stakeholder engagement;
- Clarify the project scope to be covered;
- Identify and confirm the preferred activity and technology alternative;
- Identify and confirm the preferred site for the preferred activity;
- Identify the key issues to be addressed in the impact assessment phase and the approach to be followed in addressing these issues; and
- Confirm the level of assessment to be undertaken during the impact assessment.

This is achieved through parallel initiatives of consulting with:

- The lead authorities involved in the decision-making for this EIA application;
- The public to ensure that local issues are well understood; and
- The EIA specialist team to ensure that technical issues are identified.

VRA has subsequently embarked on the ESIA Study to seek environmental authorisation from the Ghana Environmental Protection Agency (EPA), the nationally designated environmental authorisation agency. The proposed solar power project was registered with the EPA in August 2017. The EPA has formally responded and directed VRA to prepare this Environmental Scoping report to focus on key and relevant issues for decision making on the draft ToR<sup>4</sup>. EPA further requested VRA to publish a Scoping Notice on the project in any of the national newspapers to notify the public of this Scoping Report. At the time of registration, the intention was to develop a 20MW solar facility, but a decision has been taken by VRA based on available funding to expand the facility to 40MW.

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<sup>3</sup> See Figure 1-2 for EIA Review Flowchart in Ghana

<sup>4</sup> See Appendix 1 for EPA Response Letter

This scoping exercise has been undertaken to help provide an indication of the ecological, social and economic impacts that may arise following the establishment of the solar power facility, based on which the terms of reference for the study, including the spatial and temporal boundaries for the ESIA, has been defined for approval by the EPA.

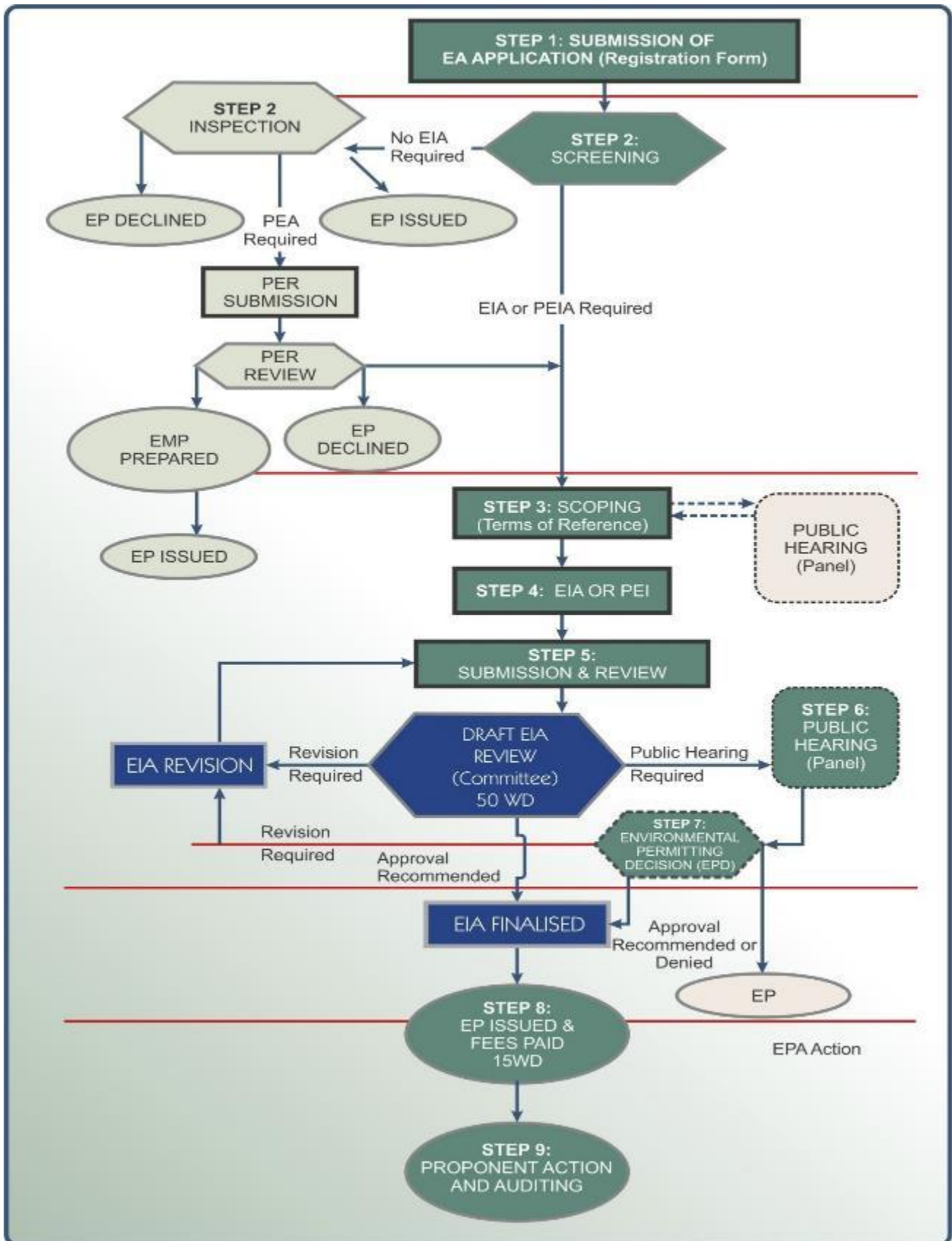
### **1.5.2. ESIA Study Team**

The environmental assessment for the project is being undertaken by a team of in-house experts of VRA, made up of Environmental Safeguard Specialist, Ecologists, Resettlement Specialist, Land Economist, Land Valuation Experts, Engineers and Geodetic Surveyors<sup>5</sup>. The ESIA Team is led by Ben. A. Sackey, the Manager, Environment & Social Impact of the Environment & sustainable Development Department. Mr. Sackey currently works as an Environmental Safeguard Specialist and has over twenty (20) years of experience in the coordination of environmental auditing, environmental scoping, EIA studies, resettlement planning as well as the production of Environmental Management Plans (EMP), particularly in the energy sector, both for the public and privates sector. He is now a Certified Environmental Auditor with the Institute of Environmental Management & Assessment as well as a Certified Lead ISO 14001 EMS Implementer by the Professional Evaluation & Certification Board.

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<sup>5</sup> See Appendix 2 for members of the study team and their roles.

Figure 1-2: Ghana EIA Review Flow Chart



Source: ESIA for Wind Power Project 1 – Dec. 2017

### ***1.5.3. Approach & Methodology***

It is recognized that to achieve the Ghana Government’s challenging targets for renewable energy generation, a greater number of renewable energy schemes, such as this project, are required. Such infrastructure should however be appropriately located and designed to avoid significant technical and environmental constraints. The site selection process is the initial stage of the project development process. It begins with the screening against several variables, including solar resource, land availability, grid connection and identification of key environmental constraints. These layout iterations and refinements contributes to reducing the potential effects of the proposal to an acceptable level. Having identified a site, a more detailed analysis is carried out as part of feasibility process. Following this, the feasibility study then informs the location of the site and associated infrastructure which have been designed and amended in response to the ESIA process (‘dynamic design process’).

To achieve the above, the approach and methodology adopted by the ESIA team is as follows:

- Site Hunting & Investigations to identify potential sites
- Identification of Potential Site and land verification process
- Surveying & Mapping of Selected Sites
- Land Acquisition & Compensation payment to Property Affected persons
- Design Studies for the preparation of Project Feasibility Report
- Review of Available Literature
- Stakeholder Engagements
- Site Reconnaissance Visit for Scoping Study

Details of how these have been achieved so far are discussed elsewhere in the report. The primary objective of the Scoping Report is to present key stakeholders with an overview of the proposed project and key issues that require assessment in the ESIA Phase and allow the opportunity for the identification of additional issues that may require assessment. Sufficient information on impacts on, inter alia, climate, topography, biodiversity, sites of archaeological, cultural and historical interest, as well as the social environment have been identified by means of the site inspection, desk-top review of available information. Again, relevant literature for the study area has been reviewed and incorporated as required to enable the authorities to reach a decision regarding the scope of issues to be addressed in this ESIA Process.

**1.6. STRUCTURE OF SCOPING REPORT**

In accordance with the regulatory requirements stipulated in the Environmental Assessment Regulations (1999), VRA has prepared this Scoping Report that has defined the scope for undertaken the Environmental and Social Impact Assessment (ESIA) for the development of the proposed project. The process and outputs of the Environmental Assessment, including this Scoping Report, is intended to meet the formal requirements of Ghana’s EPA and will be therefore structured in line with the revised format for ESIA Reports released by the Ghana EPA in 2016. The Scoping Report has subsequently followed the said format. This Scoping Report comprises of eight (8) chapters, the contents of which are described in Table 1-2.

Table 1-2: Structure & Content of Scoping Report

Location	Title	Content
Chapter 1	Introduction	An Introduction which analysed the need for the undertaking and presents the process undertaken thus far and describes the remaining phases.
Chapter 2	Description of Existing Policy, Legal & Administrative Framework	An outline of the Legislative, regulatory and policy framework, within which the proposed project is required to operate.
Chapter 3	Project Description & Consideration of Alternatives	Brief on the various activities during the pre-construction and construction as well as occupancy phase is described, including project justification. The project costs, project timelines as well as project management structure is provided. Project alternatives to be considered in the Main ESIA Phase, including the no-go option for the project
Chapter 4	Baseline Environmental Conditions of the Study Area	An identification of existing environmental conditions including social, economic and other aspects of major environmental concern
Chapter 5	Stakeholder Engagements	This Chapter provides a brief on the stakeholder engagements till date, and outstanding as well as future consultations, including public disclosure.
Chapter 6	Key Issues & Potential Impact	This Chapter provides a brief on the potential environmental concerns likely to arise from the development and key outstanding issues to be considered for inclusion in the Main ESIA Report
Chapter 7	Plan of Study for the ESIA	This Chapter outlines methodology for the assessment of identified impacts, issues required to be considered in the ESIA Study, structure of the ESIA Report, plan of study for the Main ESIA study and timeline for the completion of the EIA Process.
Chapter 8	Reference List	
Appendices		

## CHAPTER 2 DESCRIPTION OF EXISTING POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

### 2.1. INTRODUCTION

Ghana, like many countries, has enacted local laws and signed several environmental regulations and international treaties or conventions, which seeks to maintain the functional integrity of the environment. It is the aim of this environmental assessment process to provide a legal register to ensure that the solar photovoltaic power project meets the highest possible standards of ESIA and the subsequent management policies.

This Chapter therefore provides a list of national policy, legal and administrative framework as well as VRA Corporate Polices and International best practice, that applies to the Project. Details of how the legal requirements and norms apply to the project and should be complied with will be provided in the Main ESIA.

### 2.2. RELEVANT VRA CORPORATE POLICIES

The VRA is committed to providing exemplary levels of care and safety for employees, the local populations and the environment in general. As such, VRA’s Environmental Strategy aims at conducting all its operations in such a manner that the safety, health and welfare of its workers and the integrity of the environment will be safeguarded always. To achieve these, VRA has developed corporate policies regarding environmental protection, health and safety of its workers as well as welfare of the affected population, as listed below, and are expected to be applied in project implementation.

- Corporate Environmental Policy Statement (2013) <sup>6</sup>
- Community Development Programme (2012)
- Local Content Policy (2012)
- Corporate Social Responsibility Policy (2015)
- Corporate Health & Safety Policy (2015)
- Safety Policy Handbook (2001)
- Safety Rules & Standard Protection Code (2003)
- Safety Rules Book (2008)
- Health and Safety Training Manual (2009)

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<sup>6</sup> See Front Page of this Scoping Report for VRA’s Corporate Environmental Policy

- Safety, Health & Environment Standards for Contractors (2013)
- Workplace HIV/AIDS Policy (2008)

### 2.3. INSTITUTIONAL & ADMINISTRATIVE FRAMEWORK

A list of the governmental bodies in the power sector in Ghana that will be responsible for various aspects of the proposed project are outlined below. The legal framework within which these institutions exist, their relevant legislative backings, legislative instruments guiding their work, as listed, and their roles in the administration of the proposed solar power project will be provided in detail in the Main ESIA Report.

- Ministry of Energy, that promulgated the following:
  - a. Renewable Energy (RE) Act, Act 832 of 2011
  - b. National Energy Policy, 2012
- Volta River Authority, as established by the Volta River Development Act, Act 46, and backed by:
  - a. Volta River Authority (Transmission Line Protection) Regulations, 1967 (LI 542)
  - b. Volta River Authority (Transmission Line Protection) (Amendment) Regulation, 2004
- Energy Commission established by the Energy Commission Act (1997), Act 541 and backed by:
  - a. Electricity Regulations, 2008 (LI 1937).
  - b. Electricity Supply and Distribution (Standards of Performance) Regulations, 2008 (LI 1935).
  - c. Electricity Supply and Distribution (Technical and Operational), 2005 (LI 1816)
  - d. Electricity Transmission (Technical, Operational and Standards of Performance) Rules, 2008 (LI 1934)
  - e. Guidelines for electricity rate-setting in Ghana, 1999
  - f. Electricity Transmission (Technical, Operational And Standards Of Performance) Rules, (L.I. 1934), 2008
  - g. Layout-Designs (Topographies) of Integrated Circuits Act, 2004 (Act 667).
  - h. National Electricity Grid Code, 2009
  - i. Net Metering Sub-Code for Connecting Renewable Energy Generating Systems to the Distribution Network in Ghana, January 2015.
  - j. Renewable Energy Sub-Code for Distribution Network connected Variable Renewable Energy Power Plants in Ghana, January 2015.
  - k. Renewable Energy Sub-Code for NITS connected Variable Renewable Energy Power Plants in Ghana, January 2015

- Public Utilities and Regulatory Commission established by the Public Utilities Regulatory Commission (PURC) 1997, Act 538 and backed by:
  - a. Public Utilities (Termination of Service) Regulations, 1999 L.I. 1651
  - b. Public Utilities (Complaints Procedure) Regulations 1999
  - c. Public Utilities (Consumer Service Committee) Regulations 2002, LI 1704A
- Ghana Grid Company established by the Volta River Development Amendment Act 2005 (Act 692).
- Northern Electricity Distribution Company, established in line with the ongoing Power Sector Reforms and which transformed the Northern Electricity Department of the VRA that was backed by the Volta River Development (Amendment) Law, 1987, PNDC 171.

### **2.4. NATIONAL LEGISLATION AND GUIDELINES OF RELEVANCE TO THE PROPOSED PROJECT**

Key national policy and legal frameworks of relevance to the project are listed as below. Detailed discussions on their application to the project will be outlined in the main ESIA Report.

#### **2.4.1. *Environmental Protection***

- Environmental Protection Agency Act, 1994 (Act 490)
- Pesticides Control and Management Act (1996) Act 528, integrated into the EPA Act 490, as part 2
- Environmental Assessment Regulations 1999, LI 1652
- Environmental Assessment Fees and Charges (Amendment) Instrument 2015 (LI 2228)
- National Environmental Policy, 2012
- National Climate Change Policy, 2013
- EPA Guidelines Documents relevant to the project are as below:
  - a) Environmental Impact Assessment Guidelines for the Energy Sector (2011), Volume 1
  - b) The EPA EIA Guidelines for the Energy Sector (2011) (Vol. 2)
  - c) Environmental Assessment in Ghana, A Guide (1996)
  - d) Environmental Impact Assessment Guidelines for the General Construction and Services Sector (2011).
  - e) Schedule 1: Ghana EPA Guidelines for discharges into natural water bodies
  - f) Schedule 3: Ghana EPA Environmental Quality Guidelines for Ambient Air
  - g) Schedule 4: Ghana EPA Environmental Quality Guidelines for Ambient Noise

#### **2.4.2. *Occupational Health & Safety***

- Factories, Shops and Offices Act of 1970 (Act 328)



- Ghana National Fire Service Act, 1997 (537)
- The Control and Prevention of Bushfires Act, 1990 (PNDC Law 229)
- Workmen’s Compensation Law, 1986
- Persons with Disability Act, 2006, Act 715
- National HIV & AIDS STI Policy of 2004 and revised in Feb. 2013
- National Building Regulations, 1996, LI 1630
- National Building Code, 2006
- Ghana Seismic Code, November 1990
- Ghana National Environmental Sanitation Policy 2010,
- Health Care Waste Management Policy & Guidelines”, 2006.
- Environmental Sanitation Policy, Revised 2010

#### **2.4.3. Road Traffic Safety**

- The National Road Safety Commission Act, 1999 (Act 567)
- The Road Traffic Acts, 2004, Act 683
- The Road Reservation Management Manual for Coordination (June 2001)
- The National Road Safety Policy, 2007
- The Truck Driver’s Guide - Ghana, 2010

#### **2.4.4. Labour & Other Social Responsibility**

- Labour Act 2003 (Act 651)
- The Labour Regulations, 2007 (LI 1833)
- Children’s Act No. 560 of 1998
- The Criminal Code, 1960 (Act 29)
- Commission on Human Rights and Administrative Justice Act (Act No. 456 of 1993)
- National Vocational Training Act (Act No. 351 of 1970)
- The Ghana Investment Promotion Centre Act (Act No 865 of 2013),
- The Ghana Business Code

#### **2.4.5. Property Acquisition & Compensation**

- National Land Policy, 1999,
- Draft Land Bill, 2016, (Lands Act, 2016)
- Constitution of Ghana, 1992
- Local Government Service Act, 2003 Act 656
- National Development Planning Commission Act, 1994 (Act 479);
- National Development Planning (Systems) Act, 1994 (Act 480);
- National Building Regulation, 1996 (LI 1630);
- New Lands Commission Act (2008) Act 76

- Land Title Registration Act 1986, PNDCL 152
- State Lands (Amendment) Act (2005) Act 586
- State Lands Regulations (1962) LI 230
- Stools Lands Act, 1994 (Act 481)
- Concessions Act, 1962
- Immovable Property Rate Regulations (1975) LI 1049
- Lands (Statutory Wayleaves) Act 1963 (Act 186)
- Lands Statutory Wayleave Regulation 1964 (LI 334)
- National Museums Decree (1969) NLCD 387,
- Survey Act 1962, Act 127
- Resettlement Policy Framework (RPF), 2011

#### **2.4.6. *Land & Water Resource Protection***

- Water Resources Commission Act, 1996, Act 552
- The Water Use Regulations, 2001 (L.I. 1692),
- The National Water Policy of Ghana, 2007
- The National Land Policy, 1999
- Rivers Act, 1903
- Land Planning and Soil Conservation Act, 1957
- Drilling License And Groundwater Development Regulations, 2006, LI 1827

#### **2.4.7. *Biodiversity & Resource Protection***

- Wild Animals Preservation Act 1961 (Act 43)
- Wildlife Conservations Regulations, LI 685, 1971 (and Amendments)
- Economic Plants Protection Act, 1979
- Biodiversity Strategies and Action Plan, 1998
- National Biodiversity Strategy for Ghana, 2002
- National Wildlife Management Policy, 2006
- Forest and Wildlife Policy, 2012
- Wildlife Division Policy for Collaborative Community Based Wildlife Management, September 2000

### **2.5. INTERNATIONAL INSTRUMENTS AND COMMITMENTS**

In addition, the proposed project has committed to align as far as possible with the requirements of co-financers which dictate ‘best-practice’, and within this context, the under listed environmental and social impact requirements of international financiers are also to be reviewed and discussed in detail in the Main ESIA Report:

- Performance Standards of the International Finance Corporation

- Environment & Safeguard Operational Policies of the World Bank Group
- Equator Principles of Financial Institutions

## CHAPTER 3 : PROJECT DESCRIPTION AND CONSIDERATION OF ALTERNATIVES

### 3.1. INTRODUCTION

The 40MW Bongo Solar Power Project has two (2) main components as follows:

- Installation of the 40MW ground mounted single axis PV panels solar power plant on a 0.5013 km<sup>2</sup> of land at Asebga, in the Bongo District.
- Development of an approximately 29km 34.5 kV sub-transmission line from the solar power plant at Asebga and terminating on the 34.5kV bus of the GRIDCo Bolgatanga Substation, located in the Bolgatanga Municipality.

An outline of the main activities is listed below:

- Studies (Feasibility, ESIA, geotechnical, grid impact).
- Sourcing Funding
- Procurement process (specifications, Tendering etc.)
- Obtaining the necessary Licences and permits
- Construction of 40MW PV plant capacity
- Grid connection to Bolgatanga substation at 34.5 kV
- Training for VRA staff who would operate and maintain the PV plant;
- Integration of the plant into VRA Remote Renewable Energy Generation monitoring and control centre to allow for the monitoring, control and maintenance coordination of the plant with the National System Control Centre.

This Chapter provides an overview of the components of the proposed solar power and associated sub-transmission line facilities, details of the pre-construction, construction, operation and maintenance, and decommissioning stages of these components as well as the alternatives considered in the selection of the project's facilities.

### 3.2. SOLAR POWER PLANT COMPONENT

#### 3.2.1. Location

The average annual solar irradiation level at Bongo is about 2000kWh/m<sup>2</sup>, which is above the preferred average of 1600kWh/m<sup>2</sup>. This value of irradiation makes Bongo a suitable site for the development of the solar PV plant. The proposed site is at Asebga, about 1.3km from the Akorisi village in the Bongo District of Upper East Region of Ghana, and 15 kilometres south of the Ghana - Burkina Faso border.

The site is about 9km from the Bongo township, the district capital, and about 40km off the Bongo Main Road. The solar power site is situated on Latitude 10.92° and Longitude -0.73°, covering a geographical area of about 0.5013 km<sup>2</sup>. The breadth (East – West) of the site is about 0.75km and the length is 0.65km. The site is bounded on the north by the Akorisi village, on west and south-west by Bongo and Bogorogo communities respectively and on the east and south by an untarred road (see Figure 3-1). The site is accessible via this road. The solar power site is designated for agricultural use, with current agricultural practises including mixed farming and grazing for livestock (cattle, goats and sheep).

**3.2.2. General Scheme**

Solar PV plants generate electricity from solar radiation using a PV Module, which comprises of several solar cells. Solar cells produce Direct Current (DC), which is converted to Alternating Current (AC) in inverters before the plant is connected to the grid. It is anticipated that the project will feed a total of 40 MW into the national grid via the GRIDCo substation in Bolgatanga. Table 3-1 provides an overview of key components of the Project.

*Table 3-1: Key components of the Solar PV Plant*

<b>Component</b>	<b>Description</b>
Project Capacity	40 MW
Project Area	0.5013 km <sup>2</sup>
Technology Type	Photovoltaic (PV) Polycrystalline technology
Infrastructure	<ul style="list-style-type: none"> <li>• PV solar panels/modules (arranged in arrays)</li> <li>• PV module mountings</li> <li>• DC-AC electricity inverters and transformers</li> <li>• A ‘loop-in loop-out’ substation facilitating connection to the national grid</li> <li>• A substation located within the PV footprint</li> <li>• Underground cabling and Overhead power lines</li> <li>• On-Site buildings (including an operational control centre, office, inverter room and transformer units warehouse, and a guard house)</li> <li>• Access roads and internal road network</li> <li>• Ancillary infrastructure</li> </ul>

### **3.3. SUB-TRANSMISSION LINE COMPONENT**

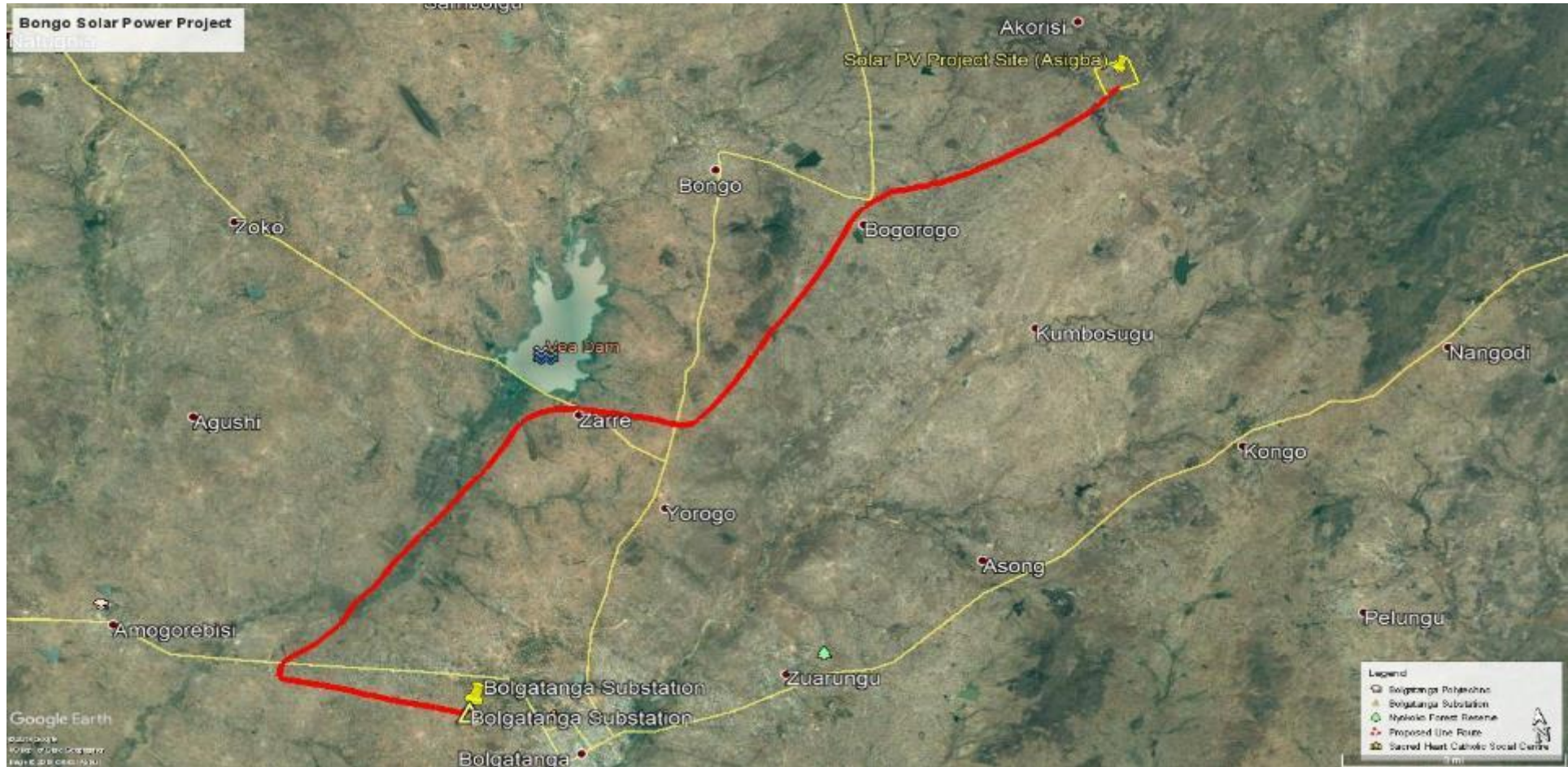
#### **3.3.1. Location**

With respect to the sub-transmission line route (See Figure 3-1), the proposed route line commences from the solar site at Asegba to Bogorogo junction and turns left and runs parallel with the high-tension lines along the main Bogorogo road. It continues to run parallel to the road using the right of way corridor until it crosses the main Bolgatanga - Bongo road. The route crosses the main Bolgatanga-Bongo highway road and runs behind the Zarre Township through the Vea irrigated farmlands, Yorogo outskirts and then terminates at the Bolgatanga-Navorongo highway. It then crosses the highway to meet the Bolgatanga-Ouagadougou 161 kV Tower lines at Zorbisi and then turns to the left and runs parallel with the 161kV line using its right of way until it reaches the existing 161kV Bolgatanga Substation within the Bolgatanga Municipality. The entire project is physically located in the Upper East Region.

#### **3.3.2. Project Component**

The works involves the design, manufacturing, testing, supply, transportation to site, off-loading, erection and commissioning of plant and equipment for the works. The supporting structures shall be self-supporting lattice steel towers of conventional type with tapered body or parallel legs and square base. Either one foundation only or four independent footing can be applied, at Tenderer's choice. In addition, special tower arrangements shall be provided for auto recloser support and for Tee-off of lateral lines. The design shall be in accordance with the ASCE manuals and reports on engineering practice No. 52 "Guide for design of steel transmission towers, 2nd Edition, 1988". The equipment associated with the sub transmission line is provided in Table 3-2.

Figure 3-1: Satellite Imagery showing proposed Solar Power Project Site



Source: Project Management Team (March 2018)

Figure 3-2: Setup of a Typical Solar PV Plant

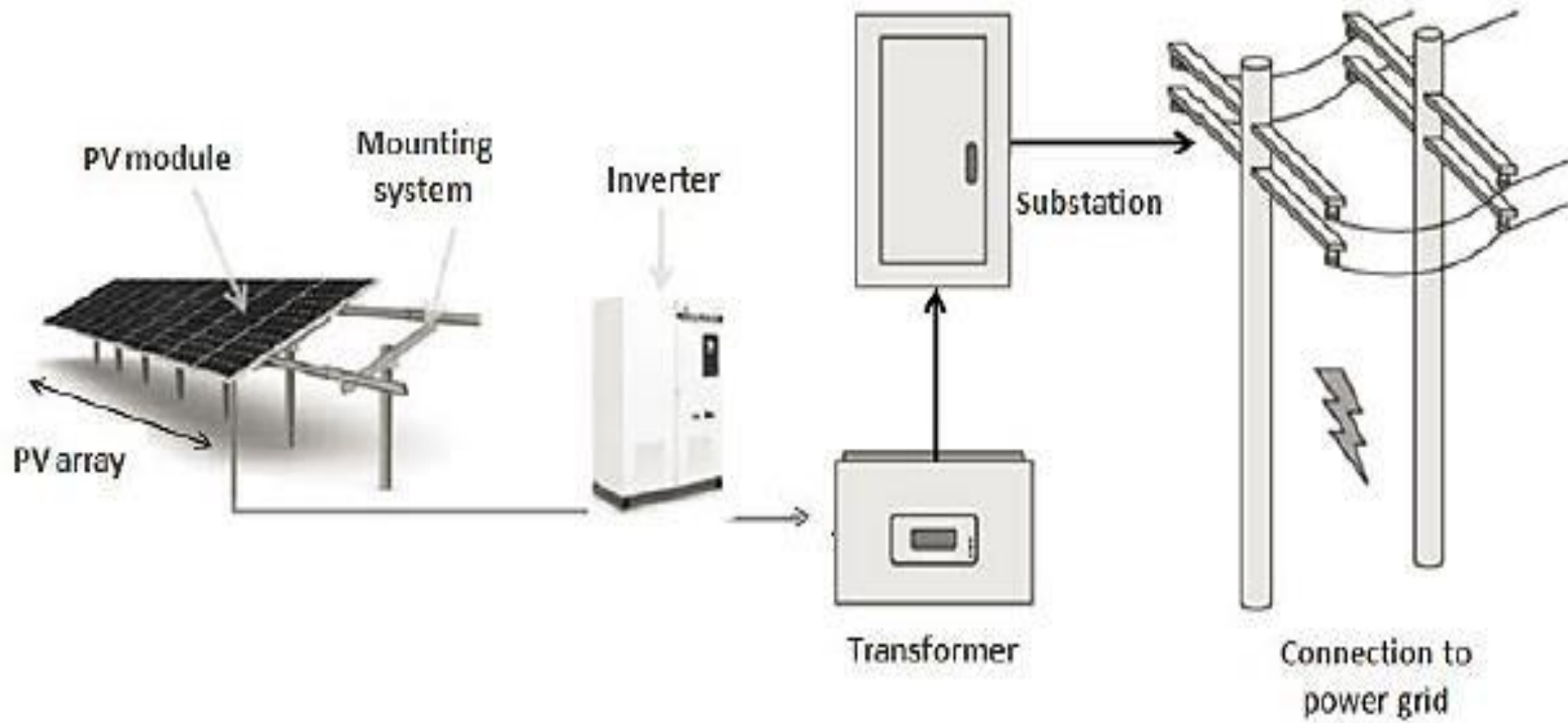




Table 3-2: Equipment of Sub-Transmission Line

Main Equipment	Auxiliary Equipment
Suspension towers	Trucks for unloading materials and equipment at each tower site;
Small angle towers	Mobile cranes;
End and large angle towers	Cable stringing pullers;
Conductors (i.e. wires)	Cable stringing tensioners;
Earth wire	Cable reel carriers;
Insulator chains	Line winders / Concrete mixers.

