Alpin Sun GmbH & Ghanalight Project Ltd
Preliminary Licence Application.
All Exhibits including WS9 Feasibility Report

Pre-Feasibility Study for a 20MW Solar Farm at Simbrofo - Central region

CONSULTANTS - INPUT from
PTL TECHNOLOGIES LTD - GHANA

DAVID TAMAKLOE MD GHANALIGHT LTD UK
WWW.GHANALIGHT.COM

Report by **Alan Brewer** of **Ghanalight Ltd & PSECC Ltd** in the UK and Michael Makado PTL Technologies Ltd, Victor Andrew - +2335 4336 3605 email victorandrew27@yahoo.co. Mike Mikado Tel - 0204218532 email - mikemikado@gmail.com or David Tamakloe email david@ghanalight.com or alan@ghanalight.com & Dan Walker **Alpin Sun GmbH** email dan.walker@alpin-sun.de
Website: www.alpin-sun.de

Table of Contents

Abstract Summary of Simbrofo 20MW Solar Farm

WS9 Feasibility Report - Provide a Feasibility Study Report on the new 20MW Solar Farm facility at Gomoa Simbrofo.

Simbrofo in the Gomoa District of the Central Region of Ghana in West Africa
Simbrofo is a populated place and is located in Ghana. The estimate terrain elevation above sea level is 20 metres.

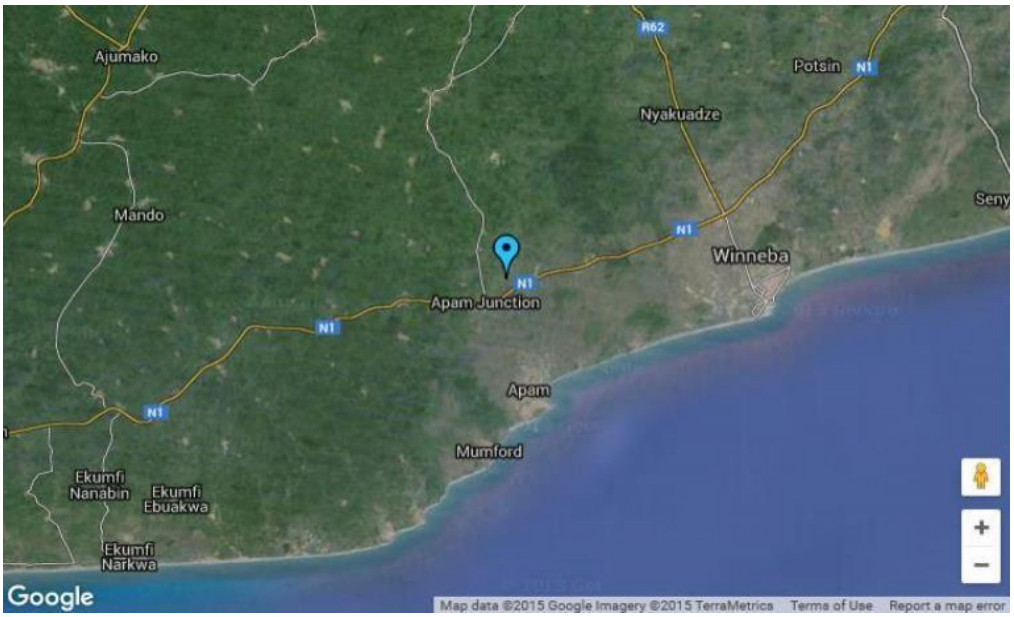
Latitude: 5°21'59.0" N Longitude:0°45'09.8''W

Alpin Sun GmbH **Website: www.alpin-sun.de** wish to build as EPC a 20MW Solar Farm at Gomoa Simbrofo with Ghanalight Project Ltd. A Special Purpose Vehicle (SPV) company Ghanalight Project Ltd will be established by Ghanalight Ltd to take forward this Alpin Sun GmbH company project. A prefeasibility impact study of a solar power plant project was carried out by us with input from PTL Enterprises Ltd, the appointed Consultancy Company of Ghanalight Project Ltd in January 2016 in order to study and search the best location to Install a concentrated solar power plant in Simbrofo Central. The investors were determined to obtain a site with a maximum possible irradiation. Ghanalight