The electricity from the PV plant would be evacuated at 34.5kV voltage level from the sub-transmission line that would be constructed from the plant to the GRIDCo substation in Bolgatanga. This sub-transmission line would terminate on the 34.5kV bus at the Bolgatanga substation. Figure 3-3 shows the single line diagram of the Bolgatanga and the Bongo substations with a distribution line between them.

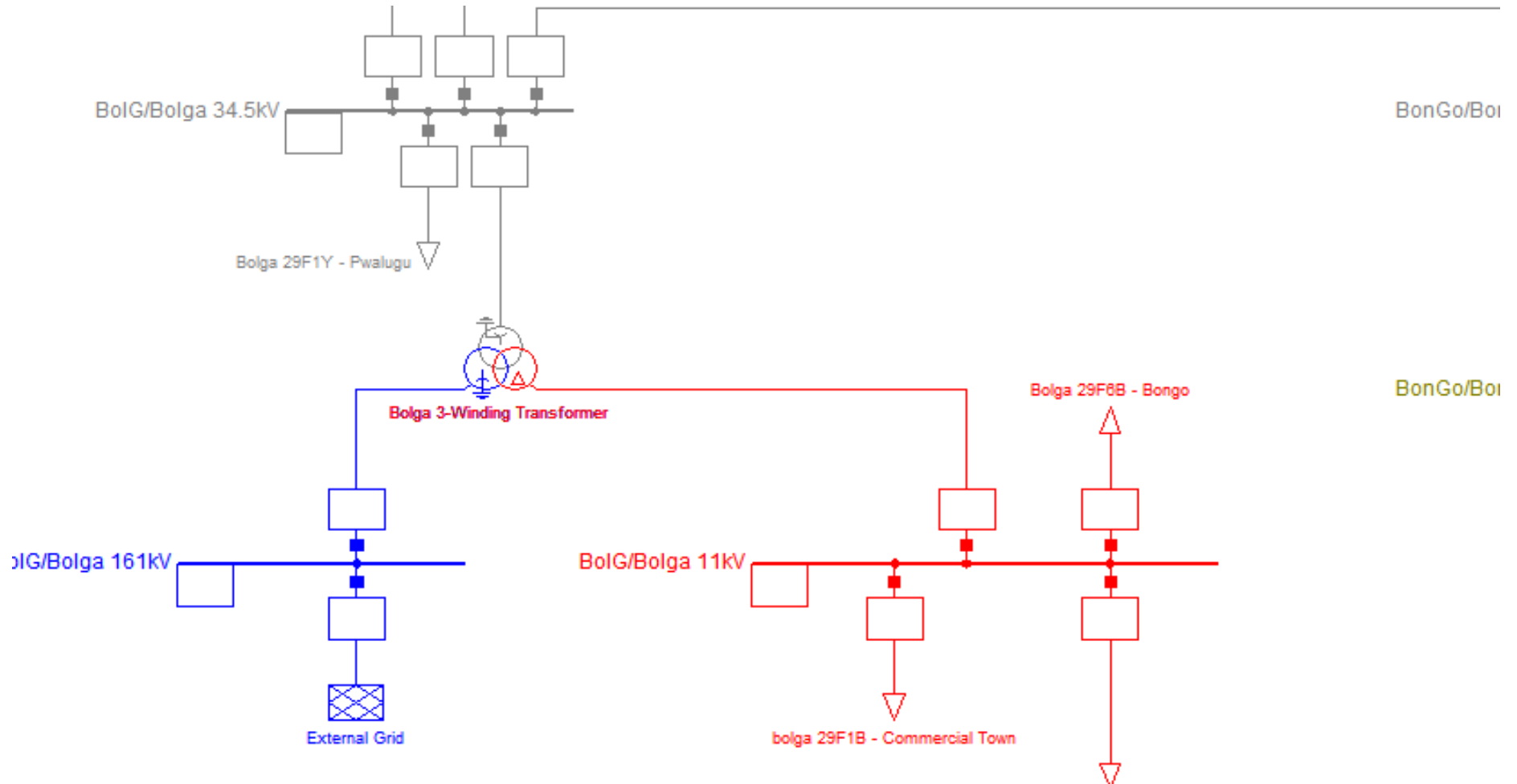
### **3.3. PRE-CONSTRUCTION ACTIVITIES**

#### **3.3.1. Site Survey & Drawings**

Investigations of various sites to be acquired for the installation of the proposed project and related sub-transmission facilities commenced in January 2014 by the Property Valuation Experts in collaboration with the Geodetic Surveyors and the Engineering Team. It involved consultations with various groups of people, including traditional authorities, especially the Bongo Naaba, to identify lands that could be acquired for the project. The Team visited six different areas in the environs of Asebga, Adaboya and Soe communities as well as two sites near the Chiana town.

From the site investigations, the VRA Team and landowners identified a suitable land at Asigbe, as well as the stretch of land for sub-transmission facility from the identified site to the Bolgatanga Substation for acquisition. The Team then undertook a land verification exercise at the Lands Commission to ensure that the rightful owners are identified for compensation payment. This exercise was necessary to enable the VRA formally acquire the sites to enable the commencement of the project implementation. Land was finally released by the traditional authority on behalf of the landowners to the VRA for use in December 2014.

Figure 3-3: Single Line Diagram of Bongo PV plant and its connection to Bolgatanga Substation



Source: Draft Feasibility Study Report for the Bongo Solar Power Project, August 2017

The total land coverage acquired for the solar power project at Asegba is 50.13 Ha. Site survey and relevant maps and initial drawings are being prepared for endorsement and approval by the relevant agencies. Following this, marked survey pillars, eight in number, have been placed at vantage areas for the identification of the project site. In addition, a preliminary line route survey has been done to identify the sub-transmission line component of the project, estimated at 29km. The final route for the sub-transmission line component of the project will be established and relevant maps to this effect will be produced to guide construction. The power will be connected to the national grid, through bulk transmission lines located about 1.8 km away from the southern end of the project site.



Plate 3-1: Survey Pillars at Solar Power Project Site at Asegba

#### 3.4.1. Land Acquisition & Compensation

No involuntary resettlement is expected under the project. There are no residence and structures at the site for both the solar power project at Asegba or within the 29 km 34.5kV sub-transmission line to the Bolgatanga Substation. The selection of the land site took into consideration the need to avoid such structures. Land acquisition process for the solar power site has been completed and compensation has been paid in full for the site. The land for the PV Plant belongs to the following families:

- Asibigah Naaba's Family
- Atisidaboro Family
- Abinogre Family
- Asamlogro Family

A declaration leasing out the land was made in December 2014 by Anafo Akor, the Chief of Asegba. Subsequently, a 50-year lease agreement, commencing on January 1, 2015 has been executed between the Bongo Skin and VRA for the solar power site<sup>7</sup>.

<sup>7</sup> See Appendix 3 for Land Acquisition Documentations

With respect to the sub-transmission line, it must be noted that currently there is no law or legislation governing the length of RoW for 34.5 kV transmission line. Thus, for the sub-transmission line route, there would not be the need for any RoW acquisition with the associated resettlement and compensation. However, due to safety of the lines because of threats from falling economic trees, VRA has demarcated a 15m RoW and proceeded to pay compensation for trees that are economic in nature. Trees compensated for included Shea butter, Dawadawa, Baobab, Teak, Berry and Mango.

Compensation to property affected owners for the surveyed land was done in May 2016, and this was done by the Property Valuation Experts in consultation with the traditional authority and the Bongo District Assembly. Details of the valuation process and payment is outlined in the Project Valuation Report, dated May 2016.

### **3.4.2. *Project Feasibility Studies***

Project Engineers have assessed the acquired lands and developed layouts for the project as well as the various technical requirements. A Feasibility Study report, dated August 2015 has been prepared by in-house Team from the Engineering Services Department of VRA. The report provided information on characterisation of the intervention area, study of the site lay out, study of the electrical design, evaluation of the irradiation data, grid connection, environmental assessment requirements, etc.

The civil and electrical design for the PV plants is yet to be developed and the description provided in this report is based on similar solar power projects to be developed under REDP Phase 1, indicated under Section 1.3 of this report. The basic design shall be developed to set a reference for reliable and easy manageable power plants. Therefore, a clear focus will be given to market-ready and proven technologies. Existing approaches employed in developed PV markets will be considered and adapted to Ghanaian conditions and the project framework.

### **3.4.3. *Stakeholder Engagements***

Engagements with stakeholders play a major role in identifying the potential impacts of any proposed project. A site reconnaissance visit was done by the Environmental Safeguard Specialist in November 2017 to collect baseline data (dry season) in the context of physical and ecological environment as well as socio-economic and Land use. The site reconnaissance visit included a focused group discussion with Interested & Affected Project Persons (I&APs) as part of information disclosure and public consultation. These engagements were done to compliment earlier ones undertaken by the Property Valuation Experts, Engineers and the Geodetic Surveyors during the site surveys and land acquisition process.

Key stakeholder institutions within the project study area that were identified and consulted included the following:

- Upper East Regional Coordinating Council
- Bongo District Assembly
- Ghana Health Service, Bongo District
- Ghana Education Service, Bongo District
- Ghana National Fire Service, Bongo District
- Bongo Traditional Authority
- Farmers

The ESIA Study Team held one-on-one stakeholder consultations with the I&APs to obtain their comments and concerns on the proposed project with respect to the potential environmental and socio-economic issues and impacts that have been addressed in the study. Details of the stakeholder engagements undertaken so far is provided in Chapter 5 of this Scoping Report.

Consultations shall continue all through the project life cycle and would be held with all stakeholders, including Project Affected Persons (PAPs) as well as the relevant Chiefs, Opinion Leaders, and Governmental Agencies with the aim of providing information on project environmental and social management issues, including valuation and compensation.

#### **3.4.4. Acquisition of Permits & Licenses**

The necessary statutory permits and licenses that must be acquired for the construction and operational/maintenance phases of the solar power project are as follows:

- a. Environmental Permits from the EPA (also to be submitted to Energy Commission) prior to construction and during operations
- b. Provisional Generation & Electricity Wholesale Supply Licence Construction Permit from the Energy Commission, prior to construction.
- c. Development Permit from the Bongo District Assembly, prior to construction.
- d. Fire permit from the Ghana National Fire Service, prior to construction and during operations
- e. Generation & Electricity Wholesale Supply Licence from the Energy Commission during operation

VRA has subsequently initiated the processes for the acquisition of these permits and licenses. The preparation of this Scoping Report is the initial step for the acquisition of the Environmental permit.

### 3.5. CONSTRUCTION

#### 3.5.1. *Engineering, Procurement & Construction*

An Engineering, Procurement & Construction (EPC) Contractor will be responsible for the procurement of the power plant and associated components., transportation, erection on site (including civil works), installation, testing, commissioning. Most of the components for the power plant, both solar and sub-transmission line, will be manufactured and procured internationally, as they are not available for purchase in Ghana. The procurement of the equipment will take into consideration, past importation records of such equipment, the operation and maintenance capability of the VRA and other relevant matters. The specifications of the new equipment will comply with the international standards as much as possible to ensure an economical design and compatibility with the existing facilities and equipment. In addition, the necessary spare parts, testing instruments, maintenance tools and operation and maintenance manuals will be provided as part of the project.

The equipment will also have the minimum but necessary configuration to achieve the objectives of the project. Concrete and aggregates will be procured locally. Other local procurement will include foodstuffs and miscellaneous supplies and services. It is expected that the materials and equipment for the power plants and associated transmission line will be stored at the NEDCo Office in Bolgatanga and supplied on as required basis to a protected site at the power plant site at Asegba.

The EPC contractor will also be responsible for organising the site construction and installation works to the required safety standards and the project programme. Where appropriate, the Contractor will use local subcontractors. The Contractor will be responsible for any sub-contractors. The construction methods should be those with which local construction companies and engineers are familiar and a carefully arranged work management system is required so that all the planned work is safely and smoothly completed. The contractor will ensure that the site is secure from the public.

#### 3.5.2. *Geotechnical Investigations*

Geotechnical studies shall be conducted to determine the soil type, which will form the basis for the foundation type to be exploited. The results from the geo-technical study will also determine the topography's effect on the proposed design. Preliminary investigations indicated that there are no major fault lines at Bongo. Figure 3-4 shows the fault lines in the Upper East Region of Ghana<sup>8</sup>.

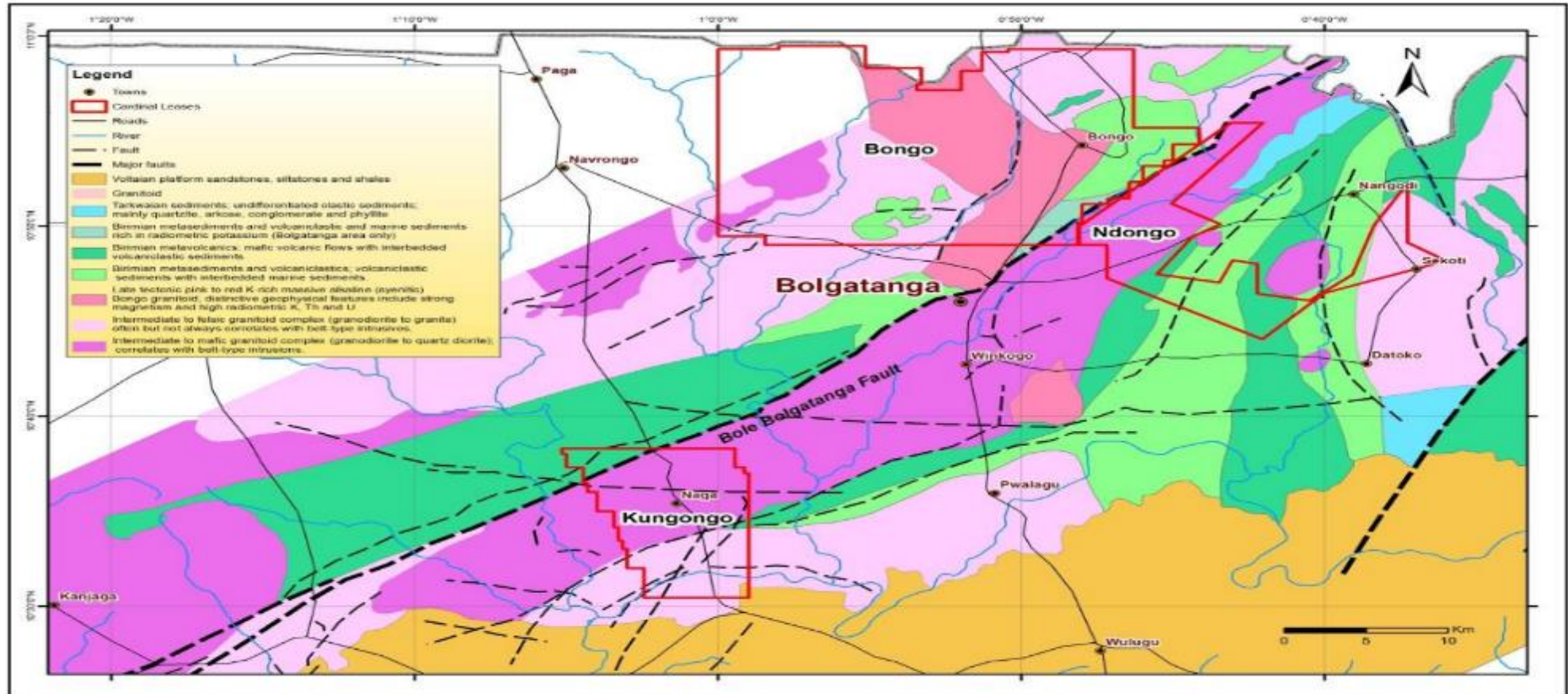
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<sup>8</sup> Report on Independent Geologist's Report Bolgatanga Gold Project, Ghana Subranum Gold Project, Ghana Kilo - Moto Gold Project, Democratic Republic of Congo by SRK Consulting (Australia)

However, it is recommended that Geotechnical Investigations be done to confirm the assumptions made. In addition, the Geotechnical Investigations would provide information on the soil profile at the site which would inform the choice of mounting structure that would be used and provide information on the availability of ground water which could be used for the cleaning of the panels and use by the plant personnel during the operational phase of the solar PV plant.

The detailed geotechnical investigation is to be done by the EPC Contractor and therefore will be dependent on the award of contract and findings and cannot be included in this Scoping and or ESIA Report. Findings of this study will be made available to the EPA when completed, as part of project environmental reporting.

Figure 3-4: Fault Lines at Bongo



Source: Draft Feasibility Study Report for the 40MW Bongo Solar Power Project, August 2017



### **3.5.3. *Transportation of Equipment***

The equipment procured will be landed at the Port of Tema and will then be transported overland to the project sites more than 830 km away, making careful packing of the equipment essential to avoid any problems at the transportation stage. The main route from Tema through Kumasi, Tamale, Bolgatanga, through Yorogo to Bongo is asphalted. However, the routes within Bongo District leading to the project site, i.e. from Bogorogo to Asigba, are untarred and poor in nature. It must be noted that the materials will not be bulky and unwieldy. They will therefore not require any specialised vehicles. Materials and equipment procured locally or nationally will be transported directly to the storage site via road in small trucks. During construction, the materials will be transported to the site via public roads and access tracks, which are mainly untarred roads, and this could result in dust generation.

### **3.5.4. *Site Preparation and Construction***

#### **3.5.4.1. *Solar Power Plant***

Prior to construction, the site will be prepared. Based on the topography of the proposed layout, site preparation will generally include the following activities:

- Vegetation clearance – removal or cutting of any tall vegetation if present (bush cutting);
- Levelling and grading of areas where the array will be sited would normally occur, but this is not deemed necessary given the flat nature of the terrain on the site;
- Levelling of hard-standing areas, e.g. for temporary laydown and storage areas;
- Erection of site fencing;
- Construction of a temporary construction camp; and
- Upgrading/construction of on-site access roads.

Once the PV components have arrived on site, technicians will supervise the assembly of the panels and test the facility. The PV panels will be installed on the fixed aluminium structures anchored to the ground through poles which will be screwed or piled into the ground. Once the site has been prepared, prior to the installation of the PV components, the following construction activities will take place:

- The installation of fixed aluminium structures to support the PV modules;
- The construction of the new ‘loop-in loop-out’ grid connection substation;
- The construction of electrical and control room;
- The construction of site office and storage facilities, including security and washroom facilities;
- The construction of array enclosures and inverter/transformer foundations and housing; and

- The installation of cables.

Planting of trees to serve as a fire buffer zone as well as greening of the site for aesthetic purposes shall be made part of the design specifications. Green grass shall also be grown on black soil (of appropriate thickness) as part of the landscaping required for the project. The Contractor shall water and care for the grass until it has taken firm roots and fully covered the landscaping area before handing over to the Client.

### **3.5.4.2. Sub-transmission Line**

With respect to the 34.5kV sub-transmission line, the EPC Contractor is likely to start at one end of the line and work through to the other end. A conventional survey of route was done in May 2014 and the survey and profile already prepared by VRA for the 34.5kV sub-transmission line will be made available to the EPC Contractor. The Contractor is required to:

- Check the line profiles that will be provided by VRA and make any amendment, additional survey and updating that might be necessary for the construction of the lines in keeping with the best engineering practice.
- Check the ground elevation at the pole location and at the points of minimum clearance of conductors to ground.
- Check all the pole-to-pole distances.
- Update the line profile and strip route map up to the date of take-over of the line by VRA.
- Be responsible of the observance of all specified clearances and of pole capabilities.

As indicated, there is no associated right of way with the 34.5kV transmission line. Access to the construction site shall mostly be on existing public roads and road networks. Tower corridor access tracks sufficient width for construction and subsequent maintenance traffic, will be constructed where relevant. The clearance of the line route will be undertaken by hand clearance. No chemicals will be used. All vegetation cleared will be left and no soils will be left exposed. Crop owners will be given the opportunity to harvest annuals where possible and take away perennials before the line route is cleared.

Self-supporting lattice steel towers are to be utilised on this project. In addition, special tower arrangements shall be provided for auto recloser support and for Tee-off of lateral lines. The Steel

towers, which are manufactured abroad, are to be shipped to the Tema port from where its components will be transported by lorry to the lay down areas where project office sites are expected to be created. Tower spotting is the determination of the individual sites for the installation of the towers and this takes place over the whole length of the transmission line. Activities that go along with tower spotting will include final survey and soil investigation. These activities necessitate intrusive access and some clearing of vegetation, leading to possible destruction of crops. Studies shall be done to determine the geology of the project area which is important to identify the tower sites. The specific sites (spots) for locating the individual towers will be finally determined based on various criteria including baseline information gathered during the ESIA Study.

Geotechnical survey and tower spotting are therefore activities that shall be carried out after the issuance of an Environmental Permit and availability of funds to identify the optimum foundation design for each tower. The soil resistance values given shall help identify confirm that the types of foundations proposed suit the various ground conditions. Generally, wherever possible the towers will be located at or near the summits of the uplands to maximize the clearance between the lines and the ground.

Anti-climbing guards would be fitted and maintained at an early stage of erection. Construction time for installation at each site will be short and will be erected using a crane. Depending on the characteristics of the soil at the selected tower spot, a foundation depth of 1.8 - 2.0 meters will be used. Once foundations have achieved their design strength, the next major task shall involve the assembly and erection of the structure. The average span between towers will be about 90m depending on the characteristics of the terrain. Anti-climbing guards shall consist of galvanized steel barbed wire having barbs at least 15 mm long and having a maximum spacing of 35 mm. In all other respects the barbed wire shall comply with BS 4102, or such other standard as may be approved. The barbed wire shall be stapled to each tower at approved positions.

The next stage of the process will be to install onto the tower structures the necessary insulators to support the conductors as well as the equipment necessary for running out and stringing the conductors. Once the full sections of towers have been assembled, the lines will be strung. The conductors shall generally comprise an aluminium conductor.

The line has been designed to always keep at least a 7.5m clearance between the cables and the ground. This distance is slightly superior to the norms in effect, so it guarantees an optimum safety. As much as possible, the conductors are to conform to VRA's specification for sub-transmission lines to cater for any future developments in the area. The installation equipment and conductor drums would be delivered to each number of pre-selected stages along the line route to allow for stringing using the winch and brake method. The stringing method to be used by the contractor will be subject to prior approval by VRA. In all cases where stringing will cross power lines, telephone lines, public roads etc., due notification to appropriate authorities will be given and the prescribed minimum clearances observed, indicated in the Road Reservation Management Manual for Coordination (2012).

A pilot wire would initially be installed for each conductor and then used to draw through the conductor under constant tension to ensure that no contact is made with the ground. This would minimise both conductor damages as well as ground damage during installation. Any damage to the conductor during this process (particularly any contact with the ground) will impair the line function.

### **3.5.5. Power Requirements**

The project will consume about 30 kWh mainly for site works, lighting purposes and constructional work, during the constructional period. Power for construction and project activities will be obtained from the existing 34.5 kV power system lines of NEDCo which will be connected by NEDCo on behalf of VRA as well as a 135kV Stand-by generator.

### **3.5.6. Labour Force**

The labour force during the construction and commissioning phases of the power plant and associated components are the responsibility of the contractor. The contractor is likely and will be encouraged by VRA to use local sub-contractors and local people where skills levels permit for civil works, electrical and mechanical works, and transportation of equipment to the site. It is expected that a peak construction work force of approximately 70 local people will be needed during the construction period; this work force will be employed on a temporary basis.

### **3.5.7. Health and Safety**

The contractor is required to prepare and submit a detailed Health and Safety Plan for the construction period prior to the start of construction. This will be reviewed and approved by VRA prior to the start of construction.

### **3.5.8. Site Security**

Site security during construction is the responsibility of the contractor, and will comprise security fencing, gates and a gatehouse. The contractor's recommendations for site security during construction must meet the approval of VRA.

### **3.5.9. Water Requirements**

During the construction phase the primary water use requirement will be for dust control. However, water may also be required to moisture condition the soils for proper compaction at roads and foundations. It is estimated that for dust control and compaction purposes approximately an average of 20,000 litres per day of water will be required. Water will also be required for concrete foundations. Temporary ablution facilities will be required during construction (i.e. portable toilets). Water requirements for the construction phase of the PV power facility will be sourced from local suppliers and is likely to be delivered by water tankers

## **3.6. TESTING & COMMISSIONING**

### **3.6.1. Solar Power Plant Component**

All systems will undergo a full functional and safety test to ensure that they are fit for purpose. The contractor will be responsible for functional testing, commissioning, performance testing and reliability testing of the complete plant. Testing and commissioning will require 24-hour operations.

### **3.6.2. Sub transmission Line Component**

Several tests will be undertaken to ensure that the line performs as per the specifications. Schedules shall be integrated into the program logic. The contractor will be responsible for functional testing and commissioning of the transmission line. This consists of connecting the line to the national grid to transmit power. Final commissioning involves, among others, the testing of the poles to ensure that all steelwork joints are correctly made and are tight, the integrity of the line hardware, the protection system, etc. Connection of electrical plant will be checked and once approved power connections established.

### 3.7. POST CONSTRUCTION DEMOBILISATION

Upon completion of the construction phase all temporary infrastructures, if any, will be removed and the areas rehabilitated. The Contractor shall carefully remove in a manner to prevent damage, all equipment and materials specified or indicated to be salvaged and reused. Salvaged items specified to be reused for other projects shall be stored and protected until reuse. Salvaged items not to be reused further, but to remain the Client’s property, shall be delivered in good condition to the Client at its storage area on-site in accordance with the requirements of the contract agreement documents.

### 3.8. OPERATIONS & MAINTENANCE

#### 3.8.1. Solar Power Plant Component

Solar power plants do not require sophisticated operational and maintenance activities. Operation and maintenance of the system would involve replacement of modules, repair of inverters, and other supporting equipment, which would be expected to occur on a limited basis at certain points during the system's estimated 30-year life cycle. Modules would likely be cleaned twice the first year. After the first year, modules would be cleaned 0-2 times annually depending on their location relative to pollinating trees and based on the results from the first year. Routine maintenance would also include periodic mowing of the ground cover to discourage invasive species and maintain vegetation heights. Faulty components will be replaced as soon as problems are identified.

Monitoring of the plant is foreseen to be executed on a weekly basis, as well as the cleaning of metrological sensors. Cleaning of modules, which can be done by auxiliary workers, and checking of cables etc., where a technician is needed, should happen twice a year. An overview of a suggested preventive maintenance schedule is provided in Table 3-3.

Table 3-3: Overview on Suggested Preventive Maintenance Procedures

Item	Interval	Required Time	Workforce	Equipment
Cleaning of Modules	6 months	2 days	2 unskilled workers	Filtered water, cleaning brush, rubber lip, Transportation carriage
Maintenance of Inverter (depends on manufacturer instructions)	1 year	1 day	2 engineers	Electrician tools
Maintenance of Mounting Structure (visual inspection)	6 months	2 days	2 unskilled workers	Camera
Checking of Surge Arresters, Cables and PV Junction Boxes	6 months	2 days	1 technician	Electrician tools

<b>Item</b>	<b>Interval</b>	<b>Required Time</b>	<b>Workforce</b>	<b>Equipment</b>
(visual inspection, test of cable fit, cleanliness of equipment, check on no intruded water)				
Monitoring	weekly	4 days at implementation 0.5 days during operation	1 engineer	Service car, Camera
Metrological Sensor	weekly	1 hour	1 technician	Filtered water, Cleaning brush
Landscape and auxiliaries (fence, roads, vegetation, cleaning of all housings)	6 months	1 day	2 unskilled workers (for vegetation: 1 shepherd, if necessary)	For vegetation: lawn mower, For housings: broom, vacuum cleaner

**3.8.2. Sub Transmission Line Component**

After commissioning, ownership of the sub-transmission system will pass to VRA, and subsequently to NEDCo. The operation and maintenance of the sub-transmission line will be based on their existing corporate policy. The main activities to be carried out during the operating life of the transmission line include surveillance of the condition of the transmission line and wayleave, routing and emergency maintenance and repairs, and vegetation control. Growth of vegetation will be controlled to ensure safe and reliable operation of the line; vegetation/economic trees above 4m in height will be cut down, as compensation payment for such trees have been made. VRA will be responsible for controlling future land uses close to the transmission line.

**3.8.3. Labour Force**

VRA staff will operate and maintain the plant once it has been commissioned. It is estimated that 10 permanent operating staff will be required. The staff shall be responsible for managing the operations of the solar power plant using international guidelines and best practice options for such operations. Strict documented procedures shall be put in place for the various technical operations. VRA will adhere to all existing Safety Codes & Guidelines for the operation and maintenance of power plants.

**3.8.4. Health and safety**

VRA Corporate Health and Safety procedures and related polices will be in place and enforced for operation and maintenance.

### **3.8.5. Security & Fencing**

The site for the solar power plant will be fully secure with barbed wire fencing and will have one principal entry/exit with a guardhouse. The construction of a wall fence of at least 2.50m height around the power plant is required for power plant's equipment protection, as also for avoiding any accident by external causes. Installing an open field PV Plant raises at the same time the request for security against theft. Hence, security systems have become state of the art in free-field PV Plants.

Generally, security systems are recommended to be equipped with periodically maintained backup battery banks, which are regarded as market standard. In other cases, an automatic message is sent to the operator in case of disruption and / or interruption of the grid. A system based on Sensor Post with Barbed Wire System and CCTV is recommended. The final requirements are to be clarified with the insurance provider. A security guard shall be onsite 24/7. This person may perform as well small jobs on site and check error signals.

### **3.8.6. Water Requirements**

Just like at the Navrongo Solar Power Plant Project, this project site shall be equipped with a borehole, drainage system and sink/tap water. The access above these installations shall be denied of any vehicle. For good quality of the groundwater, the water will be filtered to enable it to be good enough for drinking and cleaning the PV modules. For cleaning purpose, one must observe instructions from the module manufacturer's manual and verify if not further measures such as softeners are required. An underground piping system will be installed in the PV arrays with taps facilitating the provision of water for cleaning in the PV rows.

During the operational phase it is estimated that PV panel cleaning will require a total of approximately 100,000 litres/year. The PV panels will be cleaned manually with a window washer type device (covered with a specialized cloth material), soft brush, window squeegee or soft cloth. A borehole will be drilled on site to provide water for operational and domestic use.

### **3.8.7. Fire Fighting Equipment**

In accordance with the principle of "prevention first, combination of prevention and fire-fighting", the appropriate fire-fighting equipment shall be adopted. A potable fire extinguisher shall be adopted as the fire-fighting equipment and this shall include the required number of Carbon dioxide fire



extinguishers and Dry powder fire extinguishers. Moreover, the fire-fighting shovel, the sand box and other fire-fighting facilities shall all be provided. Additionally, the organisational issues that will be addressed will include an interface with the regional fire brigade, training of fire fighters and on-site staff to take correct actions in case of a fire.

### **3.8.8. Sewage System**

Sewage will go to a septic tank. The waste from the septic tank will be disposed of in an environmentally acceptable manner by a licensed contractor approved by VRA. The procedures for the disposal of this waste will be contained in the operational site environmental management plan and will also be the requirement of any contract signed between VRA and a licensed contractor.

### **3.8.9. Waste Disposal**

A waste management procedure shall be implemented which, ideally, would go in line with current VRA Health Safety & Environmental regulations. The containers for the different wastes shall be placed closed to the main gate to ease the carry-off by the disposal service provider.

### **3.8.10. Parking Area**

A designated part of the internal road system shall be reserved for parking of maintenance vehicles.

## **3.9. CONCEPTUAL DECOMMISSIONING & CLOSURE PLAN**

The life expectancy of the PV power facility is about 20-30 years. The sub-transmission system facilities are also designed to a life expectancy of 25 years. It is anticipated that these facilities are expected to be continuously maintained and repaired and will be operated for several decades. Alternatively, the facility will be upgraded. The facilities may be upgraded and/or renewed based on cost/benefit analysis and new technologies. Because of its long-life span, the circumstances under which these facilities might be ultimately decommissioned are difficult to foresee. There is therefore no decommissioning proposal for the facilities itself at this stage of the project.

The decision on whether to decommission or upgrade will depend on the development of the system. However, a Decommissioning and Site Closure Plan (DCP) is required to guard against the remote possibility that the project ceases to operate and the facilities are abandoned by VRA. Should such a circumstance arise, the potential would exist for impacts from abandonment of the PV plants and or

sub-transmission line components such as generation of waste, loss of employment and aesthetic impacts.

The decommissioning processes would be undertaken in accordance with environmental laws and standards in place at the time of decommissioning. Prior to any decommissioning of the PV Project, the Ghana EPA will be notified, and an assessment will be carried out to identify any potential environmental impacts that need to be addressed and mitigated in the decommissioning process. A report describing the performance of the final DCP in working towards its objectives, based on monitoring results, and the extent to which it has been complied with, will be submitted to the EPA. The report will be provided to documented stakeholders and will otherwise be publicly available on request. Files and documents used to collate information regarding closure commitments, licences, approvals and other information concerning closure will be catalogued and maintained in accordance with standard practices.

At the end of the decommissioning exercise, the EPA will be invited to carry out a post-decommissioning assessment to establish compliance with all regulatory requirements and issue a certificate to that effect. To provide such financial assurance before the end of the useful life of the equipment, VRA agrees to deliver to relevant agencies prior to the decommission and closure phase, a financial instrument with an aggregate initial face amount equal to the decommissioning cost estimate prepared and certified by a professional engineer in accordance with national and respective local laws.

### **3.10. FINANCING DETAILS**

The VRA is expected to provide funding for the project. The total budget for the 40MWp plant is expected to be around USD 53 Million. As there is no broad experience in the region available, the estimation of the investment and operation costs is based on the experience in PV projects around the world in markets such as Europe and Middle East as well as the recent tender price schedules provided for the Navrongo PV Project.

### **3.11. PROJECT SCHEDULE**

VRA is the responsible organization of the project's implementation. Preparations of project concept design, project specification and final design documentations are on-going. This includes, but not

limited to the acquisition of the Environmental Permit. Procurement of EPC Contractor is to be done when all permitting requirements have been collected. Bidding process using the Public Procurement Agency guidelines for the EPC Contractor is expected to be completed by close of 2018. Subject to obtaining the necessary consents, project construction shall commence in 2019 and is targeted to take approximately 12 months to complete for commissioning (See Table 3-4).

All preconstruction activities will be completed before the actual construction works begin. The Project Schedules supplied by the Contractor shall be used by VRA to monitor the overall progress of the Work. The project schedules shall fully integrate design, procurement, manufacture, erection and commissioning activities. Key events shall be clearly identified on all project schedules and will be integrated into the program logic. The programme for the sub-transmission line works is critical to the optimum timing for the project and it will be essential to have this infrastructure in place prior to completion and commissioning of the substation.

### **3.12. FUTURE UPGRADES**

While no specific upgrades to the solar arrays or project footprint are planned at this time, it would be reasonable to expect that future technological improvements may warrant changing some or all PV panels to achieve improved efficiency. It is also conceivable that future upgrades, employing similar updated technologies, could be proposed to expand the arrays beyond their current proposed footprint. Any future upgrades would be reviewed through established EPA procedure.

Table 3-4: Project Schedule

No	Activity	2018		2019				2020				2021			
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Completion of Acquisition of Land	■													
2	Completion of Feasibility, Environmental and Social Impact Assessment and Geotechnical Studies	■													
3	Acquisition of Energy Commission Siting Permit	■													
4	Acquisition of ESIA Permit		■												
5	Financial Closure with Investors		■												
6	Acquisition of Energy Commission Construction Permit		■	■	■										
7	Selection of EPC Contractor			■	■										
8	Contract Signed				■										
9	Issue of Performance Security				■										
10	EPC Commencement date					■									
11	Design and Drawing					■									
12	Construction Preparation					■									
13	Plant Equipment purchasing and delivery					■									
14	PV Plant Construction (Mounting Structure, Modules, Inverter, Cabling)						■	■	■	■					
15	Substation Transmission line					■	■	■	■						
16	Pre-commission test									■					
17	Trial period									■	■				
18	Commissioning										■	■	■		
19	Performance Test										■	■	■		
20	Taking-Over Certificate													■	■

### 3.13. ASSESSMENT OF ALTERNATIVES

A description of the proposed development has been described. However, prior to the selection of the various components of the proposed development, various alternatives must be considered both in terms of equipment and the feasibility of the project itself during the project planning stage. The Ghanaian EIA Regulations LI 1652 of 1999 require the provision of an outline of the main alternatives considered and the main reasons for the preferred choice. The alternatives to be considered in this study are as follows:

1. 'No Action' Alternative
2. Alternatives for the Generation of Electricity from a Non-Renewable Resource
3. Site Location Alternatives (Candidate Areas / Sites)
4. PV Technology Alternatives
5. PV Module Technology Selection
6. Sub-Transmission Line Type
7. Selection of Optimal Transmission Line Route

This will be expanded based on review comments on this Scoping Report from the Ghana EPA. Following this, a full description of the process followed to select the proposed preferred activity, considering environmental, social and economic variables will be provided in the Main ESIA Report. This analysis will aim at comparing, based on a set of previously established criteria, the best feasible alternatives to identify the one causing the least impact and allowing to determine the optimal option for the project location.

## CHAPTER 4 : BASELINE ENVIRONMENTAL CONDITIONS OF THE STUDY AREA

### 4.1. INTRODUCTION

The activities associated with the project could result in beneficial and adverse environmental impact on the immediate and surrounding environments. It is therefore necessary to understand the nature of the existing environment before undertaking the proposed project. This calls for the need to characterize the existing baseline environmental position. The general method being used in this environmental assessment involves an extensive review of baseline environmental data for the project area. Two major approaches are adopted in carrying out the baseline characterization.

- a) A thorough evaluation of all previous information during the literature review. This includes primary and secondary data, published or unpublished information as well as local knowledge based on discussions with the locals.
- b) Embarking on field baseline studies to collect data to be used as a reference point against which impacts could be measured.

The baseline condition was looked at from two perspectives; the environmental and the social baseline. The methodologies used to arrive at each of them were however different. Although a more comprehensive study will be conducted at the project site prior to the ESIA report, it is possible to give a brief description of the existing baseline based on preliminary visits to the project site. This section presents the prevailing environmental and social conditions in the project area.

### 4.2. INFORMATION SOURCES

The Study Team undertook an initial review of websites, publications and other sources of information that contribute to an understanding of the environmental and socioeconomic context of the project. The information was obtained to establish the existing environmental, social and health conditions and legislative requirements pertaining to the project area and its surrounds and to highlight receptors sensitive to potential impacts. Most of the data on plant species, fauna, soils, water, geology, etc. were confirmed from interviews and existing documentations for the project area.

The documentations assessed so far includes the following:

- 2010-13 Medium Term Development Plan for the Bongo District Assembly.
- 2014-17 Medium Term Development Plan for the Bongo District Assembly.

- 2010 Population & Housing Census, District Analytical Report, Bongo District Assembly, October 2014.
- Bongo District Water & Sanitation Plan, August 2008.
- Bongo Solar Power Project - Draft Feasibility Study, August 2017
- School Report Card, Ghana Education Service, Bongo District, 2016
- Report on Acquisition of Site, Bongo Power Project, June 2014
- Bongo Solar Power Project, Valuation Report on Economic Trees, May 2016

Various ESIA Reports for similar projects in Ghana, e.g. 2.5MW Navrongo Solar Power Project, 12MW Upper West Regional Solar Power Project, and elsewhere were also reviewed. These information sources will be reviewed in detail by the ESIA team and information will be extracted to form the basis of the baseline of the Main ESIA Report.

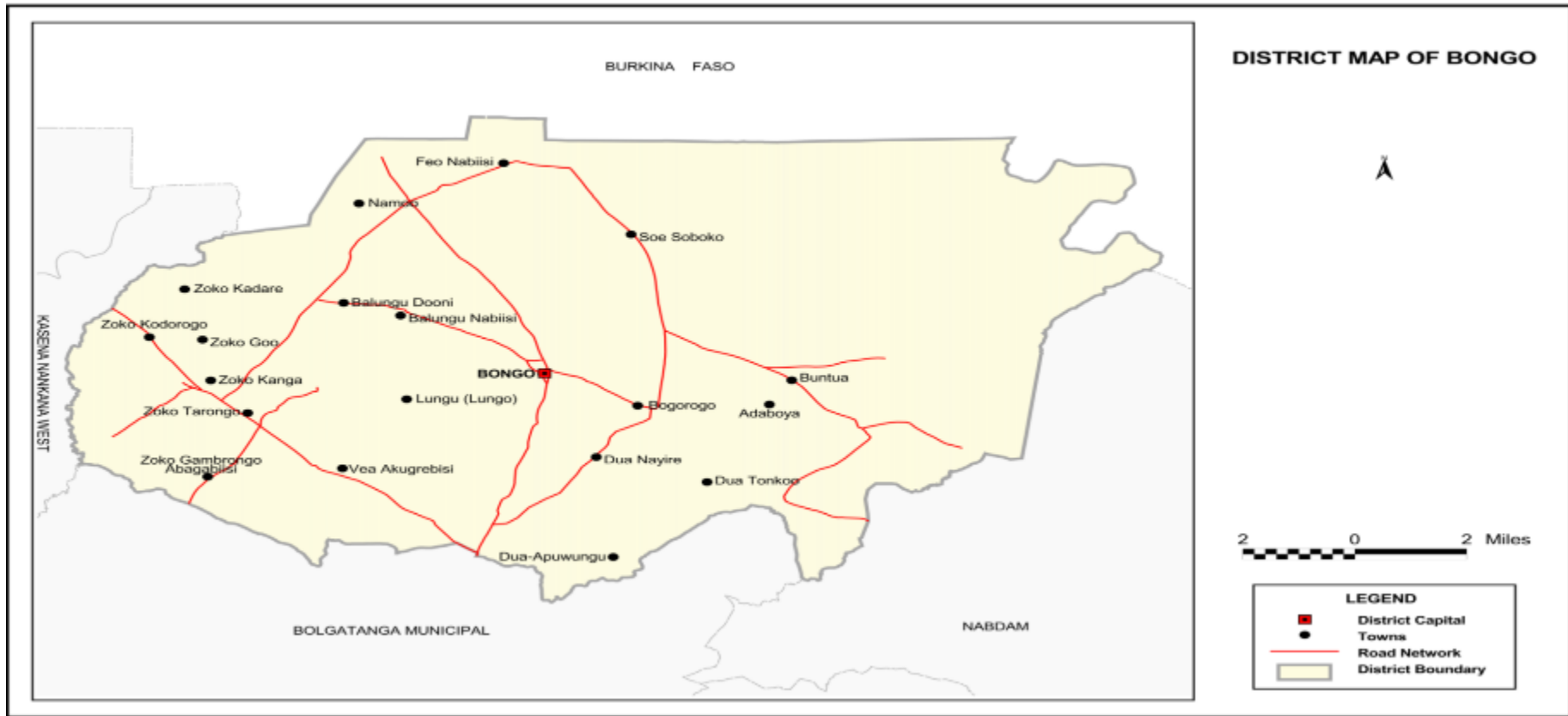
### **4.3. PHYSICAL ENVIRONMENT**

#### **4.3.1. *Geographical Location***

As indicated, the PV project and about 23km of the associated sub transmission is located within the Bongo District whilst about 6 km of the sub-transmission line will also run to the existing 161KV Bolgatanga Substation within the Bolgatanga Municipality, all in the Upper East Region of Ghana. The Bongo District lies between longitudes 0.45°W and latitude 10.50°N to 11.09°N and has a total area of 459.5 square kilometres. The District shares boundaries with Burkina Faso to the North, Kassena-Nankana East to the West, Bolgatanga Municipal to the South West and Nabdum District to South East (see

Figure 4-1). The District is made up of thirty-six (36) communities and has seven (7) Area Councils. The Upper East Region is in the north-eastern corner of Ghana between Longitude 0° and 1° West and Latitudes 10° 30' to 11° North. It has two international boundaries; namely Burkina Faso to the north and the Republic of Togo to the East.

Figure 4-1: Geographical Location of Bongo District in Ghana



Source: 2014-17 Medium Term Development Plan – Bongo District



### 4.3.2. *Climate*

The project area lies in the Tropical Continental or Interior Savannah climatic region of Ghana. This climatic region is semi-arid and characterised by a single rainy season from March to October each year, followed by a prolonged dry season. The district has an average of some 70- rain days in a year with rainfall ranging between 600mm and 1400mm (2010 PHC District Analytical Report). The rains fall heavily within short periods of time, flooding the fields and eroding soils into rivers. However, the fields dry up soon after the rainy season. Relative humidity figures are usually high in the rainy season, which spans from July to September (92%) and low in the dry harmattan period from December to March (15%).

Mean monthly temperature is about 21°C. Very high temperatures of up to 40°C occur just before the onset of the single rainy season in June. Low temperature of 12°C are experienced in December when desiccating winds from the Sahara dry up the vegetation. During the dry season, ideal conditions are created for bush fires, which have become an annual phenomenon of the environment. A ten (10) year climatic data obtained from the nearest national synoptic weather station at Navrongo (Weather station: 654010 {DGLN}) will be provided in the Main ESIA Report for climatological analyses, to provide a clearer picture of the climatic conditions in the project area. This weather station is very representative of the Bongo District, within which the proposed project will be located.

### 4.3.3. *Topography*

Generally, from literature, it is noted that the topography of the area is generally flat and low lying with outcrops of granite and Birimian rocks, which are mainly phyllites quartz-serrate schist and grey wacke. Granite rocks lie under the entire Bongo District. These granite rocks are coloured pink, coarse grained and potassium rich. Areas occupied by granites are generally of low, gently rolling relief 90–300 meters above sea level. Exceptions to these are inselbergs near Bongo (1,086ft), which abruptly rise to heights of 92–122m above the surrounding lands. The granite has a rectangular joining and weathers into large upstanding masses and blocky-perched boulders. Hornblende and a little biotite are some of the constituent primary minerals in the district.

From the field survey, the topography of the proposed project site itself is largely flat with sheet and gully erosion observed at the southern end of the site as shown in



Plate 4-1. These deep gullies are caused by running storm water from the many hills in the area and must be a subject of consideration in the development of the site. The Bongo hill rises several hundreds of meters above the surrounding land with steep and craggy sides. Because of inadequate vegetation cover, flooding and erosion are severe with the occurrence of sheet and gully erosions. This has been noted to have negative effects on agricultural production. This is because the fertile soils are usually carried away by the erosion thus leaving the land bare and rendering it not suitable for crop production. This exacerbates the power and food insecurity situations in the District.



Plate 4-1: Deep gully erosion observed close to project site (Source: Field Survey Nov. 2017)

#### 4.3.4. Water Resources

The nearest water body to the project site is the Vea Dam and the Red Volta as shown in the Figure 4-2. The Red Volta is about 10km north East of the project site. The District is drained by the Red Volta and its tributaries including *Ayedama* and *Kulumasa*. These areas are drained by the Red Volta River and endemic to the River Blindness disease, which in recent times has been controlled, thereby enabling farmers to cultivate crops in these basins. There are other small dams and dugouts located in Bongo, Zorko, Balungu, Adaboya, Akulmasa, Namoo and Soe-Yidongo. These rivers outflow their

banks in the main rainy season (April–October) and dry up soon after the season leaving disconnected pools of water in their beds, separated by dry stretches of sand and rock. During the rainy season, the streams and rivers are liable to sudden fluctuations in water level, suggesting that there is considerable surface run-off within their catchments during heavy rainfall.

Figure 4-2: Water Resources Within Project Site



Source: Project Management Team (March 2018)

### 4.3.5. *Geology and Soil Characteristics*

Granite rocks lie under the entire Bongo District. They have well-developed fractures and the granite rocks obtrude all over the landscape. These granite rocks are coloured pink, coarse grained and potassium rich. Hornblende and a little biotite are some of the constituent primary minerals in the district. The parent materials of the soils have been known to be very productive due to the high potash and phosphate content. Human population densities are high in the district and owing to long periods of intensive farming accompanied by mismanagement of the land, soil exhaustion and erosion are prevalent.

The soils are those derived from granites, sandstones and greenstones. Generally, the Bongo soils consist of about 3 inches of very slightly human stained, crumbly coarse sandy loam overlying reddish brown, fine blocky, very coarse sandy loam containing occasional incompletely weathered feldspar particles. It grades below into red, mottled pink and yellow coarse sandy clay loam of partially decomposed granite. The soils are well drained, friable and porous and possess good filth. Consequently, they have good water capacity.

They are inherently fertile but for the most part farmed continuously so that they are lacking in organic matter nitrogen. This has affected crop yield in the district. The soils are rich in phosphate and support crops like millet, sorghum, rice, maize, groundnut, cowpea, bambara beans and vegetables. However, the pressure of population and farming activities on the land have rendered the carrying capacity of the soil very low resulting into low soil fertility, low water holding capacity and susceptible to sheet erosion during the rainy season, and this has adversely affected crop yield in the district.

### 4.3.6. *Land Use*

The soils of the district exert great influence on the pattern of land-use. Land is basically allocated for farming, grazing, forest reserves, settlements, road network, dams and dug-outs. Compound subsistence farming is the pattern of farming in the area. Land use at the site was identified as being mainly for farming purposes and animal husbandry. Indeed, during the field survey, groundnuts was being harvested (See Plate 4-2) and mounds of yam were observed. The harvesting was being done mainly by women. Economic trees such as dawadawa and baobab are also common. Livestock like cattle, goats and sheep were abundant in the area.



*Plate 4-2: Harvesting of groundnuts at Project Site (Source: Field Survey Nov. 2017)*

There are no residential buildings within the site. The immediate neighbourhood of the project site at Asigba is not covered by any layout, however information from the Customary Lands Secretariat indicate that the surroundings areas have been planned. Lands lying between the Bongo Township and the project area, in which the sub-transmission component also will be physically located, have been reserved for future development. Most of the developments within the project enclave are traditional mud houses designed for occupation by households. They are roofed with either thatch or zinc sheets (See Plate 4-3).



*Plate 4-3: Typical Round Huts within the Project Enclave*

#### **4.3.7. Ambient Noise**

Surveys of baseline day- and night-time noise levels were carried out within the environs of the project site at Asegba where noise was likely to be an impact during the constructional and operational phases

of the project cycle. The results of this baseline data on noise levels will be provided in the Main EIA Report.

#### **4.3.8. Air Quality**

For this ESIA, measurement of suspended particulate matter concentrations on the project site are being established for monitoring purposes. The Casella AMS 950 Air Monitoring System is being used for the monitoring of Particulate Matter Concentrations (PM10). Static sampling methods are being employed for this exercise, since the standards/guideline limits are founded upon static sampling. All measurements are being taken downwind of the suspected sources of generation of the dusts. The results of this baseline data on air quality levels will be provided in the Main ESIA Report.

#### **4.3.9. Greenhouse Gases**

Ghana is a party to the United Nations Framework Convention on Climate Change (UNFCCC) and a climate sensitive economy. As a party to the Convention, Ghana has an obligation under Article 4, paragraph 1, and Article 12, paragraph 1 of the Convention to regularly prepare, publish and report its national communication to the Conference of Parties (COP) to the UNFCCC.

In 2000 and 2011, the country submitted its first and second national communications respectively to the Conference of Parties (COP) to the UNFCCC. Ghana in 2015 submitted the Third National Communication (TNC) in compliance with Ghana's obligations under the Convention. The main objective of the TNC was to prepare, update and communicate to the COP, policies and measures Ghana has taken and envisaged to implement the convention in the country and at the regional level. Information outlined under this section has largely been obtained from this report.

Ghana's total GHG emissions stood at 33.66 million tons (Mt) CO<sub>2</sub>-equivalent (CO<sub>2</sub>e) in 2012. When the emissions from Agriculture, Forestry and Other Land Use (AFOLU) sector were excluded, the total emissions came to 18.49MtCO<sub>2</sub>e for the same year. However, in the 2011, which is the official latest reporting year to UNFCCC, Ghana's total GHG emissions, excluding the AFOLU sector, was estimated to be 16.51MtCO<sub>2</sub>e. The 2011 emissions were 7.9 MtCO<sub>2</sub>e higher than 2000 levels and 10.9 MtCO<sub>2</sub>e above total emissions recorded in 1990 (see Table 4-1). When the emissions from AFOLU were added, Ghana's total emissions, the net emissions came to 30.60 MtCO<sub>2</sub>e for 2011. Similarly, the total emissions grew by 14.28 MtCO<sub>2</sub>e over 2000 levels and 16.38MtCO<sub>2</sub>e over emissions recorded 1990.

Table 4-1: Ghana’s net greenhouse gas emissions by sectors under the UNFCCC

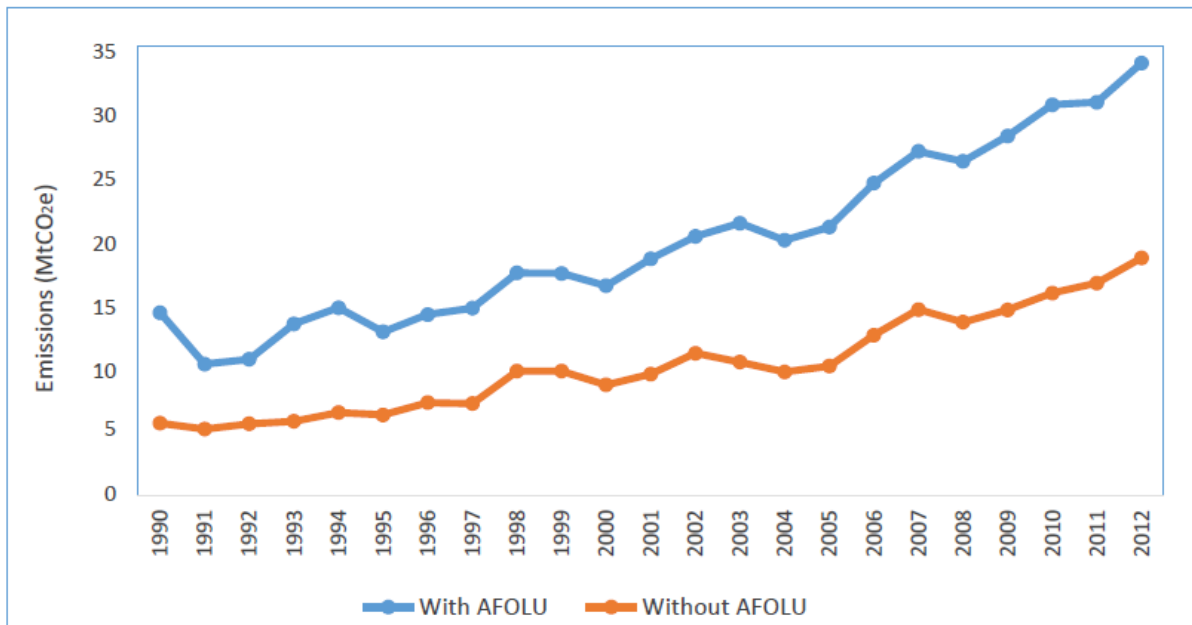
Sectors & Sub-sectors	Emissions MtCO <sub>2e</sub>					Percent Change		
	1990	2000	2010	2011	2012	1990-2012	2000-2012	2010-2012
1. All Energy (combustion & fugitive)	3.50	5.54	11.27	11.63	13.51	286.08	143.65	19.79
(1.A1,A2&A5) Stationery energy combustion	2.03	2.73	6.48	6.22	7.05	247.28	158.10	0.09
(1.A5)Transport	1.47	2.81	4.80	5.41	6.46	339.66	129.85	34.67
(1.B) Fugitive emission	0.000	0.003	0.001	0.001	0.002	284.71	-51.74	139.35
2. Industrial Process & Product Use	0.81	0.77	0.24	0.44	0.47	-42.47	-39.56	94.24
3. AFOLU	8.61	7.72	14.67	14.08	15.17	76.28	96.65	3.46
3A Livestock	1.72	2.20	2.82	2.80	3.05	77.29	38.66	8.01
3B Land	-3.02	-4.00	1.85	1.31	1.84	-160.73	-145.86	-0.96
3C. Aggregated and Non-CO <sub>2</sub> emissions	9.91	9.52	9.99	9.98	10.29	3.83	8.08	3.00
4. Waste	1.31	2.29	4.24	4.45	4.52	245.97	97.03	6.54
Total emissions (excluding AFOLU)	5.61	8.61	15.75	16.51	18.49	229.31	114.81	17.36
Total net emissions (including AFOLU)	14.22	16.32	30.42	30.60	33.66	136.69	106.22	10.66

Source: Ghana’s Third National Communication Report to the UNFCCC, 2015

The observed general increases in the emission trends corresponded to the on-going structural transformation, which has led to sustained growth and expansion of the national economy. The economic transformation programme has resulted in notable rise in emissions from road transport, electricity generation crude-fired thermal plants, biomass burning in forest, cropland and grassland. Additionally, emissions due to land use changes also recorded significant increases between 1990 and 2010 mainly due to deforestation. However, because of the implementation of government’s national reforestation programme, emissions from “Land” have seen some decreases between 2010 and 2012 (see Figure 4-3).



Figure 4-3: Trend of Ghana’s total net emissions from 1990-2012 with and without AFOLU



Source: Ghana’s Third National Communication Report to the UNFCCC, 2015

#### 4.4. BIOLOGICAL ENVIRONMENT

##### 4.4.1. Vegetation

The vegetation in the district is mainly of Sahel Savannah type consisting of short drought and fire resistant deciduous trees interspersed with open savannah grassland. Grass is very sparse, and, in most areas, the land is bare and severely eroded. The vegetation of the area exhibit changes during the different seasons of the year. In the wet season, the vegetation is green, and trees and grasses shoot up and blossom. Soon after the rains the leaves change colour from green to yellow and brown as trees shed their leaves. The area begins to look parched and very dry. Very little of the vegetation exists in its original form owing to population pressure, annual and periodic bush fires, and loss of soil fertility.

Typical species are the locust (*Parkia biglobosa*), the shea (*Vitellaria paradoxa*), the mahogany (*Khaya senegalensis*), the silk-cotton (*Ceiba pentandra*) and the Baobabs (*Adansonia digitata*). Of introduced trees, the neem, *Azadirachta indica*, and the mango, *Mangifera indica*, are common in villages and increasingly common as escapes in uncultivated areas.

The composition of grassland in the Bongo District varies according to soil type, location and conditions of burning and grazing. Large areas of exposed land carry only a thin cover of *Heteropogon contortus*. *Imperata Cylindrical* and *Pennisetum Polystchyon* occur on arable soils. The latter is valued highly as a fodder grass and transportation of this by donkey carts was a common site near the project

enclave. On the vast of the degraded land, the common grasses include *Dactyloctenium aegyptium*, *chloris spp* and *Aristida kerstins* and this is evident within the project site.

### 4.4.2. *Fauna*

The fauna of the project area has been extensively affected by alteration and fragmentation of habitat resulting from especially fire, human settlements, and agricultural activities. A faunal survey carried out showed insects such as grasshopper and butterflies as common to the area. Birds such as Vulture, Cattle Egret, Harrier Hawk were common. Reptiles identified included the agama lizard and snakes, and according to the locals, and these are mostly rattle snakes, python, cobras, Gabon Viper and the green mamba. From discussions with the locals, elephants from nearby Burkina Faso, can be found in the project area. In addition, rabbits, squirrels, bush guinea fowls, monkeys are animals that are commonly hunted by the locals.

Faunal species play very important and sometimes critical roles in food chains and by implication in the ecosystems in which they live. The presence or absence of some species may act as key ecological indicators. They may also be sources of food for the local human populations. Because of their roles in food chains, any anthropological activities that may impact negatively on them directly or their habitats may pose problems for the survival of other species in other trophic levels. Therefore, all human developments within their habitats should be carried out with due consideration for environmental concerns.

### 4.4.3. *Environmentally Sensitive Areas*

There is the Red Volta Forest Reserve which supports wildlife namely baboons, monkeys, rats, mice, grass cutters, rabbits, dwarfs, buffalos, antelopes and guinea fowls. this forest has been depleted due to the activities of fuel wood dealers and some farmers. However, this Forest Reserve is located about 7 km north of the project site and will not be directly affected by project development.

## 4.5. SOCIO-ECONOMIC & CULTURAL ENVIRONMENT

### 4.5.1. *Overview*

The revised structure for Ghana ESIA Reports requires the discussion of the following issues as part of the socio-cultural baseline information and these have been examined in this Report:

- The land area taken up by the development, its location clearly shown on a map and geographical coordinates provided.
- Human beings: (population composition and distribution, socio-economic conditions, cultural and ethnic diversity, population growth rate);

- Land use: (agriculture, forests, industrial, commercial, residential), transportation routes such as roads, rail, water and air, utility corridors)
- Social services: (electricity, telecommunication, water supply, hospitals, etc);
- Cultural heritage: (unique features of the area or its people; cemetery, fetish grove, festivals etc).

This section presents a description of the social and economic characteristics of the project area (See Figure 4-4). It is anticipated that the most significant socio-economic impacts will occur within the Bongo District and its environs within the Upper East Region of Ghana. For this reason, the discussion of baseline socio-economic conditions was looked at within the context of this District.

### **4.5.2. Land Requirements**

As indicated, a land area of 0.5013 km<sup>2</sup> has been acquired at Asebga, in the Bongo District. It is within this site that the associated substation will be developed. In addition, an associated 29 km sub-transmission line with a 15m Right of Way, is to be developed, and this will occupy a total of 0.435 km<sup>2</sup> area. Thus, a total area of 0.9363 Km<sup>2</sup> would be required for the solar power plant and the associated sub transmission line project.

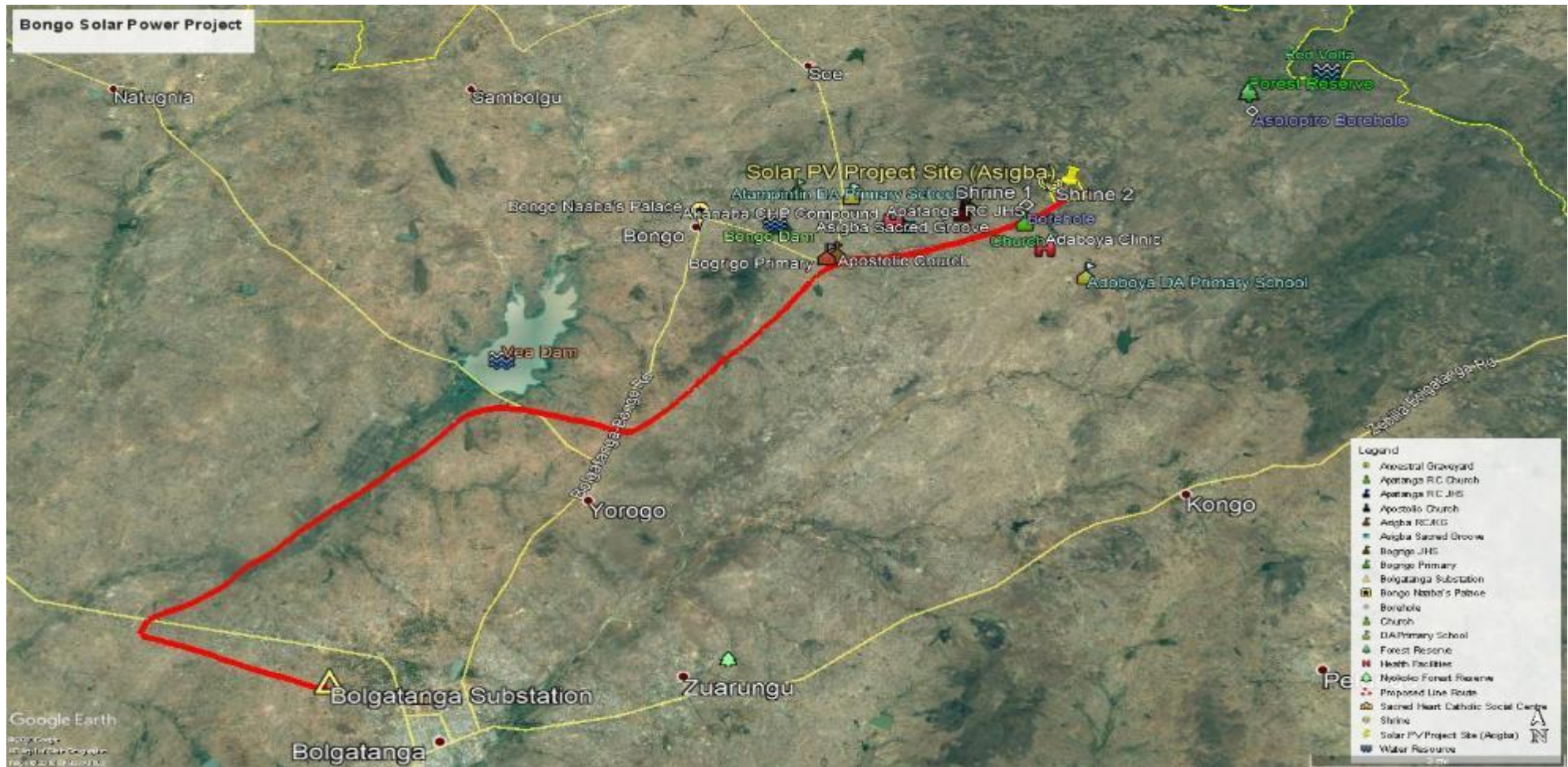
### **4.5.3. Governance Structure**

#### **4.4.3.1. Political Authority**

The Bongo District Assembly was created by a Legislative Instrument (LI 1446) in 1988 with the mission to improve upon the quality of lives of its people through the creation of an enabling environment, harnessing of its resources, proper co-ordination and integration of its activities within the framework of national policies. The district has one constituency, seven (7) Area Councils and fifty-one (51) Unit Committees.

To promote and ensure efficient and effective performance of its functions, in line with its mission, the Assembly is headed by the District Chief Executive (DCE) who is nominated by the president and approved by a two-thirds majority of the Assembly Members present and voting. The Assembly has a total membership of fifty-four (54). Two-thirds of the members are directly elected. The other one-third is appointed by the Central Government. The Member of Parliament is an ex-officio member of the Assembly.

Figure 4-4: Project Site Showing Key Social Features



Source: VRA Project Management Team (March 2018)

#### 4.4.3.2. *Traditional Authority*

The District has one Paramount chief. The traditional authority of the District resides in the paramount chief known as the Bonaba. There are eleven divisional chiefs and thirty-one sub-chiefs who support the Bonaba in the administration of the traditional area. There are also the Tindanas’ who are literally the land owners and are responsible for pacifying the gods in times of adversities. They also make sacrifices on behalf of the chiefs. There are no known chieftaincy disputes currently in the District and the commendation goes to the traditional authorities and the people for the roles they play in ensuring peace in the District.

#### 4.5.4. *Demographic Profile*

##### 4.4.4.1. *Population Size and Distribution*

According to the 2010 Population and Housing Census, the Bongo District has a population of 84,545, representing an increase of 8.6 percent of its population in the 2000 PHC (77,885). In terms of sex distribution, female constitute 52.4 percent of the population (44,461) and male 47.6 percent (40,084). The district is predominantly rural with about 94 percent (79,376) of its population residing in rural settlements. Table 4-2 shows that the district has a relatively young population with about two out of every five persons in the population below 15 years. The aged, that is those 65 years and older, constitute only seven percent of the population. A similar pattern is observed among the male and female and urban and rural populations.

*Table 4-2: Population by age, sex and type of locality*

Age Group	Gender				Type of Locality	
	Both Sexes	Male	Female	Sex Ratio	Urban	Rural
0 - 4	11811	6236	5575	111.9	699	11112
5 - 9	12537	6289	6248	100.7	604	11933
10 - 14	11727	5937	5790	102.5	657	11070
15 - 19	9571	4808	4763	100.9	604	8967
20 - 24	6049	2782	3267	85.2	520	5529
25 - 29	5075	2204	2871	76.8	419	4656
30 - 34	4139	1768	2371	74.6	284	3855
35 - 39	3835	1567	2268	69.1	255	3580
40 - 44	3571	1353	2218	61	245	3326

Age Group	Gender				Type of Locality	
	Both Sexes	Male	Female	Sex Ratio	Urban	Rural
45 - 49	3123	1288	1835	70.2	179	2944
50 - 54	2998	1266	1732	73.1	157	2841
55 - 59	1892	817	1075	76	108	1784
60 - 64	2196	910	1286	70.8	119	2077
65 - 69	1372	619	753	82.2	64	1308
70 - 74	1862	805	1057	76.2	101	1761
75 - 79	1296	635	661	96.1	83	1213
80 - 84	834	424	410	103.4	42	792
85+	657	376	281	133.8	29	628
<b>All Ages</b>	<b>84545</b>	<b>40084</b>	<b>44461</b>	<b>90.2</b>	<b>5169</b>	<b>79376</b>
<b>Age dependency ratio</b>	<b>99.17</b>	<b>113.63</b>	<b>87.71</b>		<b>78.86</b>	<b>100.7</b>

Source: Ghana Statistical Services, 2010 Population and Housing Census

#### 4.4.4.2. Age and sex structure, sex and dependency ratios

The Bongo District has an average sex ratio of 90 males per 100 females. Males dominate the population below 20 years with a ratio ranging from 101 to 112 males to every 100 females. With a sex ratio ranging from between 61 and 96 males per 100 females, the female dominance in the district population is observed among the adult population aged between 20 to 79 years. More males than females are observed among the aged population 80 years and older in the district.

#### 4.4.4.3. Age Dependency Ratio

The Bongo District has a total dependency ratio of 99.2 implying that every 100 persons in the working age group have 99 persons in the dependent ages to support. The urban areas of the district have a relatively lower dependency ratio of 79.

#### 4.5.5. Ethnic & Religious Composition

Historically, the people of Bongo trace their roots to the Mamprugu Kingdom in the Northern Region of Ghana especially those entitled to the royal skin, which has a Paramountcy status. The district is a multi-ethnic, with the Bossis and Gurunsis as major ethnic groups. The Bossis are heirs to the Paramountcy and are enskin by the Nayiri, the overlord of the Mamprugu kingdom. There are also Tindaanas who hail from Zorko, Namoo and other settlements. Two major languages are spoken in

the District; these are Bonni which is spoken by the Bossis and Guruni which is spoken by the Gurunsis.

The Bossis and the Gurunsis constitute about 95.1 percent of the district's population. Besides these two major ethnic groups are other settler ethnic groups like the Kusasi, Nankani, Builsa, Kasena, and Dargaba. The two major ethnic groups co-exist peacefully ostensibly because they have a common ancestry.

There are three major religious groups in the district. These are traditionalists (44.0%), Muslims (7.2%) and Christians (45.1%). Among the Christians, the Catholics are the majority (32.3%), followed by the Pentecostal/Charismatic (6.6%), Protestants (4.6%) and other Christians (1.6 %). Whereas the Christian population in the district experienced an increase over the 2000 figure of 34.2%, that of the traditionalists declined from 53.6% in 2000<sup>9</sup>. There is peaceful co-existence among the various religious grouping and efforts must be made to consolidate the peace.

#### **4.5.6. Archaeological, Heritage & Cultural Structure**

Based on desktop research as well as a field investigation undertaken by the EIA Team in the scoping phase, no archaeological material was found and recorded. However, an old isolated ancestral grave and two shrines, the Yabatua Shrine (Shrine 1) and the King Kalaga Shrine (Shrine 2) are situated on the proposed site as shown in Figure 4-5. This grave according to the locals, were the burial ground of their ancestors prior to the relocation to their new site. The graves will therefore have to be relocated and various traditional rites will be required for the relocation. Also, just within the project site on the eastern side is an area called the Dwarf island, where it is alleged that dwarfs exist. This is currently a prayer ground for Christians who come there to pray in the name of sacking the dwarfs. Also, along the transmission line is the Tindana sacred grove at Aseigba community and various churches, mostly Christian. The Tindana sacred grove serves as a form of forest reserve (See Plate 4-4) for the Aseigba community. The locals indicated that no day has been slated as a taboo day. Details on these community cultural structures (See Plate 4-4, Figure 4-5 and Figure 4-6 ) will be provided in the Main ESIA Report.

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<sup>9</sup> Ghana Statistical Services: 2010 Population and Housing Census, District Analytical Report



*Plate 4-4: Cultural Assets within the Project Site*



Figure 4-5: Shrines and ancestral grave on Proposed Site



Source: Project Management Team (March 2018)

Figure 4-6: Cultural Sites along Project Corridor



Source: Project Management Team (March 2018)

The district has only one major festival known as Azambene which literally means ‘Fire Festival’. The fire festival is also celebrated by the Mampurusi, Dagombas and Moshies. There is intense merry-making as well as drumming and dancing during the festival. There is also traditional pomp and pageantry with both the young and old actively participating.

The district is abound with some negative cultural practices that impede development in the district especially women and children particularly the girl-child. There are bad practices such as dehumanizing widowhood rites that infringe on the rights and freedoms of women. Child betrothal is still practiced in the district as well as early marriages. This has affected children and those who are already in school. The practice also accounts for high drop-out rate especially among the girl-child.

Another practice that affect the development of the girl-child and children in general is the practice of “tanzaba” which literally means “Sister-in-bed,” This is a practice where a young man can flirt with a relative who is a sister and give birth but cannot marry her. This practice has affected a lot of young girls and women in the district. It is noted as the principal cause of teenage pregnancies in the district. The practice is also responsible for some form of streetism in the district since children born out of this relationship are usually left to the care of the unfortunate young girls and women. Another cultural belief which a potential threat to peace in the district is also is alleged witchcraft. People have taken the law into their hands and mete out instant justice to alleged witches by lynching them. This issue also has a gender dimension where most of the alleged victims are women.

#### **4.5.7. Land Management/Land Tenure System**

Though land in the District is communally owned some portions remain under the custody of the Tindanas, the original custodians of the land. Land ownership is vested in the lineage and no one can dispossess a landholder or his family. In general, land is regarded as sacred. Land use rights are patrilineal. In some cases, land allocation may be shared between the Tindana, the religious head, and the community. Women get access to land only through allocations made to them by their husbands. However, this is done after considerations that there would be no shortage of farm land during the farming season when the woman is cropping her own farm. Widows with sons are usually permitted to keep land their husbands possessed and farm it until their sons are old enough to farm. In such case the land passes automatically to the children.

Individuals and families own about 95% of farmlands. Most families depend solely on the land for their livelihood and find it difficult to part with their land. The land holding is very small due to scarcity. Farmers on the average farm a little over 1.9 hectares with plots scattered. Farmlands are found around dwellings of compounds houses with some farms about 500metres to 1km from the

houses. This coupled with inappropriate land management practices have led to low crop yields and other environmental consequences.

#### **4.5.8. Economic Characteristics**

##### **4.4.8.1. Economic Activity Status**

The proportion of the population economically active (75.0%) is three times higher than proportion of the population not economically active (25.0%). Of the total economically active population, 73.0 percent is employed, and 2.1 percent is unemployed.

##### **4.4.8.2. Structure of the Local Economy**

The local economy consists of three major sectors namely agriculture, service and industry. Agriculture is the most dominant sectors employing 72.2 per cent of the population in food crop farming, animal rearing and as fishing. The source of income for many households is sale of foodstuff, small ruminants and poultry. The industrial sector employs 15.5 percent whilst the service sector engages 12.3 percent of the district's population of 15 years and older. Whereas a few women sell provisions, the majority are engaged in shea butter processing, groundnut oil extraction, dawadawa processing, malt making, pito brewing as well as handicraft production. Men on the other hand, are usually engaged in the sale of cattle, small ruminants and poultry. Pictures of selected local economic activities<sup>10</sup> is shown in Plate 4-5.

Sheabutter processing is one area that has engaged the services of most women in the district. It employs close to 75% of women in the district and this includes the pickers and the processors. It is one area that has served as a major source of income for most women and their families. It also has the potential of breaking through the international market and local markets. Guinea fowl rearing is one activity that cuts across the entire district and being done by men and women but dominated by the men. The guinea fowl is reared by almost all small holder farmers with an average house holding of 5-200 birds.

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<sup>10</sup> Source: 2010-2013 MDTP for Bongo District



*Shea nut tree (insert: shea nuts)*

*Inspecting shea nuts*



*Women & men busy weaving baskets*

*Plate 4-5: Pictures of Selected Local Economic Activities*

#### **4.4.8.3. Tourism Potential**

Tourism is undeveloped in the district though a lot of tourist sites abound. These include the following;

- 1) The Vea Irrigation dam
- 2) Beautifully formed rocks such as Aposerga and Azudoo rocks located in Bongo town
- 3) Apasepanga footprint, footprint of an ancient warrior located in Bongo town
- 4) Avea masera crocodile pond
- 5) Beautiful handicraft products such as baskets, hats, and mats which is district-wide
- 6) Leather works and smocks weaving at Sambolgo, Namoo, Feo and other communities in the district.

Among these tourist sites, the Vea Irrigation Dam site is fast becoming a holiday resort for holiday makers especially during festivities like Easter, Christmas and other public holidays.

#### **4.4.8.4. Industry & Occupation**

There are three major industrial activities at the District level: agriculture, including forestry and fishing (72.2%), manufacturing (14.2%) and wholesale and retail; repair of motor vehicles and motorcycles (4.6%). The three combined contribute as much as 91.0 percent of industrial activities in the district. Agriculture is the primary activity in the district for both males and females. But females (18.4%) are into more manufacturing activities than males (8.9%). Manufacturing activities in the District include brewing, shea butter extraction, groundnut processing, weaving, smock making, etc.

Major of people in the District are employed in the agriculture sector, including forestry and fishing works (72.6%). Craft and related trades workers constitute 15.5 percent while services and sales workers constitute 5.3 percent and professionals make up 2.2 percent. The first three together make up 93.4 percent of all occupations in the District. The substantial lack of formal sector office-based bureaucratic activities in the District is reflected in the fact that the proportion of managerial and clerical support workers in the District make up only 1.0 percent of the employed population. This further highlights the rural nature of the District.

#### **4.4.8.5. Agriculture**

Out of a total household of 16,499 households in the District, 15,771 (95.7) are engaged in agricultural activities. This suggests that nearly every household in the District is engaged in agricultural activities. Majority of households are engaged in crop farming accounting for 98.8 percent of household in agriculture and 88.1 percent of the households are engaged in livestock rearing. Tree planting and fish farming have smaller proportions of households that are engaged in them, 0.4 percent and 0.1 percent respectively.

Farming is the major economic activity in the district. It employs a little over 90% of the population and both men and women participate in this activity. Majority of the farmers are subsistence farmers while a few are into medium scale commercial farming. Major crops cultivated in the district are millet, sorghum, groundnuts, rice, soya beans while a few of them grow maize. Farmers who are close to the Vea Irrigation dam and other small dams also grow tomatoes and leafy vegetables. They also do all-year farming at the irrigation site.

The use of cows and donkeys for farming is common in the district and this account for the significant raising of these animals in the district. Majority of farmers still use the hoe and cutlass for farming and practice the slash and burn method. Very few farmers use tractor and other mechanized methods of farming and mostly they complain that it is very expensive to employ the services of tractors and other mechanized modes of farming.

Apart from the monetary gains from fish farming, the fish also provides yet another source of protein to the people and the growing of trees can help to deal with the menace of desertification which seriously threatening the regions in the north. This can turn to affect the crop production as well as livestock rearing which almost all the households in agricultural are engaged in.

According to the 2014-2017 MDTP, crop production in the District has recorded varying trends over since 2010, depending on the type of crop. But, overall, production has not been encouraging. Millet production has been fluctuating from 3,780 Mt in 2010 to 2,434 Mt in 2011 and 3,300 Mt in 2012. Sorghum, groundnuts, rice and cowpea have also recorded similar trends in production. Maize production on the other hand recorded consistent increases from 598 Mt in 2010 to 810 Mt in 1,377 Mt in 2012. Generally, crop production levels in the District have become a real concern to stakeholders. The trend is attributed to the continuous depletion of soil fertility, out-migration of the youth and the changing occupational pattern resulting from an increasing educated class in the District. Unlike crop production, livestock and poultry production in the District has been increasing consistently since 2010. The populations of all the major animals have increased considerably.

#### **4.4.8.6. Mining**

Mining is not done in a large scale in the district. However, it is done on a very small scale in the north eastern corner of the district on river beds and on the banks around Apatanga, Adaboya and surrounding areas, and these are areas close to the project site. It is done mostly by indigenes, but some strangers come along just for very short period. This activity though on a very small-scale basis can cause problems such as pollution of water bodies and degrading farm lands.

#### **4.4.8.7. Inter /Intra Trade**

Trade in the Bongo district is done among citizens of the district within the district and among citizens of neighbouring districts such as Bolgatanga Municipality, Kassena Nankana East and West Districts and Bawku West District. There is also trade among citizens of the district and citizens of neighbouring countries such as Burkina Faso and Togo. There is also inter-regional trade where some traders go to the Ashanti, Brong-Ahafo and Greater Accra regions.

A few people export handicraft products and sheabutter. Most traders in the district trade in foodstuffs, livestock, poultry and vegetables such as tomatoes and leafy vegetables. Some traders deal in provisions and fashion wares. There is currently brisk business between the district and Burkina Faso at a market located in Yelwongo in Burkina Faso.

#### 4.5.9. *Social Services*

##### 4.4.9.1. *Information, Communication & Technology*

Regarding postal services, the district is highly deprived. There is only one postal Agency located at Bongo, the district capital. The services at the Postal Agency are also not effective since most people prefer to go to Bolgatanga, the regional capital to post and receive letters. However, few organizations and individuals patronize the services of the agency. With the introduction of the Digital Addressing System in Ghana, which covers every inch of the country and ensures that all locations in the country are addressed, it is expected to make it easier for locations to be found to boost postal and service delivery

There are no fixed telephone lines in the district. However, four mobile phone operators are found in the district; MTN, Tigo, Vodafone and Airtel. These operators provide mobile telephony services in district. Notwithstanding the presence of these operators in the district, the services they provide are still beyond the reach of most of the people. According to the 2010 Population and Housing Census, only 16.6 per cent of the population of the district 12 years and older have mobile phones. The data reveals that only one out of every six (16.6%) persons 12 years and older in the Bongo District own mobile phones compared to a regional average of 24.2 percent. Whiles one out of every five (21.2%) of the male population 12 years and older own mobile phones, about one in every eight (12.7%) of their female counterparts own mobile phones.

According to the 2010 PHC, there is also a low usage of internet facility in the district, about 1% of the population, and this can be attributed to inadequacy of internet facilities, especially internet cafes in the district. In 2010 there was only one internet cafe at the district assembly ICT Centre with less than 15 computers connected to internet which was operational and opened to the public. It must be noted that currently mobile operators are also providing internet facility on mobile phone and therefore most mobile phone users now have internet access.

##### 4.4.9.2. *Access to Electricity and Energy*

The district is on the national grid. Fuel wood for cooking is rare. Crop residue such as dry stems of sorghum and millet are mostly used for cooking. Although the use of liquefied petroleum gas is being encouraged, constant shortages of the product remains a major obstacle to a significant shift from the stem of sorghum and millet to liquefied gas. The three main sources of lighting in dwelling units in the district are kerosene lamp (64.8%), flashlight/torch (20.3%) and electricity (11.5%).



**4.4.9.3. Housing Facilities**

The District’s population of 91,723 lives in a total of 11,231 housing units. This implies that on the average there are 1.5 households per house in the district, which translate into 8.1 persons in a house. This figure is lower than the regional figure of 9.1 persons in a house. Most of the people live in compound houses (50.3%) built of mud and roofed with straw or zinc (See Plate 4-3). The main features of the predominantly traditional architecture are round huts with flat roofs and small windows that provide poor ventilation.

**4.4.9.4. Water & Sanitation**

The District has a good spread of water infrastructure. Whereas the rural communities are served by mainly boreholes (See Plate 4-6) and hand-dug wells the District capital and some small towns are served by Small Town Water Systems (STWS). In all, the District has a potable water coverage of about 82%. The use of public refuse containers is very low as only 1.4 percent of household in the district use public container dumps compared to 25.1 percent for open public dump sites. The use of the sewerage system, drainage into a gutter, and drainage into a pit (soak away) which may be considered more appropriate, account for only 6.9 percent. Across the District there are only 6 septic tank latrines, 6 KVIP latrines, 1 environloo, 9 urinals, 110 house-hold water closets, 874 pit latrines and 87 institutional latrines.

About 80% of the populace practice open defecation due to the limited number of household, public and institutional latrines. Public toilet (WC, KVIP, Pit, Pan) is used by 3.1 percent of households and 2.8 percent of households used KVIP. More than fifty percent of households (52.9%) have own bathrooms for exclusive use. Households which use open space around house account for 15.5 percent and private open cubicle, 14.7 percent.



*Plate 4-6: Borehole near Project Site*

#### **4.4.9.5. Health Services**

The District Health Management Team (DHMT) is responsible for the overall management of health services in the district. The DHMT is supported by six sub-districts Health Management Teams. The district has the following health infrastructure: The Bongo hospital, six health centres (at Vea, Dua, Soe, Namoo, Zorko and Afobisis), one clinic, 36 functional CHPS Zones and 59 outreach points, 10 feeding centres and one rehabilitation centre<sup>11</sup>. Close to the project site is the CHPS Zones at Adaboya and Akanaba (See Figure 4-7).

Over half of the District's population is enrolled on the NHIS (57%) while new registrations are also in an increasing trend. From 35,949 (42.5%) in 2010, enrolment onto the scheme has increase significantly to 48,275 (57.1%) in 2013. Limited access to health care in the District has compelled people to resort to unorthodox health service delivery with its attendant consequences. Unorthodox practitioners attend to many health situations in the District, including reproductive health cases. Some communities however have trained Traditional Birth Attendants (TBAs) to attend to women in labour.

Access to health facilities in the district is still a big challenge especially regarding physical accessibility. The road network in the district is poor coupled with the dispersed settlement pattern makes it difficult for patients to arrive at the health facility on time to access health care. Communities that also border rivers and streams also have difficulty accessing health care especially during the rainy season and some of the communities are also far from health facilities. Limited access to health care in the District has compelled people to resort to unorthodox health service delivery with its attendant consequences. Unorthodox practitioners attend to many health situations in the District, including reproductive health cases. Some communities however have trained Traditional Birth Attendants (TBAs) to attend to women in labour.

#### **4.4.9.6. Ghana National Fire Service**

There is a fire station in Bongo which was opened in 1993. The office was initially located in a makeshift building; however they have now been provided with an office accommodation as well as basic firefighting equipment like fire tender and communication gadgets. The services of the fire service are very much needed in the district to help curb the incidence of bush fires which could pose a danger to the district. Since the district is also connected to the national electricity grid, the possibility of domestic fires is tenable, and the fire service would have to be present to deal with all these issues.

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<sup>11</sup> Source: GHS – Bongo District, 2017

**4.4.9.7. Road Network**

The total length of roads in the district is approximately 248 kilometres. The road network from the main road in the Bongo Township to the solar power site at Asegbe, about 14 km, is untarred and dusty. Tarring of the Bongo town roads is currently ongoing. These roads include the Bongo-Namoo road, Namoo-Zorkor, Yorigor-Gowrie-Vea, Balungu-Vea, Yorigor-Bogrigor, Adaboya-Apatanga and Kongo-Beo feeder roads.

It is expected that the full rehabilitation of these roads would improve travel time and also open up the road network for easy and quick transportation of farm produce to marketing centres in and outside the district. There are also several streams which are not bridged in the district and hence accessibility to many communities is a problem, as a result many communities are either inaccessible or cut off especially during the raining the season.

**4.5.10. Education**

The district currently has three public Senior High Schools and two private SHS with plans to be absorbed by the government. The district also has 47 public and three private Junior High Schools, 72 public and four private primary schools and 71 public and four private kindergartens. Ten schools were identified as being close to the solar and sub-transmission site and these are shown in Table 4-3 and their locations indicated in Figure 4-7. Many of the basic schools in the District lack basic sanitation facilities such as toilets, refuse containers, hand washing containers, etc. About 50 of the 76 primary schools in the District have toilet facilities while 46 of them have urinal facilities. At the JHS level, 22 out of the 50 schools have toilet facilities and only 29 of them have urinals. Also, 38 out of the 72 public primary schools and 16 JHS have potable water. On shelter, only 81 teachers in the district have access to teachers’ accommodation.

*Table 4-3: Number of Schools Located in Project Area*

School	Boys	Girls	Total
Atampintin D/A KG/Primary	157	160	317
Atampintin JHS	52	73	125
Adaboya DA/KG/Primary	146	159	305
Adaboya JHS	46	65	111
Kabre DA/KG/Primary	74	69	143
Akulyoo KG/Primary	52	51	103
Ghana Daa RC KG Primary School	216	217	433
Light Academy	15	23	38
Apatanga RC JHS	41	57	98
Tindonbonko JHS	44	43	87

*Source: GES –Bongo District, 2017*

Figure 4-7: Nearby Educational & Health Facilities to the Bongo Solar Power Project Site



Source: VRA Engineering Services Department (February 2018)

#### **4.5.11. Health Profile**

Like other rural districts and the nation at large, malaria is the dominant disease in the District with 52% of all OPD cases. This is largely attributed to improper sanitation and hygiene practices. Malaria continues to be a major public health concern and is one of the leading causes of morbidity and mortality, especially among children under five and pregnant women. Others are Acute Respiratory Infection, Diarrhoea diseases, Skin diseases & ulcers, Acute eye infection, Anaemia, Rheumatism & joint pains, Pregnancy & related complications, Typhoid fever and Home accidents & injuries. The district lies within the Onchocerciasis Freed Zone.

As indicated earlier, the vibrant market at the Burkina side of the border known as Yelwongo where citizens in the district brisk business with their neighbours also serves as an important source of revenue for the District. Adversely, however, it poses some health risk on the people of the district and beyond regarding the spread of HIV/AIDS. Because of the brisk trade and interaction in the area, it predisposes the people to some health risk such as HIV/AIDS and other communicable diseases. There is also pressure on the few health and educational facilities in the district because people come from the Burkina side to access these facilities in the district more so with the former.

The ESIA Team was unable to access latest data on HIV& AIDS in the district. Literature however indicated that there was ample evidence that knowledge of the disease is high but ways of preventing it is very low. There are a lot of traditional knowledge, attitudes and practices in the district and a lot of ailments are still being treated with traditional medicine and resorting to soothsayers for diagnosis of certain diseases, like HIV& AIDS and occurrences of calamities.

#### **4.5.12. Persons with Disability**

Disability, especially blindness, is a major concern in the District. Of the district disabled population of 4,408, 38.5 percent have sight disability. The proportion with physical disability accounted for 23.3 percent of total disability and comes second after sight disability (%). Hearing disability and emotional disability accounts for 21.8 percent and 12.9 percent respectively. The high proportion of sight disability is probably since until somewhere in 1984 when the now onchocerciasis freed zone was rid of the vector that causes blindness, the Beo and Soe zones were at the mercy of the vector that made a lot of people in these communities (to go) blind.

## CHAPTER 5 STAKEHOLDER ENGAGEMENTS

### 5.1. INTRODUCTION

A stakeholder to a project refers to any individual or group which is potentially affected directly or indirectly by the proposed project or who has an interest in the proposed Project and its potential impacts. Stakeholder engagement play a major role in identifying the potential impacts of any proposed project and forms a key activity in the Environmental Impact Assessment (EIA) process. The rationale for any stakeholder engagement is to help identify potential points of disagreements between stakeholders, ethnic / gender / religious / political based tensions, raised expectations by the project and emerging social problems that require attention and with which the project developer may be able to assist.

The primary aims of the stakeholder engagement process during the EIA Study are to:

- Disseminate general project and programme information to affected persons and interested parties;
- Provide local knowledge and input in identifying potential environmental (biophysical and social) impacts associated with the proposed development.
- Provide the proponent with an opportunity to record comments/opinions of affected persons/interested parties, and where possible to address these issues within the EIA.
- Provide information and answer questions regarding the location of the power generation plant and the transmission line and substation works;
- Discuss and address areas of concern/confusion;
- Promote transparency and an understanding of the project and its consequences;
- Serve as a structure for liaison and communication with I&APs; and
- Comply with national / international standards, for environmental impact statement;

There are several in-country, national regulations and international standards that set requirements for public consultation and disclosure related to EIA for proposed developments. The Equator Principle 5: Consultation and Disclosure, the IFC PS1 Assessment and Management of Environmental and Social Risks and Impacts (2012), and the World Bank OP 4.01 Environmental Assessment (Jan 1999) all require stakeholder engagement, consultation and disclosure including addressing grievances as part of the ESIA Process. This is supplemented by the IFC Policy on Disclosure. In Ghana, this is clearly outlined under Section 12(k) of the Environmental Assessment Regulation, LI 1652 of 1999, which mandates the consultation with members of the public likely to be affected by the operations of

the undertaking. Indeed, LI 1652 indicates that a public hearing is required if great adverse public reaction is apparent. The need for a hearing is taken if the project in question involves the dislocation; relocation or resettlement of communities or the EPA considers that the project could have an extensive and far reaching effect on the environment.

Subsequently, it is the requirement of the Ghana EIA process for significant new developments that an extensive consultation exercise is carried out to inform the local population, statutory bodies and local organisations and interested parties about the proposal. VRA is thus required to meaningfully consult with stakeholders on the preparation and results of the EIA undertaken for the project and undertake ongoing consultation during each phase of the development. This is to allow the Team in the EIA process to explain to the Interested and Affected Parties (I&APs) how the project may affect them and receive feedback on concerns that they may have, in order that subsequent studies undertaken, and actions can reflect those concerns. This section presents an overview of consultation undertaken to date for the project and summarises the proposed consultation activities for the remainder of the project.

### 5.2. STAKEHOLDERS CONSULTED

Stakeholder engagement is an ongoing process that may involve, in varying degrees, the following elements: stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism, and ongoing reporting to Affected Communities. The nature, frequency, and level of effort of stakeholder engagement may vary considerably and will be commensurate with the project's risks and adverse impacts, and the project's phase of development.

Key stakeholders that are directly impacted (positively or negatively) by a project usually includes:

- Project-affected communities, individual residents as well as non-organised groups with areas of interest, vulnerable groups (i.e., elderly, people with disabilities, ethnic minorities, etc.);
- State agencies at the national, regional and local levels;
- International organizations (especially donor agencies)
- Non-governmental and public organisations at all levels
- Project employees; and
- Media.

Indeed, engagements with the state agencies and regulatory agencies have assisted in defining the regulatory and institutional framework within which the project should be carried out. Consultations with community members and locals have also assisted in the identification of socio-economic,

religious and cultural impacts. Stakeholder planning and analysis under this study identified three distinct stakeholder groups that should be consulted on during the EIA process.

The individuals and organisations within these groupings are those:

- Associated with the proposed 40MW solar power generation plant site at Asegba;
- Associated with the 29Km Sub-transmission line route;
- State agencies within the Upper East Region, Bolgatanga Municipality as well as Bongo District (generic consultees).

These consultees are outlined in Table 5-1.

*Table 5-1: Identified Stakeholders under the 40MW Bongo Solar Power Project*

Consultee Type	Consultees
Solar Power Generation Site	<ul style="list-style-type: none"> <li>▪ Farmers</li> <li>▪ Bongo Traditional Authority</li> <li>▪ Community representatives on Local Government (Assemblypersons)</li> <li>▪ Heritage / Cultural Caretaker</li> <li>▪ Landlords of Bongo (Tindabas)</li> </ul>
Sub-Transmission Line Site	<ul style="list-style-type: none"> <li>▪ Farmers</li> <li>▪ Traditional authorities at Bongo</li> <li>▪ Community representatives on Local Government (Assemblypersons)</li> <li>▪ Heritage / Cultural Caretaker</li> <li>▪ Villages along the Line route</li> <li>▪ Veia Irrigation Dam</li> <li>▪ Landlords of Bongo (Tindabas)</li> </ul>
Generic Consultees	<ul style="list-style-type: none"> <li>▪ Bolgatanga Municipal Assembly</li> <li>▪ Bongo Customary Land Secretariat</li> <li>▪ Bongo District Assembly</li> <li>▪ District Education Service, Bongo District</li> <li>▪ District Health Services, Bongo District</li> <li>▪ Environmental Protection Agency</li> <li>▪ Ghana National Fire Service, Bongo District</li> <li>▪ Irrigation Company of Upper Region (ICOUR) – Veia Irrigation Project</li> <li>▪ Lands Commission, Upper East Region</li> <li>▪ Northern Electricity Distribution Company</li> <li>▪ Upper East Regional Coordinating Council</li> </ul>

### **5.3. METHODOLOGY FOR STAKEHOLDER ENGAGEMENT**

A program of stakeholder engagements was developed as part of the environmental assessment to avoid any risk of apprehension associated with this project like problem of destroying properties and



extension of the allotments. The engagement process for the project was designed to meet Ghanaian legal requirements for public participation and to align as far as practically possible with good international industry best practice, based on the project timing and budget. It is also important to note that there are practical and financial limitations to the involvement of all individuals within the engagement process. Hence, public participation aims to generate issues that are representative of societal sectors, not individuals. Hence, the stakeholder engagement was designed to be inclusive of a broad range of sectors relevant to the proposed project.

VRA has followed Ghanaian protocol and used culturally appropriate methods for undertaking public consultation activities. In all instances, the English language, translated to the local language, Frafra/Gurune, by a local representative were used for consultation purposes. Wherever appropriate, letters of notification have been sent to state institutions and meetings held with Local Chiefs. Meetings were scheduled at times and locations that best accommodated consultees.

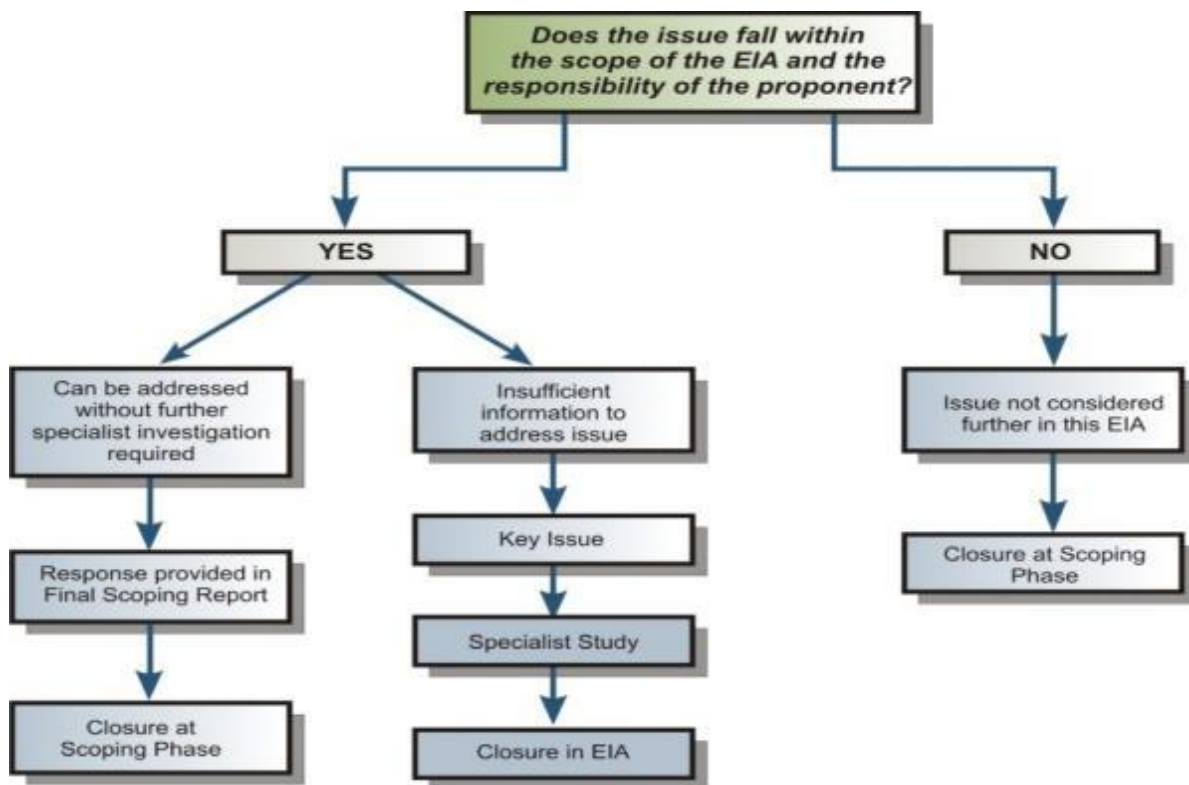
An important element of the ESIA Process is to evaluate the issues raised through the interactions with authorities, the public, the specialists on the ESIA team and the project proponent. In accordance with the philosophy of Integrated Environmental Management, it is important to focus the ESIA on the key issues, such as those issues that are considered critical for decision-making on the EA. To assist in the identification of key issues, a decision-making process is applied to the issues raised, based on the following criteria as shown in

Figure 5-1.

- Whether or not the issue falls within the scope and responsibility of the proposed project;
- Whether or not sufficient information is available to respond to the issue raised without further specialist investigation

Through consultations with I&APs and Stakeholders, issues for inclusion within the Environmental Scoping Report has been identified and recorded. Consultations took the form of telephonic interviews (note the telephonic conversation was captured in the issues report as part of the public participation record), letters and emails with key I&APs and stakeholders to inform them of the proposed project and to record their comments.

Figure 5-1: Decision-making framework for identifying key issues for the ESIA



Source: Draft Final ESIA for the Proposed Development of Wind Energy Facility in Anloga Extension (WPPI)

#### 5.4. RECORD OF STAKEHOLDER ENGAGEMENTS

VRA’s primary aim of consultation is to inform all stakeholders about the project, its activities and the impacts, and to seek stakeholders’ opinions and concerns regarding the issues that must be addressed by the EIA and the best means of developing acceptable mitigation actions. The process of stakeholder engagements begun in January 2014 following the identification of the project site and has continued till date<sup>12</sup>. From the various engagements, the communities and other stakeholders, including the state agencies, generally welcomed the plans to establish the proposed solar power project in the area. Since the project would not directly affect them in terms of pollution, the community members generally did not have any apprehension or reservation about the project. They nevertheless viewed the project as one that would create employment opportunities and small business/trade opportunities for the local population. As to be expected, these stakeholders raised a series of questions, comments and concerns. A record of all consultations and the response to consultee comments and issues raised during the stakeholder engagements prior to the release of the Scoping Report, together with responses from the ESIA team is outlined in Table 5-2.

<sup>12</sup> Some pictures of the stakeholder engagements process are provided in Appendix 4 and the list I&APs consulted so far is provided as Appendix 5.

Table 5-2: Record of Stakeholder Engagement to Date

Person/Organisation	Date	Method of communication	Reason for communication	Specific concerns/issues raised by consultee	Response/action from VRA Team	
<ul style="list-style-type: none"> <li>▪ Bongo Traditional Authority</li> <li>▪ Community representatives on Local Government (Assemblypersons)</li> </ul>	January 2014	Meeting	Project Briefing of I&APS	Appreciative of the project as it will bring development to the area	VRA will ensure project brings the needed benefits to the communities through the implementation of a Local Content Policy	
	March 2014					
	Dec. 2014		To discuss land acquisition process	They want the negotiation for the acquisition of their land done quickly and the payment done promptly	Payment will be based on valuation exercise to be done in collaboration with the Land Commission	
	February 2015		Performance of customary rights for site entry	Need to perform customary rite for site / community entry	VRA will require list of customary rights for consideration by VRA management	
	May 2016		Perform pacification rights to pave way for land survey exercise	Need for community sensitization for valuation of land, crops and socio-economic survey	Items for customary rights presented to enable surveyors enter the site	
	Nov. 2017		Commencement of Survey Works	Community will fully cooperate to ensure survey works is done without hindrance. VRA should not deal directly with families but rather the chief and the Assembly man in the negotiation for compensation packages	VRA will come to undertake referencing of affected crops after the survey. As requested, VRA will deal directly with the Chief and assembly man in the negotiation of the compensation packages.	

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<b>Person/Organisation</b>	<b>Date</b>	<b>Method of communication</b>	<b>Reason for communication</b>	<b>Specific concerns/issues raised by consultee</b>	<b>Response/action from VRA Team</b>
			Payment of fees for signing of land documents	Grateful for the involvement of the traditional authority for land negotiations	VRA will continue to liaise with the traditional authorities regarding land acquisition and compensation
			Payment of Compensation to Farmers	Traditional authorities will ensure that all affected person receive their compensation	VRA has issued cheque for compensation of affected crops using approved rates as determined by the Lands Valuation Division of the Lands Commission (2014)
			Commencement of ESIA Study	Need to finalise studies so that the project can commence. It is important that workers are recruited from the community	VRA will ensure that project development is facilitated and that community members will surely be considered for employment
			Erection of Signage on Asigba Site	It is important that such signages are placed as part of project visibility	VRA paying homage
<ul style="list-style-type: none"> <li>▪ Affected Landowners</li> </ul>	<p>January 2014</p> <p>Dec. 2014</p>	Meeting	Project Briefing of I&APS	Negotiation for the acquisition of their land should be done quickly and the payment done promptly	This will be done after the project site has been properly demarcated and the total area clearly determined

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<b>Person/Organisation</b>	<b>Date</b>	<b>Method of communication</b>	<b>Reason for communication</b>	<b>Specific concerns/issues raised by consultee</b>	<b>Response/action from VRA Team</b>
	May 2016		Commencement of Survey Works	Need to pay compensation for ancestral grave and shrine at Asigba Site	VRA will require list of customary rights for consideration by VRA management and this was provided
			Payment of Compensation to Farmers	Traditional authorities will ensure that all affected person receive their compensation	VRA has issued cheque for compensation of affected crops using approved rates as determined by the Lands Valuation Division of the Lands Commission (2014)
Landlords of Bongo (Tindabas)	March 2014	Meeting	Perform pacification rights to pave way for land survey exercise	Need for community sensitization for valuation of land, crops and socio-economic survey	To perform customary rights to enter surveyors enter the site
	June 2014		To show appreciation for their collaboration	Leadership of Bongo will continue to collaborate with VRA regarding project implementation if VRA continues to consult with the elders	Consultations with communities will be an ongoing process
	Dec. 2014		Explanation of compensation process	What compensation would be available and how titled, untitled and customary land would be addressed.	Property evaluation will be done, and payment effected in line with requirements of the Lands Commission.
	May 2016		Employment opportunities	Concern that the works will	The Local content policy of VRA will be applicable

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<b>Person/Organisation</b>	<b>Date</b>	<b>Method of communication</b>	<b>Reason for communication</b>	<b>Specific concerns/issues raised by consultee</b>	<b>Response/action from VRA Team</b>
				provide employment opportunities for workers from large towns outside of the study area.	to the project and the contractor will be required to consider locals for recruitment. The contractor will also be advised to consider this proposal from the community. However, this will be dependent on the skill set available within the community and what is required to successfully execute the project.
Bongo Customary Land Secretariat	Dec. 2014	Meeting	Commencement of Survey Works	CLS to prepare Lease Agreement on behalf of the Lands Commission	Payment for documentation of lands have been made
	Feb. 2015		Obtain Draft Lease Agreement	Draft lease Agreement made available to VRA	Draft lease Agreement to be reviewed by VRA legal team
Irrigation Company of Upper Region (ICOUR) – Veia Irrigation Project	June 2014	Meeting	Project Briefing	ICOUR will support VRA in the development of the project	VRA will collaborate with ICOUR throughout the project phases to ensure smooth implementation
	Dec. 2014		Impact of siting the 34.5kV transmission line route within Veia Irrigation Project, due to 15m RoW	Crops to be affected are cereals and vegetables and there is the need for VRA to pay compensation for affected	VRA will pay compensation for any affected crop

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<b>Person/Organisation</b>	<b>Date</b>	<b>Method of communication</b>	<b>Reason for communication</b>	<b>Specific concerns/issues raised by consultee</b>	<b>Response/action from VRA Team</b>
Lands Commission	June 2014	Meeting	Enquiries on rates for land in the Bongo Area	Lands Commission to investigate current rates for lands and advise VRA	VRA to utilise rates received as basis for negotiations with land owners
			Processes leading to entering into lease agreements with land owners in the Upper East Region	Lands Commission to develop a lease agreement for review by the VRA	VRA to review lease agreement when received
Bolgatanga Municipal Assembly	June 2014	Meeting	Briefing about Proposed Bongo Solar Power Project	Project will bring development to the area and the country.	VRA will ensure project brings the needed benefits to the communities.
	Dec. 2014		Commencement of Survey Works	The Assemblyman will be contacted to help in the survey process to ensure a smooth implementation of the works	Survey will commence in 2015 and is grateful for the assistance from the Municipal Assembly
Upper East Regional Coordinating Council	June 2014	Meeting/letter	Briefing about Proposed Bongo Solar Power Project	Need to utilise design that will help optimise space.	VRA will consider the optimal design for such project during the front-end engineering design stage
	De. 2014		Update on the Proposed Bongo Solar Power Project and related project process including land acquisition and compensation	Ministry will ensure support for the project but VRA should formally inform them on the project	VRA will continue to update the Minister on project development
			Commencement of ESIA Study and explanation of compensation process	Ministry is happy about the project and would provide any assistance that would be required	VRA will continue to update the Minister on project development
Bongo District Assembly	Dec. 2014	Meeting/Letter	Commencement of Survey Works	Happy about the development in the Bongo	Project briefing and VRA requested for cooperation

**40MW Bongo Solar Power Project – Environmental Scoping Report**

<b>Person/Organisation</b>	<b>Date</b>	<b>Method of communication</b>	<b>Reason for communication</b>	<b>Specific concerns/issues raised by consultee</b>	<b>Response/action from VRA Team</b>
	Nov. 2017			District and there is the need for VRA to formally inform the Assembly on it	from the District Assembly
			Commencement of ESIA Study	Need to finalise studies so that the project can commence	VRA will ensure that project development is facilitated
District Health Service	Nov. 2017	Meeting/letter	Commencement of ESIA Study and the need for health-related data for review	Deprived district with teenage pregnancy being an issue as well as TB due to migration from neighbouring Burkina Faso	The community will benefit from the VRA's Community Development programme which provides among others, support for health facilities in project impacted communities..
District Education Services	Nov. 2017	Meeting/Letter	Commencement of ESIA Study and the need for data on education in the district review	Need for the District to benefit from the VRA Community Development programmes that students are provided with scholarships and the provision of free text books	The community will benefit from the VRA's Community Development programme which provides among others, educational scholarships to needy students in project impacted communities.
Northern Electricity Distribution Company	Nov. 2017	Meeting/ Letter	Commencement of ESIA Study and the need for staff to assist in the consultation process as well as in data collection on behalf of VRA	As NEDCo will be the offtaker, there is the need for greater collaboration in project implementation to ensure all concerns are addressed.	VRA will endeavour to collaborate with NEDCo throughout the project implementation phases.



## 5.5. NEXT STEPS IN THE STAKEHOLDER ENGAGEMENT PROCESS

As required, consultation for the project will be an ongoing process and therefore will see another round of information sessions and displays as well as other activities undertaken during the main ESIA. These activities will include public notices, one-on-one meetings and responses to emails, telephone and written enquires with state agencies and a district based public forum. It is important to monitor and report on the on-going stakeholder engagement efforts to ensure that the desired outcomes are being achieved, and to maintain a comprehensive record of engagement activities and issues raised. This is currently on-going, and all records of consultations are available and have been included in this Scoping report and is to be updated and included in the Main ESIA Report.

### 5.5.1. *Public Disclosure of Scoping Report*

According to the requirements under the Ghana EIA process in accordance to the Regulation 15 (1) of LI 1652, the administrative procedure for scoping exercise required that the public is adequately and appropriately informed. The IFC Disclosure Policy (1998) highlights the importance of accountability and transparency in the development process of projects. Under the “**Equator Principle 10: Reporting & Transparency**”, clients are committed to ensure that, at a minimum, a summary of the ESIA is accessible and available online. From these, it is recognised that disclosure of information throughout the project will help to ensure accountability and transparency and this has been reiterated at the various stakeholder engagements that the project has conducted so far.

VRA will publish a Scoping Notice on the project in any of the national newspapers to notify the public of this Scoping Report. As required, the Scoping Notice will be issued to relevant ministries, departments and agencies including the Bongo District Assembly / Bolgatanga Municipal Assembly<sup>13</sup>. Further, the notice will be posted at appropriate locations, strategically at Palace of the Bongo Naaba and the premises of the District Assembly.

Copies of the Scoping Report will be made available at the following locations:

- VRA Corporate website at [www.vra.com](http://www.vra.com)
- VRA Head Office Library in Accra
- VRA Environment & Sustainable Development Department Library in Akosombo
- EPA Head office in Accra

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<sup>13</sup> Sample of the Scoping Notice to be published is attached as Appendix 6 and it follows the format as prescribed by the Ghana EPA.

- EPA Regional Office in Bolgatanga
- Bongo District Assembly
- Upper East Regional Coordinating Council,
- Bolgatanga Municipal Assembly
- Bongo Traditional Authority

When published, it is expected that all those with concerns, interests or special knowledge relating to potential environmental effects of the proposed undertaking are to contact or submit such concerns to the VRA or the EPA. The date for submission of review comments has been provisionally set at June 1, 2018 and this could change depending on the situation at the time. Comments can be provided to the ESIA team at the address, tel./fax numbers or e-mail address provided below. All stakeholder comments and concerns will be captured and addressed in the Main ESIA Report.

**The Chief Executive  
Volta River Authority  
P. O. Box MB 77, Accra  
Tel No: +233-302-664941-9; Fax: +233-30-2662610  
Email: corpcomm@vra.com**

All comments received following the release of the Scoping Report, through meetings and written correspondence will be posted in the Draft ESIA Report. Again, such comments are to be reviewed and addressed as necessary and incorporated in the Draft ESIA report, and plans are that they will subsequently have an impact on the project design, construction and operation.

#### **5.5.2. Public Hearing on Scoping Findings**

In accordance with the Environmental Assessment Regulations, Legislative Instrument 1652 (1999), a public hearing is required only if great adverse public reaction is apparent. The need for a hearing is taken if the project in question involves the dislocation; relocation or resettlement of communities or the EPA considers that the project could have an extensive and far reaching effect on the environment. However, as part of VRA's strategies and in line with international best practice, it is intended to undertake a district based public forum, preferably at the Bongo District Assembly, to provide a platform to engage stakeholders on key project findings from the ESIA study. Feedback from the public will be used as input for the main ESIA Report.

## CHAPTER 6 KEY ISSUES AND POTENTIAL IMPACTS

### 6.1. INTRODUCTION

A key part of the Scoping Process is a preliminary identification and consideration of the ways in which the project may interact (positively and negatively) with environmental and socio-economic resources or receptors. Consequently, the purpose of this chapter is to present a synthesis of the key issues and potential impacts that have been identified thus far as part of the Scoping Process. These issues and impacts have been identified via initial site visit, the environmental status quo of the receiving environment (baseline information as discussed in Chapter 4 of this report), discussions with the project team, issues and concerns raised by key stakeholders during the initial consultation process, and available information about the environmental effects of similar solar energy developments.

The Terms of Reference for the specialist studies deemed necessary, based on the relevant issues and impacts discussed within this chapter, are incorporated into the Plan of Study for the ESIA (refer to Chapter 7 of this Scoping Report).

### 6.2. POSITIVE IMPACTS OF PROPOSED PROJECT

The VRA has currently developed a 5-10 year Renewable Energy generation target of 164.5 MW comprising 150MW of wind power and 14.5MW of solar power. This is in line with the National Renewable Energy Law and takes cognisance of the local and export demands as well as system constraints. The object of this law is to promote the sustainable development and utilization of RE resources for electricity and heat generation. The goals of the renewable energy sub-sector are to increase the proportion of renewable energy in the total national energy mix and ensure its efficient production and use.

The support for renewable energy projects is guided by the need to address climate change as well as a rationale that Ghana has a very attractive range of renewable resources, particularly solar and wind and that renewable applications are in fact the least-cost energy service in many cases - and more so when social and environmental costs are considered. The proposed project will have significance positive environment impacts when compared to other forms of power production including the thermal power production, which involves the burning of fossil fuel. The major positive impacts of the project will include stabilization of electricity in Ghana, potential for carbon market, promotion of economic growth in the country, increased employment in the project area among other positive benefits. Details of this is explained elsewhere in Chapter 1 and will be elaborated on in the Main ESIA Report

### **6.3. POTENTIAL IMPACTS ON CLIMATE CHANGE**

#### **6.3.1. Constructional Phase**

The development of the Solar Power Plant Project would involve the use of construction equipment and operation of motor vehicles which would produce GHGs. Again, the vegetation clearing of not more than 0.9363 Km<sup>2</sup> will also reduce carbon sinks and contribute to greenhouse gas emissions. Clearing of such vegetation because of project activities will be insignificant with respect to carbon sink reduction generally.

#### **6.3.2. Operational Phase**

The proposed project would provide a new, utility-scale source of solar energy to complement existing and proposed sources of renewable energy. When the sun shines and electricity is generated by the solar power project, the real-time output required from fossil fuel plants would be reduced by the amount of renewable generation going into the electrical grid to maintain the balance between the supply and demand for electricity. GHG reductions therefore would be realized by this project. By displacing fossil fuel-based energy generation with renewable energy generation, GHG production would be reduced.

#### **6.3.3. Recommendations for ESIA Study**

The IFC Performance Standard 3 - Resource Efficiency and Pollution Prevention mandates proponents to reduce their GHG emissions. Under the Equator Principle 10 - Reporting & Transparency, clients are to publicly report GHG emission levels (combined Scope 1 and Scope 2 Emissions) during the operational phase for Projects emitting over 100,000 tonnes of CO<sub>2</sub>.

Section 4 of the EIA Guidelines for Power projects, Volume 2 requires proponents to assess the potential contribution of the proposed power plant to a reduction in greenhouse gases. Thus, it will be relevant to quantify GHG emissions, for the current proposal and there is also the need to carefully consider detailed information about the potential for construction, operation, maintenance and decommissioning related activities to emit GHGs and, thereby, contribute meaningfully to global warming considering the combined emissions of other broad-scale causes of climate change. The Equator Principles advises that public reporting requirements can be satisfied via regulatory requirements for reporting or environmental impact assessments, or voluntary reporting mechanisms such as the Carbon Disclosure Project where such reporting includes emissions at Project level.

Currently, GHG Reporting Guidelines are being drawn up by Ghana. There is currently no requirement for consideration of direct and indirect GHG emissions from the action and to quantify and disclose those emissions in the environmental document. Although it is doubtful that this individual project, standing alone, could result in significant climate change effects, the “incremental impact” of the proposed project emissions can be considered as a possible contributor, together with the incremental impacts of other past, present, and reasonably foreseeable actions, to cause global climate change, which intrinsically is a cumulative issue.

Thus, even though it will not be relevant to quantify GHG emissions, for the current proposal and alternatives, there is the need to carefully consider detailed information about the potential for construction, operation, maintenance and decommissioning related activities to emit GHGs and, thereby, contribute meaningfully to global warming considering the combined emissions of other broad-scale causes of climate change. It is therefore important that VRA considers mitigation measures to reduce proposed action-related GHG emissions from all phases and elements of the proposed action and alternatives over its/their expected life, subject to reasonable limits based on feasibility and practicality. A climate change impact assessment will be undertaken as part of the ESIA to ensure that adaptation measures are included in the design as necessary, and this will include annual Carbon Accounting Programme, which is underway by the VRA.

### **6.4. POTENTIAL AIR QUALITY & DUST IMPACTS**

#### **6.4.1. *Constructional Phase***

The current air quality is generally good given that the area is predominantly agricultural and that it is rural in character. The absence of industries also contributes to the good air quality of the area. Potential impacts on air quality due to constructional activities include temporary decrease in air quality (i.e. limited to the construction phase of development). During the construction phase, the site will need to be cleared of vegetation. Bare soil will be exposed to wind and dust will likely be generated from the movement of construction vehicles on the site.

Limited dust generation may also occur during transportation of materials as the road network is untarred and dusty, especially from Bongo to the project site at Asigbe and along the sub-transmission line route. In addition, activities such as cable trenching and construction of buildings as well as digging of tower foundations for the associated sub-transmission line will also result in dust generation. The generation of dust is expected to be short term and only last for the duration of the construction period. Standard dust suppression interventions used in civil construction projects must be applied to

minimise the impact on surrounding receptors. Taking into consideration the distance of sensitive receptors to the site, impacts from increased dust are not likely to be significant.

Construction traffic will also result in the production of emissions of NO<sub>x</sub>, PM<sub>10</sub>, hydrocarbons and CO<sub>2</sub>. The magnitude of the emissions will depend on the number and type of vehicles used; details of the type of construction traffic are not currently available. There is also the potential for the emission of fugitive gases (notably volatile organic compounds and methane (CH<sub>4</sub>) from the use of equipment at the site during construction. The use of construction equipment and vehicles will result in the emission of dust and fugitive emissions and contaminants from construction plant and vehicles may give rise to odour. Emissions from construction vehicles and construction equipment will be short term and temporary in nature; the impact of these emissions is expected to be insignificant.

### **6.4.2. Operational Phase**

It is expected that the project may be assigned not more than two (2) vehicles during the operational phase. No dust generation is expected to occur during the operational phase of the project, except for minimal dust created by this and other maintenance vehicles along the dusty roads, which is expected to be infrequent.

### **6.4.3. Recommendations for ESIA Study**

The Ghana EPA Ambient Air Quality Guidelines represents a move for air pollution control strategy that is based on receiving air quality management. It sets standards as the benchmark for air quality management performance. At the same time, it sets emission standards to minimize the amount of pollution that enters the environment. The Guidelines regulates the control of noxious and offensive gases emitted by industrial processes, the control of smoke and wind-borne dust pollution.

The impact of the project on air quality is considered negligible and does not require a specialist study during the ESIA process. Thus, management actions for mitigation will be incorporated into the Environmental Management Plan (EMP) that will form part of the ESIA Report.

## **6.5. POTENTIAL NOISE AND VIBRATION IMPACTS**

### **6.5.1. Constructional Phase**

Pre-construction noise levels within the project sites and neighbouring communities has been carried out to prepare the basis for monitoring during the project construction and operational phases. As indicated, data on pre-construction noise levels will be provided in the Main ESIA Report. The potential for noise disturbance is normally greatest during the construction phase of a project. During

the construction phase, construction vehicles including delivery trucks and minimal excavation equipment may produce a slight increase in noise disturbance. Heavy duty machinery and vehicular movement, friction between vehicles and the road surface, driver behaviour, vehicles' horns, resonance of traffic and piling increase ambient noise levels and vibration. Impacts are likely to be minimal due to the methods of construction to be used, i.e. poles will be hammered into the ground by hand as opposed to mechanically pile driven by machinery.

Delivery vehicles will also create some noise and vibration along access routes. The site, however, is in a rural setting with few or no receptors considered sensitive within proximity. For traffic noise, overall daily traffic movements are predicted to be low as the delivery requirements for men and materials at any one time are low and will be restricted to daytime only. As such, the noise increases over the current baseline along these routes will be adverse but temporary in nature and minor in significance.

Noise will be monitored periodically during the construction period and results compared to that of the EPA guidelines. The Project Environmental Officer (EO) will maintain records of noise monitoring activities and include such results in progress environmental reports to demonstrate compliance with the noise limits set and to provide information for any necessary mitigation measures.

### **6.5.2. Operational Phase**

Increased noise levels are not anticipated during the operational phase of the development either at the power plant site or the transmission line. Emissions of noise during the operation of the solar power plant will not be significant enough to generate noise nuisance, based on the actual noise emitted during operation and the distance of the nearest receptors from the plant site.

### **6.5.3. Recommendations for ESIA Study**

Noise impacts resulting from construction, operation, maintenance and decommissioning of the project could result in a cumulative effect with other past, present, or reasonably foreseeable future actions and this is to be investigated in the main EIA Study. A standardised impact assessment methodology will be used to evaluate the impact during the construction, operational and maintenance phases of the project on each noise sensitive area. The prevailing ambient noise levels each of these phases will differ due to the location of these areas to other point and/or linear noise sources. Potential noise impacts will be addressed in the EIS and appropriate mitigation measures if considered necessary will be included in the Provisional Environmental Management Plan (EMP).

## 6.6. POTENTIAL IMPACT ON WATER RESOURCES

### 6.6.1. *Constructional Phase*

The potential for surface water contamination is an important consideration in relation to the construction of the power facility. Erosion, resulting from vegetation clearing and excavations during construction can lead to downstream siltation resulting from run-offs with high sediment load. This could ultimately lead to contamination of water resources. Soil erosion leading to increased sediment load in surface water runoff could impact on drainage channels in the local area.

The potential for groundwater contamination is associated with uncontrolled spills of fuels and lubricants during the construction phase. Hydrocarbons are toxic to the ecosystem, with spills and leaks of hydrocarbon product having potential negative impacts on the surface and groundwater ecosystems. Hydrocarbons are also a health and safety risk to humans. Hydrocarbons such as diesel and petrol may cause respiratory tract irritation, headaches, dizziness, drowsiness, nausea and may lead to unconsciousness. Additionally, the Benzene contained in these petroleum products is carcinogenic (cancer causing). The extent and impact of potential groundwater or surface water contamination is largely dependent on the nature of the subsurface soil conditions, their transmissivity and susceptibility to erosion. Apart from the permeability of the soil substrate, groundwater contamination could also occur through joints, fractures and contact zones associated with the geology.

There is no existing water body close to the solar power project site. The nearest water body to the solar power plant site is the Red Volta, located about 10km North-East of the project site and this would not be impacted upon by the project. The nearest water bodies to the sub-transmission line are the Vea and Bongo Dams and both are located north of the transmission line. However, the farmlands that utilise the Vea irrigation facility will be directly traversed by the transmission line.

Water will be required during construction for some construction activities, such as dust suppression measures, and for potable water supply. The supply of water during construction is the responsibility of the contractor. Construction phase impacts on the local water environment will largely be controlled through the application of good construction methodology including consideration of drainage on the construction site and appropriate control and storage of potential pollutants such as fuels or cementitious material used in the construction process.



### **6.6.2. Operational Phase**

The topography of the area has been discussed. From the field survey, the topography of the proposed project enclave itself is largely flat with sheet and gully erosion observed at the southern end of the solar power plant site. These deep gullies are caused by running storm water from the many hills in the area and must be a subject of consideration in the development of the site both during construction and operation. Thus, the development of the solar power plant could have an impact on water quality because of alteration of the existing drainage characteristics of the site. The main impact is likely to arise because of runoff from the power plant.

There is no local watercourse, downstream within the vicinity of the transmission line site. The Bongo and Vea dams are both upstream. Again, there are no demands for water supply during operation of the transmission line. The operations of the sub-transmission line will therefore have no impact on water resources. The loss of tree and dense shrub cover during construction will probably allow herbs to germinate rapidly and apart for some slowness in growth in the dry season, their growth will protect against erosion. Furthermore, the cleared vegetation will be left on the site and so will minimise sediment runoff.

### **6.6.3. Recommendations for ESIA Study**

Construction phase impacts on the local water environment will largely be controlled through the application of good construction methodology including consideration of drainage on the construction site and appropriate control and storage of potential pollutants such as fuels or cementitious material used in the construction process.

There are a few potential options for water supply which have already been considered by the project engineers. It is considered unlikely that groundwater will be used, however, the confirmed outcome from the water supply options assessment will be highlighted in the ESIA. If there is the potential for significant impacts, these impacts would be assessed as part of the appropriate chapter within the ESIA. Basic precautions to prevent groundwater and surface water impact during construction will be identified in the Provisional EMP developed during the ESIA phase of the project.

## **6.7. POTENTIAL TRANSPORT & TRAFFIC IMPACTS**

### **6.7.1. Constructional Phase**

As indicated, the site for the solar power facility is at Asegba. The route to access this site as well as the sub-transmission line commences from the solar site to Bogorogo junction along the main

Bogorogo road to Bongo. From Bongo, the route is a direct one on main Bolgatanga- Bongo road. The route line then crosses the main Bolgatanga-Bongo highway road and runs behind the Zarre Township through the Vea irrigated farmlands, Yorogo outskirts and then terminates at the Bolgatanga-Navrongo highway. The route line then crosses the highway to meet the Bolgatanga-Ouagadougou 161kv Tower lines at Zorbisi and then turns to the left and runs parallel with the 161kv line using its right of way until it reaches the existing 161KV Bolgatanga Substation within the Bolgatanga Municipality.

The proposed solar site and majority of the sub-transmission line within the Bongo District is rural and serene and experiences virtually no public transportation. During the scoping baseline survey, the only mode of transportation experience along majority of the project site within Bongo District was by donkey carts. This can be attributed to the largely bad roads within the area, which make its unmotorable by saloon cars. Vehicles able to use such roads are mainly four-wheel drives. Thus, encroachment and traffic load on the designated road network within the Bongo District are not considerably heavy. Hence, traffic congestion during the construction phase will not be an issue. Areas within the Bolgatanga Municipality is however well served by public transport, the local bus service known as the Metro Mass, as well as short-hub transport, popularly known as “Tro-tro”, as well as taxis runs several times on the route.

The equipment procured will be brought from Tema and transported overland to the project site more than 830 km away. The main route from Tema through Kumasi, Tamale, Bolgatanga, through Yorogo to Bongo is asphalted. However, the routes within Bongo District leading to the project site, i.e. from Bogorogo to Asigba, are untarred and poor in nature. During all phases (construction, operation and decommissioning) of the project, traffic will be generated.

The highest traffic volumes will be created during the construction phase. The activities that will generate traffic during the construction phase include site preparation and the transportation of construction materials and associated infrastructure to the site, as well as the transportation of employees to and from the site daily. During this period, the site will receive many truckloads of fill material, construction materials daily for the constructional period. Concrete plant and some material (cabling, cement etc.) will be transported to the site via normal articulated heavy goods vehicles. Aggregate for tracks and foundations will be sourced from off-site quarries in proximity to the Project therefore no borrow pits are proposed. Building materials supply to the site would be frequent for sand, stones, cement, and blocks, especially during early stages of the construction period. In addition to this are the equipment and machinery, and this would be delivered to be project site, via road to the project sites.

### **6.7.2. Operational Phase**

There may be some alterations in the existing road traffic movements associated with the operational project. However, these impacts will be considerable less than during construction. The operation of the sub-transmission line has the potential to give rise to changes in road traffic because of operation and maintenance movements. The operation of the transmission line will result in the occasional vehicle movements associated with maintenance of the line. Maintenance staff will use existing access tracks to access the site and are likely to use VRA/NEDCo vehicles. There is an existing transmission line in the area so operational and maintenance activities for the new line will not present any new impact within the project enclave.

### **6.7.3. Recommendations for ESIA Study**

Owing to rural settings of the project area, traffic impacts are expected to be moderately significant during construction and decommissioning phases but of very low significance during the operational phase of project. Further information regarding traffic levels and an assessment of significance will be provided in the ESIA. The ESIA will include desk-based assessment of the existing capacity of the roads, ability to accommodate wide / heavy loads and give preferences for routing. A traffic management plan may need to be developed. Depending on the sensitivity of the area surrounding chosen transport routes, movements of construction vehicles may be restricted to daylight hours. The socio-economic assessment will discuss potential impacts to local communities from the increased traffic movements. Road maintenance measures and other traffic management measures will be prepared and included within the Provisional EMP.

## **6.8. POTENTIAL IMPACTS DUE TO WASTE GENERATION**

### **6.8.1. Constructional Phase**

Solid waste will be generated during the construction phase and will likely consist of biodegradable waste such as cleared vegetation; general waste such as paper, packaging, plastics, food waste; and construction related waste such as rubbles, metal off cuts, etc. The applicant proposes to temporarily store general waste on the site in bins. The bins will be emptied, and the waste will be taken to the nearest landfill site. Wastewater will also be generated from human activities such as hand washing on the site and from water used for construction purposes such as washing tools covered in excess cement. Sewage will also be generated on site and this is likely to make use of potable ablutions.

It is proposed that any areas set aside for washing of hands or tools must be more than 100 meters from any water resource. Additionally, an approved contractor must be employed to regularly empty and

maintain the portable ablution facilities if implemented on site. It is the responsibility of the applicant to ensure that the sewage removal contractor removes and transports the sewage to a licensed sewage treatment facility.

### **6.8.2. Operational Phase**

During the operational phase, general waste is expected to be generated from food wastes, i.e. packaging, paper, etc. The project facility will also undergo routine maintenance which may necessitate the use of oils, grease and other lubricants. Accidental spillage of small amounts of oil for machinery maintenance or from vehicles may contaminate the soil. Management and mitigation measures will be included in the EMP to ensure optimal use and recycling of material and to minimize the possibility of soil pollution on site

Solid waste that might be produced during routine maintenance must be disposed of at the closest registered landfill. There is no known solid waste that could be classified as hazardous in terms of the relevant legislation. The associated impact is therefore considered negligible provided that an appropriate waste management plan is efficiently implemented.

### **6.8.3. Recommendations for ESIA Study**

Given the existing knowledge about the anticipated waste outputs and the management measures in place, waste generation is not considered to require a specialist study and will not be considered further in the ESIA process. Appropriate waste management actions will be incorporated into the draft EMP for the project that will form part of the ESIA Report.

## **6.9. POTENTIAL VISUAL AND AESTHETIC LANDSCAPE IMPACTS**

### **6.9.1. Constructional Phase**

The construction of associated infrastructure of the solar energy facility (i.e. the substation, associated power line, access road to the site, internal access roads within the site) has the potential of visual impacts on the residents or passers-by. There is the potential visual impact of the construction of ancillary infrastructure on observers residing near of the facility. Such potential visual impacts during the construction phase on observers near the solar farm and power line are expected to be of a short duration and limited to the site.

The proposed development will result in a significant change to the local landscape character. The development is likely to impact the overall sense of place of the wider area. The site is in a rural area

and is relatively flat and as such the visual impact of the PV power facility is regarded as a potentially important consequence of the proposed development. Various aspects of the construction phase that will contribute to visual impacts caused by the proposed development include:

- Approximately 50 ha of vegetation will be cleared for the proposed solar field, equipment laydown areas and buildings;
- Construction activities and equipment associated with construction of the proposed development, including access roads and buildings;
- A slight increase in traffic can be expected on rural roads, particularly large construction and freight vehicles.
- The nightscape will potentially be affected by security and construction lighting at night;
- Construction of the overhead distribution lines and the onsite substation are likely to be visible against the skyline in places;
- Large areas cleared of vegetation will potentially generate dust which will draw attention to the development over a wide area (i.e. increase the visibility of construction activities); and
- There is also potentially an increase in the risk of veld fires occurring during this phase which will have a similar visual effect to dust generation.

The resultant disfigured landscapes and mounds of spoils are visually intrusive. The solar power plant construction activities will also lead to landscape disfiguration. In addition, the soil mounds, presence of machinery, and other equipment and materials on the project site will be visually intrusive. Subsequently, key issues during the construction phase are:

- Potential visual intrusion of construction activities on the existing views of sensitive visual receptors in the rural landscape;
- Potential visual intrusion of a large area cleared of vegetation on the existing views of sensitive visual receptors; and
- Erection of towers.
- Potential visual impact of night lighting during the construction phase on the nightscape of the region.

### **6.9.2. Operational Phase**

During the operational phase, a few elements of the proposed PV solar plant will potentially intrude on the existing views of visual receptors. The very large solar field (with solar panels covering an area of approximately 50 ha, tall structures such as the on-site substation, and overhead transmission lines

connecting the plant with the national power grid at the Bolgatanga Substation. Thus, key issues related to the operational phase of the development are:

- Potential landscape impact of introducing a large solar plant into a remote rural landscape;
- Potential visual intrusion of a large solar field on the existing views of sensitive visual receptors;
- Potential visual intrusion of tall, relatively large structures on the existing views of sensitive visual receptors; and
- Potential impact of night lighting of the development on the relatively dark rural nightscape.

### **6.9.3. Recommendations for ESIA Study**

The proposed development will result in a significant change to the local landscape character. The development is likely to impact the overall sense of place of the wider area. The site is located in a rural area and is relatively flat and as such the visual impact of the PV power facility is regarded as a potentially important consequence of the proposed development. A desktop Visual Impact Assessment specialist study will be conducted during the ESIA Phase, to assess the potential visual impacts of the proposed development on the surrounding communities and regional setting.

An examination of landscape characteristics and elements, including topography and features; changes to local and strategic views, impact on visual receptors, short, middle and longer distance views, landscape character and the local landscape setting of the development and its impact and visibility from surrounding areas and any existing rights of way will be carried out. Consideration will be given to the opportunities to enhance the landscape. The assessment will also identify appropriate mitigation and management measures to be included in the Provisional EMP, if necessary.

## **6.10. POTENTIAL IMPACT ON ARCHAEOLOGICAL, HERITAGE & CULTURAL STRUCTURE**

### **6.10.1. Constructional Phase**

Significant impacts to heritage resources are likely to be limited and may be easily avoided by the final layouts. Based on desktop research and initial site visit, no fatal flaws on heritage resources are anticipated. The heritage and scientific potential of an archaeological or heritage site is highly dependent on its geological and spatial context. This means that even though, for example a deep excavation may expose artefacts of heritage significance, the artefacts are relatively meaningless once removed from the area in which they were found. Large scale excavations may damage heritage sites and can contribute towards high levels of impact.

Potential heritage impacts associated with the proposed project include:

- Impacts on Living Heritage

Living heritage is defined as including cultural tradition, oral history, performance, ritual, popular memory, skills and techniques, indigenous knowledge systems and the holistic approach to nature, society and social relationship. Close association with the land, such as that experienced by land owners and workers, may result in certain features on the landscape enjoying social or ritual significance. For example, certain places may be utilized for social outings while others may be visited for indigenous plants, etc. The implementation of a proposed facility therefore could impact on the living heritage through the destruction of places which may have significant social/ritual consequences for the community.

- Cultural landscape and scenic routes

Cultural landscapes are highly sensitive to accumulative impacts and large-scale development activities that have the potential to change the character and public memory of a place. The construction of a large facility is likely to result in profound changes to the overall landscape qualities and sense of place of a locality and/or region. The proposed activity would essentially constitute a visual intrusion which is very difficult to measure because there is little reference material on which the sense of change can be gauged. The locating of infrastructure close to historical settlements may result in impacts to the quality of the place and detract from sense of history and/or remoteness.

The project site is not located in a designated archaeological priority area nor contains any scheduled ancient monuments, listed buildings or locally listed buildings. As indicated, no archaeological material has been found and recorded at this scoping stage. Heritage items identified include an old isolated ancestral grave and two shrines, the King Kalaga Shrine and the Yabatua Shrine. Also, just within the project site on the eastern side is an area called the Dwarf Island, where it is alleged that dwarfs exist, and forms a prayer ground for Christians who come there to pray in the name of sacking the dwarfs. Also, along the transmission line is the Tindana sacred grove at Asigba community and various churches, mostly Christian. The heritage items within the project site will have to be compensated for the community leaders to re-locate these items and the list of items required for such an activity made available to the VRA for necessary action. Indeed, such payment has been made for the Tindana sacred grove.

As the value of archaeological resources is predicated on their discovery within a specific geological host unit, construction of the proposed project could result in a net gain to the science of palaeontology by allowing fossils that would not otherwise have been found to be recovered, identified, studied, and preserved.

### **6.10.2. Operational Phase**

The general impacts during the operational phase are the same as for construction. Activities of the proposed development, or longer-term effects of the operations of the development under investigation may impact on archaeological heritage that was not identified prior to the commencement of development works. As with any project site, there is a potential for previously unrecorded cultural sites to lie within. Disturbance within the project area following operation could potentially occur during the excavation works of building facilities, infrastructure, pipelines and the installation of fencing for other works. As all unknown cultural heritage will be sub-surface it is only direct impacts arising from disturbance that could occur.

Once built, it is unlikely that operation of the facility would impact on any areas of cultural interest. The operation, future decommissioning and closure of the proposed new solar energy generating facility would not adversely impact paleontological resources because the ground disturbed during these activities would have been already disturbed, and impacts mitigated as required, during construction of the proposed action.

### **6.10.3. Recommendations for ESIA Study**

Since all the activities related to project during construction or operational stage shall be confined to the designated site, and the nature and magnitude of the activities is too small, hence no impact on any of the archaeological or heritage properties identified are anticipated. Thus, the project is unlikely to have an impact on cultural heritage.

However, a Heritage Impact Assessment is ongoing with the aim of identifying possible heritage sites and finds that may occur in the proposed development area. This assessment shall aim to inform the ESIA in the development of mitigative measures that will assist VRA in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the National Museums Decree (1969) NLCD 387.



## 6.11. POTENTIAL IMPACT ON LAND QUALITY

### 6.11.1. *Constructional Phase*

Contamination of ground and groundwater at the development site may be present because of past releases. However, as the site is a greenfield development, these risks are considered low. The preparation of the power plant site and the sub-transmission line could have an adverse impact on soils through topsoil compaction, rutting and mixing because of:

- Excavation of the site for civil works
- The movement of equipment on site during construction; and
- Excavation for the tower foundations

Contamination of soils may also arise through the spillage of lubricants, oils and machine fuel during construction activities. The main impact on soils will be because of the excavation of the site for the foundations of the site, site for the foundations of the transmission line towers and the movement of equipment along the centre of the wayleave.

### 6.11.2. *Operational Phase*

There are potential impacts to land quality from the operation of the facility because of the presence of contaminative substances and the possibility of minor or major uncontrolled releases during operation. The operation of the transmission line has the potential to impact on soils as a result of maintenance activities to gain access to the site and in the periodic clearance of vegetation within the wayleave exposing soils to rainwater erosion. Clearance of the vegetation greater than 4m height within the wayleave for maintenance purposes is unlikely to have an impact on soils as the vegetation will be cleared by hand and left on site.

### 6.11.3. *Recommendations for ESIA Study*

Generally, the Bongo soils consist of about 3 inches of very slightly human stained, crumbly coarse sandy loam overlying reddish brown, fine blocky, very coarse sandy loam containing occasional incompletely weathered feldspar particles. The superficial soils are not soils sensitive to disturbance. The impact on soils during construction is therefore anticipated to be insignificant.

It must be noted that during the operational phase, the design of the facility to good practice standards will aim to prevent releases and minimise the potential consequences such that any effects should be insignificant. However, consideration within the ESIA is likely to be required to demonstrate that adequate control and mitigation measures are included in the development scheme. Relevant

management, remediation (if required) and mitigation for identified contamination will be included within the ESIA.

### 6.12. POTENTIAL IMPACT ON LAND USE & AGRICULTURE

#### 6.12.1. *Constructional & Operational Phase*

There were no residential buildings on the identified site. Land use at the site was identified as being mainly for farming purposes and animal husbandry. Indeed, during the field survey, groundnuts was being harvested and mounds of yam were observed. Economic trees such as dawadawa and baobab are also common. Livestock like cattle, goats and sheep were abundant in the area. A land area of 50.13 ha (0.5013 km<sup>2</sup>) has been acquired at Asebga, in the Bongo District. In addition, an associated 29 km sub-transmission line with a 15m Right of Way, is to be developed, and this will occupy a total of 0.435 km<sup>2</sup> area. Thus, a total area of 0.9363 Km<sup>2</sup> would be required for the solar power plant and the associated sub transmission line project and will therefore not be available for agricultural purposes.

Impacts with regards to land use and agricultural potential which may occur because of the development include:

- Loss of agricultural land occupied by steel towers and other infrastructure for the duration of the project.
- Land surface disturbance due to construction of tower foundations, hard standing areas, roads etc., and its resultant potential impact on erosion.
- Change in land use from agriculture to solar power production.
- Competing land use rights resulting in the solar farm being the main source of income as opposed to farming.
- Loss of agricultural production potential and change in agricultural character.
- Impacts on food security.

Currently, the PV plant sites at Asebga has been acquired by VRA for the project as well as for future expansion. This land acquisition (expropriation of property for the project) will result in loss of business, properties and incomes, social stress especially where an ancestral grave and shrine are to be relocated, social and psychological disruption for the affected individuals, families and farmers. Construction works within the sub-transmission component will also affect crops in farmlands that may be within the line route.

Economic displacement from key activities because of the development such as farming, and associated infrastructure can plunge households into poverty and / or dislocate communities severing

extended support networks such as childcare. Thus, the acquisition of the project enclave has the potential to adversely affect land tenure and ownership and land-use planning characteristics, as land will have to be acquired from some individuals, communities and/or skins.

The Physical Planning Authority (formerly Town & Country Planning) will also have to demarcate the area and map out accordingly. The land to be affected by the implementation of the proposed project has the following categories of land-uses, agricultural lands, potential agricultural lands or fallow agricultural lands. Land for the project site has been surveyed and is to be acquired. The demarcation of the land for the project would result in some potential effects on land-use characteristics such as hunting as well on the fauna within the project environment, however, on a very minimal basis. The major activity requiring mitigation is the land-use as this ultimately leads to loss of land for agriculture, hunting and possible land-use conflicts. Subsequently, any development that has an impact on the potential land use, could have serious consequence on agriculture and the economy of the locals.

### **6.12.2. Recommendations for ESIA Study**

It is hoped that physical displacement for associated facilities can be avoided as much as possible. Land acquisition and economic displacement is anticipated for the Rights of Way (RoW) for the access roads and associated transmission lines. This potential adverse effect on land ownership and land-use requires mitigation measures to minimize the impact on individuals and the community. This will need to be properly managed through sensitization and information sharing. The support and involvement of the residents of Bongo District as well as Government agencies are essential to the smooth implementation of the project. There is the potential of conflict and misunderstanding with individuals and communities, and even state agencies responsible for land management issues and these have to be exhaustively addressed and resolved prior to the implementation of the project. These potential effects will be thoroughly investigated during the study and relevant mitigation measures outlined in the ESIA Report. The assessment will identify appropriate mitigation and management measures to be included in the Provisional EMP, if necessary.

The project requires the acquisition of land for the development of the wind power projects in the various areas. VRA considers involuntary compensation as an integral part of project design, and subsequently deal with resettlement issues from the earliest stages of project preparation. If not mitigated appropriately and early, resettlement impacts can cause great controversy and result in significant public objections, time delays and considerable cost overruns for the project currently, project-affected persons (PAPs) are being engaged in a meaningful manner, and to provide opportunity

for their participation in the planning and execution of resettlement programs. The land acquisition has been completed and procedures carried out was in accordance with national regulations and this will be detailed out in the Main ESIA.

### **6.13. POTENTIAL IMPACT ON ECOLOGY (FLORA & FAUNA)**

#### ***6.14.1. Constructional & Operational Phase***

Potential impacts on flora and fauna during construction will be limited to the direct loss of habitat because of the footprint of the plant and the construction laydown area as well as disturbance and/or damage to habitats and species because of construction activities e.g. through smothering of plants by dust, movement of vehicles and construction workers to and from the site. A total land area of approximately 0.94 Km<sup>2</sup> is to be acquired and there are no special habitats for endangered fauna or flora. There are no sensitive habitats or plant species within the PV site. Therefore, although a large area of habitat will be permanently lost the overall significance of the impact is low due to the low conservation value of the habitat within the site area. There will be minimal impacts during the operational phase as there will be no additional land take.

Measures taken to control loss of biodiversity will include clearing and grading the ground surface within approved work limits, stripping the top soil layer from the subsoil, stockpiling the removed soil in approved areas to be retrievable for landscaping and site restoration around the building structure, clearing the nearby drainage systems and replanting the original vegetation after construction is completed. The soil removed from the building site will be used in landscaping around the paved areas for enhancement of environmental quality. The surrounding areas of the solar power plant site will be replanted with grass and flowers, and other suitable plants.

#### ***6.14.2. Recommendations for EIA Study***

Impact analyses typically characterize effects to plant communities as temporary or permanent, with a permanent impact referring to areas that are paved or otherwise precluded from restoration to a pre-project state. The potential impacts flora and fauna from the construction and operation of the project shall be analysed. The analysis shall address potential impacts of the project (including ancillary facilities) to special-status plant species, sensitive natural communities and other significant vegetation resources. Direct, indirect, and cumulative impacts shall be analyzed and quantified, if possible.

Direct impacts are those resulting from the project and occur at the same time and place. Indirect impacts are caused by the project but can occur later in time or farther removed in distance while still

reasonably foreseeable and related to the proposed action. The potential impacts discussed in this analysis are those most likely to be associated with construction and operation of the project. Currently, floral and faunal survey is underway to determine the level of species and this will be fully documented in the EIA Report, together with mitigation and monitoring measures.

### **6.14. POTENTIAL IMPACTS ON COMMUNITY, HEALTH, SAFETY AND SECURITY**

#### **6.14.3. *Constructional Phase***

As with any construction project, there is potential for impacts on human health and safety because of accidents and unplanned events that may occur during the construction of the PV power facility. The risk of injury associated with the construction of the PV power facility will be mainly limited to the subcontractors (as the site will be secured to avoid public incursion into the active development area), but there remains some risk of injury to other site users (i.e. farm workers).

The impact of employment created during construction is considered a positive effect from the project. However, most of employment during construction is likely to be relatively short-term and significant employment opportunities for local communities may be limited due to the low levels of education, skills and limited experience and training opportunities that the local people have. This can result in a large percentage of skilled and semi-skilled workforce being sourced on a temporary or permanent basis from outside of the local community. At this stage in the project development, the origin of these workers is unknown.

There will be the potential for increased road traffic accidents from increased construction traffic. During construction, non-local employees are typically employed on a ‘single’ basis, they will not come with their families. Often, they can be housed close to the construction sites either in purpose-built accommodation or within the nearby communities, which will most be likely in this case.

Coinciding with the influx of migrant workers is typically a raise in demand for goods and services during the construction period which can result in a rapid expansion in supply chain businesses operating in the area. This will result in increases in formal employment and informal labour. This expansion may result in migration into the area. The impacts that may arise from the presence of migrant and/or expatriate employees are largely comprised of:

- Inappropriate behaviour and lack of respect for local leadership and cultural norms on the part of expatriate workers;

- Conflict resulting in part from resentment by skilled nationals and residents if they perceive that expatriates have been hired into jobs for which they are suitably qualified;
- Spread of transmissible diseases including HIV/AIDS both within the workforce and between the workforce and the local community;
- Resentment of non-local nationals by residents if they are perceived to have taken jobs that could be successfully filled by local people, or due to non-integration with the local community; and
- Increased local demand for consumer goods and housing with resulting encouragement for improved supply resulting in financial hardship and benefits for local people; and,
- Increased pressure on infrastructure, services (such as healthcare) and roads, particularly with the establishment of informal settlements.

#### **6.14.4. Operational Phase**

During operation, the impacts are considered largely positive. The project will provide a good source of long term primary and secondary employment and economic growth for the area. However, the likelihood exists for vandalism of the solar power site by the locals.

#### **6.14.5. Recommendations for ESIA Study**

Public safety, occupational safety and health hazards associated with the project are extremely significant and must be the priority of site management as they pose potential threat to the safety and health of the workers. These hazards could be from falling and/or swinging objects, potential collapse of towers due to rainstorms or vandalism, falling from heights and snakebites. Without mitigation measures, all project sites present a risk to public safety, occupational health and safety, including fire hazards. Mitigation measures shall be proposed in the EIA to minimize these potential hazards

To complete this analysis of environmental consequences associated with impacts on public health and safety, the study will consider potential impacts on the following issue areas: hazardous materials/hazardous waste, waste management traffic and transportation safety, worker safety and fire protection, and geologic hazards.

The socio-economic assessment will also consider potential impacts to the community, health, safety and security from the project. Initiatives to encourage local recruitment and training will be considered within the ESIA. Community, health, safety and security will be considered in environmental and social management plans developed for the project. Consultation will take place with community

members. Information about the project will be disclosed and grievance mechanisms developed and implemented.

### **6.15. POTENTIAL IMPACT ON SOCIO-ECONOMIC AND LOCAL COMMUNITIES**

#### **6.15.1. Constructional Phase**

Construction activities can potentially have a positive socio-economic impact by the provision of temporary employment opportunities and an improvement in local economies generated by an increased demand for local goods and services. Conversely, construction activities can also have a negative impact on local communities through the impact of an influx of construction workers, which may place pressure on local resources, affect social dynamics and culture, and exacerbate health problems, etc.

Based on the status quo conditions of the study area and the nature of the proposed development, the following socio-economic impacts are anticipated:

- Influx of job seekers;
- Increased competition for urban-based employment;
- Increases in social deviance;
- Impact on health;
- Increases in incidence of HIV/AIDS infections;
- Expectations regarding jobs;
- Local spending;
- Change in land use
- Creation of temporary jobs during construction (including local jobs);
- Skills training for local workers during construction;
- Creation of long-term jobs during operations and skills training;
- Potential for sourcing materials locally (during construction and operations); and
- Job losses at the end of the project life-cycle.

By far the most significant driver of change likely to result from the proposed project is the influx of people into the study area, and the corresponding increase in spending and employment. Such an influx of “strangers” into the receiving environment is likely to cause a disturbance in the order of the existing social structure and might also lead to increases in social deviance. Increased spending and

employment (even though such employment might be short-term) generates positive impacts through the multiplier effect and by providing much needed financial relief in the area. However, it also creates significant, and often unrealistic, expectations regarding potential employment.

As indicated, this project will bring in employment opportunities for the local inhabitants. It is expected that the project will create approximately 70 direct construction employment opportunities over this period (i.e. 10 skilled expatriates, 10 Skilled Ghanaians, 20 semi-skilled Ghanaian, and 30 low skilled workers). Construction crews will constitute mainly skilled and semi-skilled workers. Unskilled jobs will be offered mainly to the local people particularly during the construction phase. About 10 VRA support staff will be present in addition to the above. It will be necessary for the EPC Contractor and project parties to ensure appropriate labour and working conditions and facilities are in place for their workforce. These conditions will need to meet national and international requirements.

### **6.15.2. Operational Phase**

There is currently an imbalance between demand and the ability to supply electricity, thus the operation of the BSPP will provide generation capacity to address the current electricity demand-supply deficit in Ghana. The installation of approximately 20 MW Solar Power Plant will improve system reliability. This will result in benefits to the Ghanaian economy by providing a more reliable electricity supply to the southern interconnected system, which serves the mining companies.

The costs of the project will not be directly passed onto the customers. Furthermore, the improvement in system reliability will significantly reduce the need to run private diesel generators that are currently being used by customers during load-shedding periods. This will have a positive impact on air quality through the reduction of air emissions in urban areas and will reduce the cost of electricity for customers currently running diesel generators at their own expense.

Approximately 10 technical persons on shift basis shall be hired for operations at the solar power plant during operational phase. This number will be in addition to those engaged at site for security and administrative duties expected. Again, the operation of the plant may also result in employment opportunities, indirectly through improved electricity supply to the Northern Ghana. It would enhance the emergence and development of businesses e.g. suppliers/distributors of foodstuff, among other service providers. The development could increase income for this group of enterprises.

Operation of the power plant could have an impact on land use by disturbing access to land uses through the operations themselves or indirectly through traffic movements. The proposed site of the power plant is not within an area of developed structures. Movement of traffic to and from the site will



be limited primarily to that of workers vehicles. These movements are unlikely to have a significant impact on current access along the road leading to the power plant site.

### **6.15.3. Recommendations for EIA Study**

A socioeconomic survey of the proposed site will be required, which will be fully documented in the EA Report. The assessment study area shall cover mainly the Bongo District, within the Upper East Region in Ghana. The socio-economic assessment will consider potential impacts to the community, health, safety and security from the project. Initiatives to encourage local recruitment and training will be considered within the ESIA. Community, health, safety and security will be considered in environmental and social management plans developed for the project. Consultation will take place with community members. Information about the project will be disclosed and grievance mechanisms developed and implemented.

The location and size of the district has implications for development, especially in a situation where the district share borders with Burkina Faso. Peoples of these countries, share so much in common: language, socio-cultural and belief systems. This offers the District an opportunity for exchange of goods and services between the District and Burkina Faso. Already in existence is a vibrant market at the Burkina side of the border known as Yelwongo where citizens in the district do brisk business with their neighbours. This trade interaction has brought about increase in household incomes, which has a direct influence in the standard of living of the people of both countries. It also serves as an important source of revenue for the District.

Adversely, however, it poses some health risk on the people of the district and beyond regarding the spread of HIV/AIDS. Because of the brisk trade and interaction in the area, it predisposes the people to some health risk such as HIV/AIDS and other communicable diseases. There is also pressure on the few health and educational facilities in the district because people come from the Burkina side to access these facilities in the district more so with the former. The challenges of disease surveillance and control and health service delivery in general arising out of this geo-physical and social cultural associations cannot be over emphasised.

Again, it exposes the District to influx of foreigners, including Fulani herdsmen, and cross-border crime, as it is one of the transit points to the country from countries in the Sahel. The district has been under siege by Fulani herdsmen resulting in many vices such as cattle rustling, armed robbery and rape. The few trees in the district are also been cut down by these Fulani herdsmen for fuel wood and

as feed for their cattle. Furthermore, their activities have adverse impacts on farmlands, which negatively affect productivity.

The introduction of the project could exacerbate the already existing issues discussed above and such impacts are critical and will be assessed under the socioeconomic impact survey of the proposed, which will be fully documented in the Main ESIA Report.

### **6.16. POTENTIAL IMPACTS LINKED TO THE DECOMMISSIONING PHASE**

As indicated in Chapter 3 of this report, because of its long-life span of about 30 years, the circumstances under which these facilities might be ultimately decommissioned are difficult to foresee. The decision on whether to decommission or upgrade will depend on the development of the system. Should such a circumstance arise, the potential would exist for impacts from abandonment of the PV plants and or sub-transmission line components such as generation of waste, loss of employment and aesthetic impacts.

The key impacts regarding decommissioning of the project are:

- Generation of waste;
- Potential termination of the employment opportunities associated with the facility; and
- Necessity to rehabilitate or restore the development footprint of the solar power project.

A Decommissioning and Site Closure Plan (DCP) will be prepared to guard against the remote possibility that the project ceases to operate and the facilities are abandoned by VRA

#### **6.16.1. Generation of Waste**

At this stage, it can be assumed that the generation of waste is a potential direct impact. The removal of the supporting infrastructure (e.g. cabling, fencing and control rooms, etc.) will generate waste. Recommendations regarding the management of decommissioning wastes will be included in the Provisional EMP, e.g. where feasible, waste must be re-used or recycled. For example, steel support structures may be suitable for re-use elsewhere or re-cycled to form new products. The amount of waste will be limited and is not expected to significantly reduce the capacity of the closest operational landfill.

#### **6.16.2. Potential Termination of the Employment Opportunities**

With respect to socio-economic aspects, the jobs that were offered by the solar facility will be terminated. At the approach of the decommissioning phase, staff employed at the facility and

contracted service providers must be given adequate notice so that they may seek alternative employment.

### **6.16.3. *Necessity to Rehabilitate or Restore the Solar Energy Facility Development Footprint***

With respect to ecology and vegetation issues, the development footprint must be returned to an ecological functional state. The strategy for rehabilitating or restoring the development footprint will be developed during the ESIA, for incorporation into the project EMP.

## **6.17. CUMULATIVE IMPACTS**

Cumulative impacts with existing and planned facilities may occur during construction and operation of the proposed solar power facility. Cumulative impacts and effects are those that arise because of an impact and effect from the Project interacting with those from another activity to create an additional impact and effect. These are termed cumulative impacts and effects. It is a key part of any ESIA process that the additional or cumulative impacts associated with nearby existing or proposed developments be considered and the results reported in an EIS.

A Cumulative Impact assessment shall be done following the guidance of the IFC document *Good Practice Handbook (GPH) on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets*, published in 2013. This cumulative effect assessment is concerned with identifying situations where several effects from separate projects combine to cause a significant effect on a resource.

Examples of cumulative impacts associated with the development of this solar power project will include the following:

- Effects on ambient conditions such as the incremental contribution of pollutant emissions in an airshed.
- Increases in pollutant concentrations in a water body or in the soil or sediments, or their bioaccumulation.
- Secondary or induced social impacts, such as in-migration, or more traffic congestion and accidents along community roadways owing to increases in transport activity in a project's area of influence.

Cumulative impacts from operation of project will need to be considered in relation to existing and proposed developments. The nearest similar solar power project is the existing 2.5MW Navrongo Solar Power Project, located in the bordering Kassena-Nankana East District (See Plate 6-1). Integration of

the power from the solar energy facility in the national grid vis-a-vis the existing project will need to be assessed.



*Plate 6-1: Satellite Description of the Location of the 2.5 MW Navrongo PV Plant (April 2015)*

### **6.18. TRANSBOUNDARY ISSUES**

It must be noted that none of the direct project activities will impact on the neighbouring Burkina Faso. However, the introduction of the project could exacerbate the already existing socio-economic impacts and this will be assessed under the socioeconomic impact survey of the proposed.

## CHAPTER 7 PLAN OF ESIA STUDY

### 7.1. OVERVIEW

As discussed under Section 1.5, the Scoping phase represents an initial step of the ESIA process and a key outcome includes the identification of key issues for the development of a Terms of Reference (TOR) for approval by the authorisation entity, in this case the Ghana EPA for the preparation of the Main ESIA. This chapter presents the Plan of Study for the ESIA (PSESIA) which sets out the process to be followed in the ESIA Phase in line with the Ghanaian EIA Regulations LI 1652 of 1999. The PSESIA is based on the outcomes of the Scoping Phase (to date) and provides the Terms of Reference (TOR) for the key issues identified under Section 6.0 as well as the stakeholder engagement process that will be undertaken during the ESIA Phase.

### 7.2. PURPOSE OF ESIA AND REQUIREMENTS LI 1652 OF 1999

The purpose of the ESIA Phase is to:

- Address issues that have been identified through the Scoping Process;
- Assess alternatives to the proposed activity in a comparative manner;
- Assess all identified impacts and determine the significance of each impact; and
- Recommend actions to avoid/mitigate negative impacts and enhance benefits.

The ESIA Phase consists of three parallel and overlapping processes:

- Central assessment process through which inputs are integrated and presented in an ESIA Report that is submitted for approval to the EPA and other commenting authorities
- Stakeholder engagement process whereby findings of the ESIA Phase are communicated and discussed with I&APs and responses are documented
- Studies that provide additional information/assessments required to address the issues raised in the Scoping Phase

### 7.3. OVERVIEW OF APPROACH TO PREPARING THE ESIA REPORT

The results of the studies and other relevant project information for the solar power facility will be summarised and integrated into the ESIA Report. The Report will be released for a 50-day I&AP and authority review period as shown in Figure 1-2. This shall be done through an Advertisers Announcement and in addition through formal notification of key state agencies. Should it be deemed necessary (based on feedback on the Scoping Process), a public meeting can be arranged during this

review period, or following requests from stakeholders, several focus group meetings with key I&APs and stakeholders can instead be arranged.

The purpose of these meetings (if deemed necessary) will be to provide an overview of the outcome and recommendations from the studies, as well as provide opportunity for comment. Comments raised, through written correspondence (emails, comments, forms) and at meetings (public meeting and/or focus group meetings) will be captured in a Comments and Responses Trail for inclusion in the ESIA Report that will then be submitted to the EPA for decision-making. Comments raised will be responded to by the ESIA team and/or the applicant. These responses will indicate how the issue has been dealt with in the ESIA Process. Should the comment received fall beyond the scope of this ESIA, clear reasoning will be provided. All comments received (and the associated responses from the ESIA team) will be attached as an appendix to the ESIA Report for submission to the EPA.

As required by the Ghana EPA, the ESIA Report will include a Provisional Environmental Management Programme (EMP), which will be prepared in compliance with the relevant regulations. This EMP will be based broadly on the environmental management philosophy presented in the ISO 14001 standard, which embodies an approach of continual improvement. Actions in the EMP will be drawn primarily from the management actions in the specialist studies for the construction and operational phases of the project. If the project components are decommissioned or re-developed, this will need to be done in accordance with the relevant environmental standards and clean-up/remediation requirements applicable at the time.

**7.4. ISSUES TO BE ADDRESSED IN MAIN ESIA PHASE**

The issues to be considered and addressed during the various phases of the ESIA for the various components of the project are discussed in Chapter 6 of this Scoping Report and summarised below in *Table 7-1* for ease of reference.

Table 7-1: Summary of Issues to be addressed during the ESIA Phase

Phase of project	Power Generation Plant And Associated Substation Site	Sub-Transmission Line Site
Construction phase	<ul style="list-style-type: none"> <li>• Climate Change Impacts</li> <li>• Air Quality &amp; Dust</li> <li>• Noise &amp; Vibration</li> <li>• Water Resources</li> <li>• Transport and Traffic</li> <li>• Waste</li> <li>• Visual &amp; Aesthetic Landscape</li> <li>• Archaeological, Heritage &amp;</li> </ul>	<ul style="list-style-type: none"> <li>• Climate Change Impacts</li> <li>• Air quality &amp; Dust</li> <li>• Noise &amp; Vibration</li> <li>• Water Resources</li> <li>• Transport and Traffic</li> <li>• Waste</li> <li>• Visual &amp; Aesthetic Landscape</li> <li>• Archaeological, Heritage &amp;</li> </ul>

Phase of project	Power Generation Plant And Associated Substation Site	Sub-Transmission Line Site
	<ul style="list-style-type: none"> <li>Cultural Structure</li> <li>• Land Quality</li> <li>• Land Use &amp; Agriculture</li> <li>• Ecology</li> <li>• Community, Health, Safety &amp; Security</li> <li>• Socio-economic and local community impacts, including compensation</li> </ul>	<ul style="list-style-type: none"> <li>Cultural Structure</li> <li>• Land Quality</li> <li>• Land Use &amp; Agriculture</li> <li>• Ecology</li> <li>• Community, Health, Safety &amp; Security</li> <li>• Socio-economic and local community impacts, including compensation</li> </ul>
Operation phase	<ul style="list-style-type: none"> <li>• Climate Change Impacts</li> <li>• Water Resources</li> <li>• Visual &amp; Aesthetic Landscape</li> <li>• Community, Health, Safety &amp; Security</li> <li>• Socio-economic and local community impacts</li> </ul>	<ul style="list-style-type: none"> <li>• Climate Change Impacts</li> <li>• Transport and Traffic</li> <li>• Visual &amp; Aesthetic Landscape</li> <li>• Archaeological, Heritage &amp; Cultural Structure</li> <li>• Land Quality</li> <li>• Land Use &amp; Agriculture</li> <li>• Ecology</li> <li>• Community, Health, Safety &amp; Security</li> <li>• Socio-economic and local community impacts</li> </ul>
Decommissioning phase	<ul style="list-style-type: none"> <li>• Transport and Traffic</li> <li>• Air quality &amp; Dust</li> <li>• Noise &amp; Vibrations</li> <li>• Community, Health, Safety &amp; Security</li> <li>• Wastes</li> </ul>	<ul style="list-style-type: none"> <li>• Transport and Traffic</li> <li>• Air quality &amp; Dust</li> <li>• Noise &amp; Vibrations</li> <li>• Community, Health, Safety &amp; Security</li> <li>• Wastes</li> </ul>

**7.5. ALTERNATIVES TO BE ASSESSED AT THE ESIA PHASE**

A list of the seven (7) alternatives that will be assessed or considered during the ESIA Phase is provided in Chapter 3 of this Scoping Report. As indicated, this will be expanded based on review comments on this Scoping Report from the Ghana EPA. A summary of the issues for considerations are discussed below:

**7.5.1. No-Action Alternative**

The no-action alternative assumes that the proposed project will not go ahead i.e. it is the option of not constructing the proposed solar power project and its associated facilities. This alternative would result in no environmental impacts on the site or surrounding local area, due to the facility. It will provide a baseline against which other alternatives will be compared and considered during the ESIA Phase and the rationale for the project to go ahead based on projects benefits.

**7.5.2. *Alternatives for the Generation of Electricity from a Non-Renewable Resource***

The proposed 40 MW Power project could be obtained using fossil fuels (Light crude oil, diesel fuel oil, heavy fuel oil, natural gas) to generate electricity. The rationale for using renewable energy as the preferred alternative to generate this power will be provided.

**7.5.3. *Site Location Alternatives***

The selection of the solar project sites is based on the total amount of annual solar energy radiation. Factors considered in the selection of any site includes direct solar radiation, sky scattering radiation, and ground reflection radiation. Solar energy resource in Ghana is reviewed and discussed to provide the rational for selection of Asegba in the Upper East Region in Northern Ghana.

**7.5.4. *PV Technology Alternatives***

Applicable and relevant technology options related to wind energy will be described during the ESIA Phase. PV technology alternatives considered under this project were the Concentrated Solar Photovoltaic (CSP) Plants and the Solar Photovoltaic Plants (Fixed PV plants; and Tracking PV plants). The rationale for selection Fixed PV Plants is discussed. Factors considered includes the type of solar power technology for the site, including the local solar resource and its likely generation output, the economics of the proposed facility and availability of government feed-in tariffs and energy production licenses, and the requirement for other development inputs such as water resource requirements.

**7.5.5. *PV Module Technology Selection***

The suitability of different types of PV solar panels was assessed including thin film and polycrystalline panels. The design of a PV plant involves a series of compromises aimed at achieving the lowest possible cost of electricity. Choosing the correct technology (especially modules and inverters) is of central importance. Selecting a module requires assessment of a complex range of variables. At the very least, this assessment would include cost, power output, benefits / drawbacks of technology type, quality, spectral response, performance in low light, nominal power tolerance levels, degradation rate and warranty terms. Based on performance in high temperature environments like those typical of Bongo, polycrystalline panels were selected as the preferred option.

**7.5.6. *Transmission Line Type***

Underground and overhead transmission lines exist and the selection of any of this type depends on various factors. Considerations for selection of the use of overhead transmission lines as the medium for power evacuation under the project is discussed.



#### 7.5.7. *Selection of Optimal Transmission Line Route*

The choice of corridors considers the following constraints and general considerations, which have repercussions on the feasibility and cost of project implementation:

- To be as short and as direct as possible, to minimize costs
- To avoid crossing identified problem zones, requiring non-standard and costlier technical solutions
- To stay a reasonable distance from urbanized areas
- To avoid crossing protected areas, such as parks, nature reserves, etc.
- To avoid crossing tourist areas or important panoramic sites

Factors considered in the section of the optimal line route is discussed.

#### **7.6. TOR FOR THE SPECIFIC STUDIES UNDER THE MAIN ESIA**

Members of the ESIA Team are provided under Chapter 1 and these specialists are to continue their role in assessing the environmental impact and provide reports for input in the ESIA Report. The TOR for the specific studies to be undertaken by these specialists will essentially consist of the generic assessment requirements and the specific issues identified for each discipline, discussed under Chapter 6 and summarised in Section 7.4. The TOR will be updated to include relevant comments received from I&APs and authorities during the review period of the Scoping Report. The following specific studies have been identified based on the issues identified to date, as well as potential impacts associated with the project (refer to Table 7-1). The TOR for each specialist study is discussed in detail below. Additional specialist studies could possibly be commissioned because of issues raised during the Scoping Process.

Cumulative impacts from operation of project will need to be considered in relation to existing and proposed developments. The nearest similar solar power project is the existing 2.5MW Navrongo Solar Power Project, located in the bordering Kassena-Nankana East District. As explained in Chapter 6 of this Scoping Report, it is important to note at the outset that cumulative impacts will be assessed the specialist studies (as applicable) by identifying other applicable projects, such as construction and upgrade of electricity generation, transmission or distribution facilities in the local area (i.e. within 20 km of the proposed project) that have been approved (i.e. positive EP has been issued) or for which an ESIA process is currently underway.

### **7.6.1. Stakeholder Engagement Process**

Stakeholder engagements activities undertaken till date has been described under Chapters 3 and 5. Outstanding activities required and planned for the ESIA Phase are described below. This approach will be confirmed with the environmental authorities through their review of the Plan of Study for the ESIA and any additional requirements will be considered for implementation.

#### **Step 1: I&AP Review of the ESIA Report**

A district based public forum during the ESIA phase would be held as part of the process to explain the findings of the study and impacts identified and the proposed mitigative measures to enable the public make inputs. Following this, a Draft ESIA report will be prepared and submitted to the National and Regional EPA offices in Accra and Bolgatanga, for review. The first stage in the review process will entail the release of the ESIA Reports for a 50-day I&AP and stakeholder review period. Relevant organs of state and I&APs will be informed of the review process in the following manner:

- Placement of copies of the reports at the Upper East Regional Coordination Council, Bongo District Assembly, the Traditional Authority in Bongo, the VRA Head office in Accra as well as that of the Engineering Services and Environment & Sustainable development Libraries in Akuse and Akosombo respectively.
- Placement of one English advertisement in a newspaper to notify potential I&APs of the availability of the ESIA Reports.
- An e-copy of the Draft ESIA Report will also be placed on the VRA website at [www.vra.com](http://www.vra.com) and the public will be referred for access to it. Key authorities will be referred to obtain an electronic copy from the VRA Corporate website.
- As part of the disclosure processes, VRA will also give approval for potential funding agencies to publicly disclose the Draft ESIA report on their online portal.
- Another district based public meeting could possibly be held during the review of the ESIA Report, if warranted, and if there is substantial public interest during the ESIA Phase. Furthermore, telephonic consultations with key I&APs will take place, upon request; and
- Meeting(s) with key authorities involved in decision-making for this ESIA (if required and requested).
- Telephonic consultations will be held with key I&AP and organs of state groups, as necessary.

### ***Step 2: Comments and Responses Trail***

A key component of the ESIA Process is documenting and responding to the comments received from I&APs and the authorities. The following comments on the ESIA Reports will be documented:

- Written and emailed comments (e.g. letters and completed comment and registration forms);
- Comments made at public meetings and/or focus group meetings (if required);
- Telephonic communication with the VRA project team; and
- One-on-one meetings with key authorities and/or I&APs (if required).

As has been done in this Scoping Report, the comments received during the review of the ESIA Reports will be compiled into a Comments and Responses Trail for inclusion in an appendix to the ESIA Reports that will be submitted to the EPA for decision-making. The Comments and Responses Trail will indicate the nature of the comment, as well as when and who raised the comment. The comments received will be considered by the ESIA team and appropriate responses provided by the relevant member of the team and/or specialist. The response provided will indicate how the comment received has been considered in the ESIA Reports for submission to the EPA and in the project design or EMP.

### ***Step 3: Compilation of ESIA Report for Submission to the EPA***

Following the 50-day commenting period of the ESIA Report and incorporation of the comments received into the reports, the Final ESIA Report (i.e. hard copies and electronic copies) will be submitted to the EPA for decision-making. In line with best practice, I&APs on the project database will be notified via email (where email addresses are available) of such submission. The ESIA Report submitted for decision-making will also include proof of the PPP undertaken to inform organs of state and I&APs of the availability of the ESIA Report for review (refer to Task 1). The EPA will have 15 days (from payment of the environmental permit fees) to either grant or refuse an Environmental Permit (EP).

### ***Step 4: Public Disclosure***

After the decision-making phase, if an Environmental Permit is granted by the EPA for the proposed project, a Non-Technical summary (NTS) of the ESIA Report will be prepared and both the NTS and the Final ESIA Report will be posted on the VRA website. The NTS is intended to provide a briefing for decision makers and to allow the general reader an appreciation of the key environmental issues of

the project and the way they have been addressed to satisfy the requirements of the Ghana EPA and the funding agency. Copies of the NTS and Final ESIA Reports will be made available to the Upper East Regional Coordination Council, Bongo District Assembly and the Traditional Authority in Bongo. The NTS and Final ESIA Report shall also be available in the offices of VRA and the website as well as the EPA for public disclosure purposes.

### ***Step 5: Pre-Construction Local Stakeholders' Event***

A local stakeholder hearing event will be organised to present key recommendations in the NTS to the public, prior to the EPC contract signature.

#### ***7.6.2. Land Acquisition & Resettlement***

As indicated, a land area of 50.13 ha (0.5013 km<sup>2</sup>) has been acquired at Asebga, in the Bongo District. It is within this site that the associated substation will be developed. In addition, an associated 29 km sub-transmission line with a 15m Right of Way, is to be developed, and this will occupy a total of 0.435 km<sup>2</sup> area. Thus, a total area of 0.9363 Km<sup>2</sup> would be required for the solar power plant and the associated sub transmission line project. Acquisition of land has been completed. Compensation payment has been largely completed and Project Valuation Report, dated May 2016 has been prepared. The ESIA Study shall provide information on affected individual and community properties, and compensation packages that was required for the acquisition of the land and any impacts due to the project.

#### ***7.6.3. Ecological Survey & Habitat Assessment Study***

An assessment of the current ecological status of the project sites is ongoing. This is being performed in line with IFC P6 and World Bank OP 4.04. The study objectives are to:

- List the prominent plant species (trees, shrubs, grasses and other herbaceous species of special interest) present for vegetation unit and ecosystem delimitation.
- Identify plant and animal/faunal species of conservation importance; which could possibly occur at the site.
- Assess impacts of the proposed solar power development on terrestrial ecology, including loss of habitat and habitat fragmentation, potential risks for erosion, impacts on potential ecological corridors, loss of ecosystems services, etc.
- Make recommendation on suitability of site for the project regarding the extent of impacts on ecology.

#### **7.6.4. Archaeological, Historical & Cultural Structural Impact Assessment**

The ESIA Study will continue with a reconnaissance survey to identify available historical and cultural heritage resources that are present in the proposed development area. The following wide range of places and objects are to be investigated during the survey:

- Places, buildings, structures and equipment
- Places to which oral traditions are attached or which are associated with living heritage;
- Historical settlements and townscapes;
- Landscapes and natural features;
- Geological sites of scientific or cultural importance;
- Archaeological and palaeontological sites;
- Graves and burial grounds,
- Movable objects

This assessment shall aim recommending appropriate mitigation measures that will assist VRA in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the National Museums Decree (1969) NLCD 387.

#### **7.6.5. Noise Impact Assessment**

Background noise at the project site has been collated and will be provided in the Main ESIA report. A noise impact assessment study will be undertaken to establish the relationship between the project development noise and the natural masking noise, and to assess anticipated noise levels against established standards (over Ghana/IFC a threshold levels). The baseline noise levels will be assessed qualitatively. It is intended to utilize the “Guidelines for Community Noise Impact Assessment and Mitigation”, March 2011<sup>14</sup>.

The following broad terms of reference have been specified for the noise specialist study:

- Conduct a desktop study of available information that can support and inform the noise study;
- Identify all noise sensitive receptors within the study area;

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<sup>14</sup> I-INCE Technical Study Group on Community Noise: Environmental Noise Impact Assessment and Mitigation (TSG 6)

- Measure the existing ambient noise at the proposed site during both the day and night time;
- Identify potential noise sources and their relative contribution to noise generated by the development;
- Specify methodologies and intervals for noise monitoring to evaluate, assess and report the noise emissions; and
- Consider a range of parameters including topography, location of receptors, weather conditions and seasonal variations that can influence the location and timing of noise measurements required to determine the noise level emitted by other developments within the enclave of the solar farm.

### **7.6.6. Socio-economic Impact Assessment**

The nature of the proposed project requires that both primary and secondary data source will be utilized. Secondary data source will be relied upon for the population of the catch communities involved. Various documentations have been assessed so far at this Scoping Stage. It is envisaged that the proposed solar power project has the potential of affecting communities, settlements, individuals, and business entities and activities in the catchments area, there is the need to undertake primary data collection through a compressive socio-cultural baseline survey.

The main objectives of the baseline survey will be to:

- Document the present socio-economic and socio-cultural situation prevailing within the project footprint before the commencement of the proposed project.
- Ascertain the potential project impacts on the PAPs,
- Recommend appropriate measures to mitigate the negative impacts, and to
- Solicit the views, concerns the expectations of the identified PAPs with respect to the implementation of the proposed project.

Three sets of approaches will be employed to collect primary data:

- Reconnaissance survey/Rapid Rural Appraisal methodology.
- A detailed socio-economic and socio-culture baseline survey will be undertaken by the administration of well-structured questionnaires to households and identifiable stakeholders and

- a. The initial reconnaissance survey discussed earlier was a preliminary survey that was adopted to quickly gather first-hand background information about the catch area in terms of their socioeconomic background characteristics, beliefs and norms, archaeological resources and cultural heritage sites ahead of the detailed survey. This has helped to help pose relevant questions for the questionnaire.
- b. All the communities, settlements/hamlets within an accepted range of project impact will be identified. Depending on the number of identified communities in the project catchments area and on the number of identified households per community, all of these PAPs will be interviewed. If on the other hand the numbers are large, a simple random sampling will be employed to select a statistically representative sample of affected households (respondents) in very community. The household questions will solicit socio-economic, socio-cultural, demographic, information from the respondents, which will include the following, among others as required under the Ghana ESIA process:
  - The land area taken up by the development, its location clearly shown on a map and geographical coordinates provided.
  - Human beings: (population composition and distribution, socio-economic conditions, cultural and ethnic diversity, population growth rate);
  - Land use: (agriculture, forests, industrial, commercial, residential), transportation routes such as roads, rail, water and air, utility corridors)
  - Social services: (electricity, telecommunication, water supply, hospitals, etc);
  - Cultural heritage: (unique features of the area or its people; cemetery, fetish grove, festivals etc).
- c. Consultations with relevant stakeholder in the project footprint. This may take the form of focus group discussions and/ or individual consultations and has been described earlier under Chapter 5. The issues to be considered will include:
  - Knowledge of the project
  - Impact of the project
  - Compensation issues
  - Employment opportunities
  - Corporate social responsibility
  - Community expectations and concerns

The terms of reference for the socio-economic specialist study include:

- To collate the socio-economic baseline data
- Broad level review of the need and financial viability/risks associated with the project. This would be based primarily on information from the client. It is assumed that an adequate assessment of technical and financial feasibility of the project has been conducted to establish viability and justify further assessment of the project in the ESIA phase. Feasibility considerations are assumed to include the generation of carbon credits as a potential income stream.
- Degree of fit with local, regional and national economic development visions and plans including renewable energy plans.
- Impacts on overall economic development potential in the area including impacts on commercial enterprises nearby the site (incl. tourism, agriculture, small businesses and others).
- Impacts associated with project expenditure on direct and indirect employment and household incomes. These impacts would be investigated through an examination of how the project and the spending injection associated with it may impact on the local, regional and national economy. Impacts associated with upstream and downstream economic linkages and spin-offs would also be assessed taking import content and other relevant factors into consideration. Experience from other similar projects and any suitable economic models for the area would be used to assess these impacts.
- Impacts associated with environmental impacts that cannot be mitigated and have economic implications. This would focus on potential negative impacts on neighbouring land owners should they be relevant.

### **7.6.7. Visual Intrusion Assessment**

It is expected to utilise a recognised visual impact assessment methodology, such as “Guidelines for Landscape and Visual Impact Assessment Third edition, Landscaped Institute, Institute for Environmental Management & Assessment and Routledge, 2013”. A desktop review of any existing data and literature on the specialist field of expertise which will inform the rest of the assessment process in terms of documentation (e.g. municipal and regional planning policy, spatial development frameworks, legislation, national and international examples of similar developments) and availability of data (sensitive landscapes and visual receptors, spatial data for visibility analyses and landscape assessment). The desktop review will also provide a basis for evaluating the confidence levels for the overall assessment.

A photographic survey which will use results of the desktop analyses to provide the following:

- Photographic record of landscape elements within the study area.
- Photographic record of the visual baseline for views from principal viewpoints.
- The actual zone of visual influence by determining the effect of vegetation, buildings and topography on visibility in the study area.



- Identification of sensitive receptors (viewers and landscape elements that will be affected by the proposed development).

The landscape baseline should incorporate results from the desktop review and field survey to provide a description of the existing character and condition of the landscape. Factors such as geology, topography, land cover and human settlements that combine ways to form the landscape should be described, as well as the ways they combine to create unique landscape types within the study area. The value attached to the landscape by residents and other sensitive receptors should also be determined.

### **7.7. APPROACH TO IMPACT ASSESSMENT**

This section outlines the assessment methodology to be adopted for the ESIA study.

#### **7.7.1. *Generic TOR for the Assessment of Potential Impacts***

The identification of potential impacts should include impacts that may occur during the construction, operational and decommissioning phases of the development. The assessment of impacts is to include direct, indirect as well as cumulative impacts. To identify potential impacts (both positive and negative) it is important that the nature of the proposed projects is well understood so that the impacts associated with the projects can be assessed. The process of identification and assessment of impacts will include:

- Determining the current environmental conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- Determining future changes to the environment that will occur if the activity does not proceed;
- Develop an understanding of the activity in sufficient detail to understand its consequences; and
- The identification of significant impacts which are likely to occur if the activity is undertaken.

A simple, clearly defined method is used in order to accurately determine the significance of the predicted impact on, or benefit to, the surrounding natural and/or social environment. Nonetheless, an impact assessment will always contain a degree of subjectivity, as it is based on the value judgment of various specialists and Environmental Assessment Practitioners. The evaluation of significance is thus contingent upon values, professional judgement, and dependent upon the environmental and community context. Ultimately, impact significance involves a process of determining the acceptability of a predicted impact to society. The following methodology is to be applied to the predication and assessment of impacts:

- **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
- **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity.
- **Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. The cumulative impacts will be assessed by identifying other applicable projects, such as construction and upgrade of electricity generation, and transmission or distribution facilities in the local area (i.e. within 20 km of the proposed WPP1 project) that have been approved (i.e. positive EP has been issued) or is currently underway. The proposed and existing developments that will be considered as part of the ESIA Phase is provided in Chapter 6 of this Scoping Report.
- **Nature of impact** - this review the type of effect that a proposed activity will have on the environment and should include “what will be affected and how?”
- **Potential Intensity**

<u>Potential Intensity Description (negative)</u>	<u>Rating</u>	<u>Score</u>
<b>Potential to severely impact Human Health (morbidity/mortality); or to lead to Loss of species<sup>15</sup> (fauna and/or flora)</b>	Very High/Fatal Flaw	16
<b>Potential to reduce faunal/flora population or to lead to severe reduction/alteration of natural process, loss of livelihoods or sever impact on quality of life<sup>16</sup>, individual economic loss</b>	High	8
<b>Potential to reduce environmental quality – air, soil, water. Potential Loss of habitat, loss of heritage, reduced amenity</b>	Medium	4
<b>Nuisance</b>	Medium-Low	2

<sup>15</sup> Note that a Loss of species is a global issue and is differentiated from a loss of “flora/fauna” population

<sup>16</sup> Note that a visual impact or air emissions for example could be considered as severely impacting on quality of life should it constitute more than a nuisance but not being life threatening

Negative change – with no other consequence	Low	1
<b>Potential Intensity Description (positive)</b>	<b>Rating</b>	<b>Score</b>
Potential Net improvement in human welfare	High	8
Potential to improve environmental quality – air, soil, water. Improved individual livelihoods	Medium	4
Potential to lead to Economic Development	Medium-Low	2
Potential positive change – with no other consequence	Low	1

Note that the concept of “irreplaceable loss of a resource” is to be taken into account in the Potential Intensity score of an impact

- **Irreplaceability of resource** loss caused by impacts –
  - High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment. For example, if the project will destroy unique wetland systems, these may be irreplaceable);
  - Moderate irreplaceability of resources;
  - Low irreplaceability of resources; or
  - Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).
  
- **Spatial extent** – The size of the area that will be affected by the risk/impact:

Extent Description	Score
Site specific	1
Local (<10 km from site)	2
Regional (within 100 km of site)	3
National	4
International/Global (e.g. Greenhouse Gas emissions or migrant birds).	5

- **Duration** – The timeframe during which the risk/impact will be experienced:  
The concept of “reversibility” is reflected in the duration scoring. I.e. the longer the impact endures the less likely it will be reversible.

Duration Description	Score
Temporary (less than 2 year) or duration of the construction period. This impact is fully reversible. <i>E.g. the construction noise temporary impact that is highly reversible as it will stop at the end of the construction period</i>	1
Short term (2 to 5 years). This impact is reversible.	2
Medium term (5 to 15 years). The impact is reversible with the implementation of appropriate mitigation and management actions.	3
Long term (> 15 years but where the impact will cease after the operational life of the activity). The impact is reversible with the implementation of appropriate mitigation and management actions. <i>E.g. the noise impact caused by the desalination plant is a long term impact but can be considered to be highly reversible at the end of the project life, when the project is decommissioned</i>	4
Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient). This impact is irreversible. <i>E.g. The loss of a palaeontological resource on site caused by construction activities is permanent and would be irreversible.</i>	5

▪ **Reversibility of impacts -**

- High reversibility of impacts (impact is highly reversible at end of project life, i.e. this is the most favourable assessment for the environment. For example, the nuisance factor caused by noise impacts associated with the operational phase of an exporting terminal can be considered to be highly reversible at the end of the project life);
- Moderate reversibility of impacts;
- Low reversibility of impacts; or
- Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment. The impact is permanent. For example, the loss of a palaeontological resource on the site caused by building foundations could be non-reversible).

Using the criteria above, the impacts will further be assessed in terms of the following:

- **Probability** – The probability of the impact/risk occurring:

Probability Description	Score
Improbable (little or no chance of occurring <10%)	0.1
Low Probability (10 - 25% chance of occurring)	0.25
Probable (25 - 50% chance of occurring)	0.5
Highly probable (50 – 90% chance of occurring)	0.75
Definite (>90% chance of occurring).	1

- **Magnitude**–The anticipated severity of the impact (Intensity + Extent + Duration):
  - Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);
  - Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or
  - Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).
  
- **Significance** – Will the impact cause a notable alteration of the environment? To determine the significance of an identified impact/risk, the consequence is multiplied by the probability (as shown below).

**Significance rating = Impact magnitude \* Probability**

**Impact Magnitude = Potential Intensity + duration + extent**

*Table 7-2: Guide to assessing risk/impact significance as a result of consequence and probability*

Scoring	Significance rating	Description
18-26	<b>Fatally flawed</b>	The project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating.
10 - < 18	<b>High</b>	The impacts will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making.

<b>Scoring</b>	<b>Significance rating</b>	<b>Description</b>
5 - <10	<b>Medium</b>	The impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures and will only have an influence on the decision-making if not mitigated.
2 - <5	<b>Low</b>	The impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures and will not have an influence on decision-making.
<2	<b>Very Low</b>	The impact may result in very minor alterations of the environment and can be avoided through the implementation of mitigation measures.

- **Status** - Whether the impact on the overall environment (social, biophysical and economic) will be:
  - Positive - environment overall will benefit from the impact;
  - Negative - environment overall will be adversely affected by the impact; or
  - Neutral - environment overall will not be affected.
  
- **Confidence** – The degree of confidence in predictions based on available information and specialist knowledge:
  - Low;
  - Medium; or
  - High.

Where appropriate, national standards will be used as a measure of the level of impact.

**7.7.2. Mitigation and Assessing Residual Impacts**

As specified in Section 12 of part II of the ESIA Regulations, appropriate mitigation measures will be identified to eliminate, minimise or manage identified potential significant environmental effects. The following will be considered:

- Embedded or inherent mitigation - mitigation which is built in to the project during the design process.
- Mitigation of significant effects or key mitigation (pertinent measures that will be written into and enforced through the EMP for implementation to ensure that the significance of the associated impact is acceptable).
- Mitigation of non-significant effects or additional mitigation (management actions to be considered by proponent and authority).

- Enhancement measures.

Impacts will be described both before and after the implementation of the proposed mitigation and management measures. It is expected that for the identified significant impacts, the project team will work with the client in identifying suitable and practical mitigation measures that are implementable. Mitigation that can be incorporated into the Project design in order to avoid or reduce the negative impacts or enhance the positive impacts will be developed. A description of these mitigation measures will also be included within the Environmental Management Plan (EMP).

Residual impacts are those impacts which remain once the mitigation measures have been designed and applied. Following the identification of mitigation measures to address significant adverse effects, an assessment of the significance of any residual effects (i.e. those remaining after mitigation) will be completed. The result is a significance rating for the residual impact.

### **7.7.3. *Proposed Monitoring***

After the completion of the assessment, proposals for monitoring requirements will be put forward where relevant. Proposals for monitoring will be designed to evaluate the accuracy of the impact prediction and the success of any implemented mitigation measures.

### **7.7.4. *Dealing with Uncertainty***

Even with a final design and an unchanging environment, impacts are difficult to predict with certainty, but in projects such as the proposed wind power project, where the design process is currently in progress, uncertainty stemming from on-going development of the Project design is inevitable, and the environment is typically variable from season to season and year to year. Where such uncertainties are material to the ESIA findings, they are clearly stated and are approached conservatively ('the precautionary approach') in order to identify the broadest range of likely residual impacts and necessary mitigation measures.

Potential impacts may be assessed using tools ranging from quantitative techniques such as modelling to qualitative techniques based on expert judgment and historical information. The accuracy of these assessment tools depends on the quality of the input data and available information. Where assumptions have been made, the nature of any uncertainties associated with the assumption is discussed. For qualitative predictions/assessments, some uncertainty is removed through consultation. These uncertainties are reflected in the Confidence level scoring.

## **7.8. CONTENT OF ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT REPORT**

Annex B to Operational Procedures 4.01 provides an outline of the information that should be included in a full EIA Report. The ESIA Team will collate all the gathered and generated information and data into an ESIA Report and submit same toward the acquisition of an environmental permit. The process and outputs of the Environmental Assessment is intended to meet the formal requirements of Ghana's EPA and will be therefore structured in line with the revised format for ESIA Reports released by the Ghana EPA in 2016.

The format will be as follows:

### **COVER PAGE**

- Name of Company/Proponent
- Title of Report
- Name of Consultant (s)
- Month and year of submission

### **SIGNATURE PAGE**

- Leader Team of Consultant
- Name: Signature
- Acceptance and declaration by Proponent
- Name Signature

The text will be presented under the following headings:

- Non-Technical Executive summary
- Introduction
- Policy, Legislative and Administrative Requirements
- Description of proposal and alternatives
- Description of existing environment/baseline
- Stakeholder consultation
- Impacts identification and significance
- Mitigation and enhancement measures
- Provisional Environmental Management Plan
- Reclamation/Decommissioning
- Conclusion

The ESIA report will also include a Table of Contents, a Glossary of Terms and Abbreviations and a Reference List and Annexes. The ESIA report will provide maps, figures and process diagrams to facilitate understanding of the descriptive elements of the report. The font style will be Size 12 of Times New Roman, with a 1.5 spacing and printed on both sides.



**7.9. SCHEDULE FOR ESIA**

It is expected that the ESIA Study will be completed for the issuance of an environmental authorisation latest by November 2018. The key milestones for the process are summarised in

*Table 7-3* and the proposed schedule to achieve this provided in *Table 7-4*. It should be noted that this schedule could be revised during the ESIA Process, depending on factors such as the time required for decisions from authorities.

Table 7-3: Key Milestones of the ESIA Process

Key Milestones activities	Proposed Timeframe
Submit Scoping Reports to the EPA for Decision-making.	March 2018 (Current Stage)
I&AP, Stakeholder and Authority Review of the Scoping Reports	April – May 2018
Review of the Scoping Reports by the EPA (i.e. accept or refuse EA)	April – June 2018
Local Stakeholder Event	May 2018
Submit Draft ESIA Reports to the EPA for Decision-making.	June 2018
I&AP, Stakeholder and Authority Review of the Draft ESIA Reports	June – August 2018
Submit Final ESIA Report to the EPA for Decision-making.	November 2018
<b>Next steps: Notification to applicant</b>	

**40MW Bongo Solar Power Project – Environmental Scoping Report**

*Table 7-4: Proposed schedule for the ESIA*

		2017 Q4			2018 Q1			2018 Q2			2018 Q3			2018 Q4			2019 Q1		
Phase	Task	10	11	12	1	2	3	4	5	6	7	8	9	10	12	13	1	2	3
Pre-application Phase	– Pre-application work (Project Description) & consultation with EPA	■	■	■															
	– Project announcement (BID, adverts, &vSite Visit		■	■															
	– Prepare Scoping Report			■	■	■	■	■											
Scoping Phase	– Submit Scoping Report to EPA						■	■	■										
	– Review of Scoping Report by Public						■	■	■										
	– Receipt of Review Comments on SR																		
ESIA Phase	– Independent Specialist studies			■	■	■	■												
	– Local Stakeholder event								■	■									
	– Compile/Submit Draft ESIA Report to EPA								■	■									
	– PPP 2 - 60 days										■	■							
	– Integrate comments and submit EIR to EPA										■	■							
<i>End of ESIA phase</i>	– EPA to grant/refuse EA												■	■	■				
Notification phase	– EPA to provide feedback														■				
	– Notify I&AP/s of EA decision															■	■	■	■

## CHAPTER 8 REFERENCES

1. 2010 Population & Housing Census, District Analytical Report, Bongo District Assembly, October 2014.
2. 2010-13 Medium Term Development Plan for the Bongo District Assembly.
3. 2014-17 Medium Term Development Plan for the Bongo District Assembly.
4. Bongo District Water & Sanitation Plan, August 2008.
5. Bongo Solar Power Project - Draft Feasibility Study, August 2017
6. Bongo Solar Power Project, Valuation Report on Economic Trees, May 2016
7. Environmental Impact Statement of Limbe Power Project, September 2003
8. Environmental Scoping for the Proposed New Route at P166/12 at Mbombela, Mpumalanga Province, February 2014
9. Preliminary Environmental Report (Updated) for the 12 MW Upper West Regional Solar Power projects, June 2014
10. Preliminary Environmental Report for the 2.5 MW Navrongo Solar Power Plant, 2013
11. Report on Acquisition of Site, Bongo Power Project, June 2014
12. School Report Card, Ghana Education Service, Bongo District, 2016

## CHAPTER 9 APPENDICES

- Appendix 1 - EPA Response Letter to Project Registration
- Appendix 2 - Documentations on Land Acquisition
- Appendix 3 - Some pictures of the stakeholder engagements process
- Appendix 4 - List of Interested & Affected Persons Consulted so far.
- Appendix 5 - Sample of the Scoping Notice

## APPENDIX 1: EPA RESPONSE LETTER TO PROJECT REGISTRATION

**Tel:** (0302) 664697 / 664698 / 662465  
667524 / 0289673960 / 1 / 2  
**Fax:** 233 (0302) 662690  
**Email:** info@epa.gov.gh



### Environmental Protection Agency

P. O. Box MB 326  
Ministries Post Office  
Accra

**Website:** <http://www.epa.gov.gh>

Our Ref: CE: 6384/01/02

October 26, 2017

The Chief Executive Officer  
Volta River Authority  
Electro Volta House  
P.O. Box MB 77  
Accra

Dear Sir,

**ENVIRONMENTAL IMPACT ASSESSMENT (EIA)**  
**20MW BONGO SOLAR PHOTOVOLTAIC POWER PROJECT**

We acknowledge receipt of your letter dated October 10, 2017, submitted to the Agency for the purpose of obtaining environmental approval for the above proposal in accordance with the Environmental Assessment Regulations 1999, (LI 1652)

The proposal falls in the category of undertakings (Regulation 3) for which Environmental Impact Assessment (EIA) is required to help understand the likely implications of the proposal, the relevant alternatives and mitigations to consider in order to ensure sound decision-making and sustainable development of the project.

However, in line with Regulation 11 of LI 1652, you are advised to carry out a scoping exercise to generate the relevant terms of reference (TOR) to guide satisfactory EIA study of the proposal.

Please note that scoping is meant to focus the EIA on the key issues, concerns and decision areas and solicit input and guidance of all relevant stakeholders on the TOR. Scoping notices must be served as appropriate to facilitate stakeholder involvement (see attached sample). Six (6) hard copies of the scoping report must be submitted to the Agency for study and agreement on the TOR, prior to the EIA studies.

It is important that the Scoping Report and Environmental Impact Statement contains information on the consultants who prepared the reports. This should include the names, address, email, telephone, experience and their specific contribution to the study. Failure to provide this information would render the submission incomplete.

Do not hesitate to contact the Agency (Head Office Room 305) and the EPA Upper East Regional Office, Bolgatanga for any further guidance you may require in this regard.

Yours faithfully,

  
**KWABENA BADU-YEBOAH**  
**AG. DIRECTOR/ EAA DIVISIO**  
**FOR: EXECUTIVE DIRECTOR**

*CC: The Regional Director, EPA, Upper East, Bolgatanga*

## APPENDIX 2: VRA ESIA STUDY TEAM

Contact Details	Qualification	Role/Study to Be Undertaken
<p>Name: Ben A. Sackey</p> <p>Email: <a href="mailto:ben.sackey@vra.com">ben.sackey@vra.com</a></p> <p>Mobile: 0243344779</p>	<ul style="list-style-type: none"> <li>• BSc Biochemistry</li> <li>• MPhil Food Science</li> <li>• PG Cert. OSHM</li> <li>• Cert. in PPM</li> <li>• Certified Env. Auditor</li> <li>• Certified ISO 14001 EMS Implementor</li> <li>• Member, IAIA</li> </ul>	<p>ESIA Team Leader</p> <ul style="list-style-type: none"> <li>• Undertake rapid socio-economic and environmental appraisal of project area</li> <li>• Lead expert responsible for data collection and literature review</li> <li>• Provide inputs in the determination of the Present Ecological State and Ecological Importance and Sensitivity of any ecological sensitive areas</li> <li>• Lead in Public Consultation Process</li> <li>• Due diligence for quality project reporting</li> <li>• Drafting Reports and Quality Assurance</li> </ul>
<p>Name: Godfred Ofosu-Asare</p> <p>Email: <a href="mailto:godfred.ofosu-asare@vra.com">godfred.ofosu-asare@vra.com</a></p> <p>Mobile: 0243503588</p>	<ul style="list-style-type: none"> <li>• BSc Chemistry</li> <li>• MSc in Env. Science</li> <li>• Member, IAIA</li> </ul>	<p>ESIA Specialist</p> <ul style="list-style-type: none"> <li>• Environmental Management Expert / ESIA Specialist</li> <li>• Supervision and coordination for effective implementation of project activities.</li> <li>• Baseline ambient noise/air quality study</li> <li>• Conduct interviews and collect relevant oral accounts, including migration and settlement histories of descendant communities in the project areas</li> <li>• Due diligence for quality project reporting</li> <li>• Partake in public education/stakeholder consultations</li> <li>• Review and assure timely compilation and submission of all reports.</li> <li>• Coordinate preparation of project Environmental Scoping as well as Detailed ESIA reports</li> </ul>
<p>Name: Lloyd Kofi Sutherland</p> <p>Email: <a href="mailto:lloyd.sutherland@vra.com">lloyd.sutherland@vra.com</a></p> <p>Mobile: 0241370926</p>	<ul style="list-style-type: none"> <li>• BSc in Biochemistry</li> <li>• MSc in Env. Science;</li> <li>• NEBOSH-IGC</li> <li>• Member, IAIA</li> </ul>	<p>ESIA Specialist</p> <ul style="list-style-type: none"> <li>• Environmental Management Expert / ESIA Specialist</li> <li>• Supervision and coordination for effective implementation of project activities</li> <li>• Baseline ambient noise/air quality study</li> <li>• Due diligence for quality project reporting</li> <li>• Partake in public education/stakeholder consultations</li> <li>• Review and assure timely compilation and submission of all reports.</li> <li>• Coordinate preparation of project Environmental Scoping as well as Detailed ESIA reports</li> </ul>
<p>Name: Baffo Blankson</p> <p>Email: <a href="mailto:baffo.blankson@vra.com">baffo.blankson@vra.com</a></p> <p>Mobile: 0200366511</p>	<ul style="list-style-type: none"> <li>• Forestry Certificate</li> <li>• BSc Environment &amp; Natural Resource Management,</li> <li>• MSc in Env. Science (ongoing)</li> </ul>	<p>Natural Resource Management Specialist</p> <ul style="list-style-type: none"> <li>• Responsible for supervision of data collection and literature review of biological environment</li> <li>• Identify floral species around environmental influences of the project</li> <li>• Draw up a list of floral and faunal species in the study area and identifies environmental impacts.</li> <li>• Partake in public education/stakeholder consultations</li> </ul>

<p>Name: Frederick Kyei-Dompreh  Email: <a href="mailto:fred.kdompreh@vra.com">fred.kdompreh@vra.com</a>  Mobile: 030-2660078</p>	<ul style="list-style-type: none"> <li>• BSc. (Hons) Land Economy;</li> <li>• MBA</li> <li>• Member-GhIS</li> </ul>	<p>Property Valuation Expert</p> <ul style="list-style-type: none"> <li>• Valuation Expert responsible for valuation of all properties</li> <li>• Measure, describe and record vital ethnographic objects and surface archaeological materials in project areas</li> <li>• Partake in public education/stakeholder consultations.</li> <li>• Lead in the preparation of the “Property Valuation Report”.</li> </ul>
<p>Name: Kofi Orstin  Email: <a href="mailto:kofi.ortsin@vra.com">kofi.ortsin@vra.com</a>  Mobile: 0244234336</p>	<ul style="list-style-type: none"> <li>• BSc. (Hons) Land Economy;</li> <li>• Member-GhIS</li> </ul>	<p>Property Valuation Expert</p> <ul style="list-style-type: none"> <li>• Valuation Expert responsible for valuation of all properties</li> <li>• Conduct interviews and collect relevant oral accounts, including migration and settlement histories of descendant communities in the project areas</li> <li>• Measure, describe and record vital ethnographic objects and surface archaeological materials in project areas</li> <li>• Partake in public education/stakeholder consultations.</li> <li>• Assist in the preparation of the “Property Valuation Report”.</li> </ul>
<p>Name: Ebenezer Kojo Antwi  Email: <a href="mailto:ebenezer.antwi@vra.com">ebenezer.antwi@vra.com</a>  Mobile: 0260438891</p>	<ul style="list-style-type: none"> <li>• BSc. Electrical Engineering</li> <li>• Member-GhIE</li> </ul>	<p>Electrical Engineer</p> <ul style="list-style-type: none"> <li>• Development of project technical feasibility report</li> <li>• Project design and layouts</li> <li>• Partake in public education/stakeholder consultations Due diligence for quality project reporting</li> <li>• Provide quality assurance in the preparation of project Environmental Scoping as well as detailed ESIA Reports.</li> </ul>
<p>Name: Linus Abenney-Mickson  Email: <a href="mailto:linus.mickson@vra.com">linus.mickson@vra.com</a>  Mobile: 0208889688</p>	<ul style="list-style-type: none"> <li>• BSc. Electrical Engineering</li> <li>• Member-GhIE</li> </ul>	<p>Electrical Engineer</p> <ul style="list-style-type: none"> <li>• Development of project technical feasibility report</li> <li>• Project design and layouts</li> <li>• Partake in public education/stakeholder consultations Due diligence for quality project reporting</li> <li>• Provide quality assurance in the preparation of project Environmental Scoping as well as detailed ESIA Reports.</li> </ul>
<p>Name: Khalilu-lahi Abdulai  Email: <a href="mailto:abdulai.khalilu-lahi@vra.com">abdulai.khalilu-lahi@vra.com</a>  Mobile: 0204544074</p>	<ul style="list-style-type: none"> <li>• BSc. Mechanical Engineering</li> <li>• Member-GhIE</li> </ul>	<p>Mechanical Engineer</p> <ul style="list-style-type: none"> <li>• Development of project technical feasibility report</li> <li>• Project design and layouts</li> <li>• Partake in public education/stakeholder consultations Due diligence for quality project reporting</li> <li>• Provide quality assurance in the preparation of project Environmental Scoping as well as detailed ESIA Reports.</li> </ul>
<p>Name: Lawrence Addipa  Email: <a href="mailto:lawrence.addipa@vra.com">lawrence.addipa@vra.com</a>  Mobile: 0509180415</p>	<ul style="list-style-type: none"> <li>• MSc. Geomatic Engineering</li> <li>• Diploma in Mine Surveying</li> </ul>	<p>Geodetic Surveyor</p> <ul style="list-style-type: none"> <li>• Coordinate surveying of project area</li> <li>• Production of Maps for project technical feasibility report.</li> </ul>

**CONFIDENTIAL**



CONFIDENTIAL

APPENDIX 4: SOME PICTURES OF THE STAKEHOLDER ENGAGEMENTS PROCESS



Pacification Rights by Traditional Authority to enter Asigba Land Site



Meeting with Bongo Traditional Authority





**Consultations with the Upper East Regional Coordinating Council**



**Consultations with the Bongo District Assembly**



**Consultations with District Education Office**



**Consultations with District Fire Service**



**Consultations with District Health Service**



**APPENDIX 5: LIST OF INTERESTED & AFFECTED PERSONS CONSULTED TILL DATE**

<b>Stakeholder</b>	<b>Name</b>	<b>Position</b>	<b>Contact Address</b>	<b>Contact Number</b>
<b>Bolgatanga Regional Coordinating Council</b>	Ayambire Akaditi	Deputy Director	P. O. Box 105, Bolgatanga	0244884712
	Godwin A. Nkuru	Public Relation Officer		0209378764/ 0547333272
	Hon. James Zoogah	Immediate Past Regional Minister		
	Hon. Daniel Aweyme Syme	Immediate Past Deputy Regional Minister		
<b>Bolgatanga Municipal Assembly</b>	Edward Ayagle	Municipal Chief Executive	P. O. Box 38, Bolgatanga	038-20-22214 / 22534
<b>Bongo District Assembly</b>	Ebenezer Asomaning	Water & Sanitation Engineer	P. O. Box 1, Bongo	0249419063
	Issaka Mohammed	Internal Audit		0200330607
	Sibaway Ahmed	District Budget Office		0244458910
	Fawei Issifu Mohammed	District Coordinating Director		0243645512
	Abubakar W.A Bila	District Planning Officer		0243768724
	David Aruk	Head Of Works		0249364844

Stakeholder	Name	Position	Contact Address	Contact Number
	Mohammed Mubarak	Senior Procurement Assistant		0244011002
	Ayinbisa A. Peter	District Chief Executive		0244940509
	Atayom Cosmos Mba	Assemblyman		0200211240
	Joseph Arizie	Area Engineer		0208156299
	Yakubu Bukari	Technician Engineer		0208777191
<b>Bongo District Health Administration</b>	Bantin Cabral	DNO	P. O. Box 1, Bongo	0200956334
	Aminu Mashoud	Deputy Chief Accountant		0507369910
	Yamusah Salifu	CHPS Coordinator		0203030001
	Faustina Anabile	Enroll Nurse, Adaboya Clinic		0245721944/0507361822
<b>Bongo District Education Office</b>	Ayamga Christiana	AD II/ CPC	P. O. Box 1, Bongo	0242388575
	Yadeh Evelyn	AD II/SHEP		0209021852
	Adindaa Rose	AD I/2ND CYCLE COORDINATOR		0207928251
	James Asampana	AD II/BUDGET		0208784246
	Linus Akolgo Amigra	PS/ STATISTICS		0246924278
	Stephen Akuba	AD I / SENCO		0246776500
	Abamah Rita	AD II/ DGEO		0203104846
	Awine David K.	A/D SUPERVISION		0200816055
	Nicholas N. Kolog	A/D HRMD		0243635330

Stakeholder	Name	Position	Contact Address	Contact Number
	Ayariga Joseph A	C/S, SOUTH		0208379158
	Agambure Paul	C/S, NORTH		0203517670
<b>Northern Electricity Distribution Company</b>	Frank Akligo	Managing Director	NEDCo, Box TL 77, Tamale	0208162454
	Moses Tawiah	Director, Engineering Services		0244546588
	Mohammed Tayeb Tampuri	Electrical Engineer		0548588853
	Ms. Victoria Kotia Bugri	Area Manager		0205687785
	Joseph Arizie	Area Engineer		0208156299
	Justice Abban	Engineer		0200795502
	Moses Anaba	Senior Watchman		0209779731
Bongo Customary Land Secretariat	Musah Salifu			
<b>Bongo Traditional Authorities</b>	Bonaba Baba Saklifu Lemyaaron	Paramount Chief	Bongo Traditional Authority	0249805087
	Atayom Cosmos	Assemblyman		0200211240
	Sam Abata	Elder		0244118640
	Azengoo Aduko	Elder		0246913800
	Naazo Anaba	Chief Linguist		
	Apolle Mwee	Elder		
	Aduko Agana	Elder		
	Ishmeal Salifu	Elder		0243931129
	Yinne-Tun Abudu	Elder		
	Asampana Abugalaa	Elder		
	Ayam Ga Adugbile	Elder		
Azumah Anaba	Elder			

Stakeholder	Name	Position	Contact Address	Contact Number
	Kobina Abugbile	Elder		0242383825
<b>Ghana National Fire Service</b>	Aduko Nyaaba Joseph	Leading Fireman	P. O. Box 20, Bongo	0506373144
	Ayiredine Patritus	Station Officer II		0249443588
	Abaje Sixtus Kaba	Assistant Station Officer		0506110303
	Salifu Mariam	Leading Fire Woman		0245983346
	Adugbire John	Subordinate		0508165238
	Felix Akpaloo	District Fire Officer		0249721923
Irrigation Company of Upper Region (ICOUR) – Vea Irrigation Project	Alhaji Issah Bukari	Managing Director	Box 780 Accra	0244577663
	Sebastian Bagira	Deputy Managing Director		0244599393
	Iddrisu Seidu	HR Manager		
Lands Commission (Upper Region) East	Charles Agama	Regional Valuer	P. O. Box 463 Bolgatanga	0244535106
	Erxi Mwin	Regional Lands Officer		0202857941
Farmers	Abongo Asempana	Farmer	Asegba Community	
	Aduko Asempana	Farmer		
	Anamdita Arku	Farmer		
	Asabsu Anafo	Farmer		
	Akologu Anafo	Farmer		
	Awini Ngange	Farmer		
	Ayambila Muntala	Farmer		0202384178
	Akaliga Nyamba	Farmer		



<b>Stakeholder</b>	<b>Name</b>	<b>Position</b>	<b>Contact Address</b>	<b>Contact Number</b>
	Mba Akiske	Farmer		

## APPENDIX 6 : SAMPLE OF THE SCOPING NOTICE

# SCOPING NOTICE

The Volta River Authority (VRA) proposes to construct and operate a 40MW solar power plant and associated electrical infrastructure on a 0.5013 km<sup>2</sup> of land at Asebga, in the Bongo District in the Upper East Region of Ghana. The project would involve the installation of ground mounted single axis Photovoltaic Voltaic (PV) panels which will tie into the national electricity grid. Basically, electricity from the solar power plant would be evacuated at 34.5kV voltage level and a sub-transmission line, of approximately 29 km with a wayleave of 15m, would be constructed from the solar power plant and would terminate on the 34.5kV bus at the Bolgatanga Substation, in the Bolgatanga Municipality also in the Upper East Region. The project is titled the “**40MW Bongo Solar Power Project**”.

Notice of the proposed “**40MW Bongo Solar Power Project**” is hereby served for public information, as required under the procedures for the conduct of EIA in accordance with Regulation 15(1) of LI. 1652.

Any person(s) who have an interest, concern, or special knowledge relating to potential environmental effects of the proposed undertaking may contact or submit such concerns, etc., to:

The Chief Executive  
Volta River Authority  
P. O. Box MB 77, Accra  
Tel No: +233-302-664941-9  
Fax: +233-30-2662610  
Email: [corpcomm@vra.com](mailto:corpcomm@vra.com)

**AND**

The Executive Director  
Environmental Protection Agency  
P. O. Box M 326, Accra  
Tel No: +233-302-664697/8  
Fax No: +233-302-662690  
Email: [info@epa.gov.gh](mailto:info@epa.gov.gh)



**VOLTA  
RIVER  
AUTHORITY**

**Not later than June 1, 2018**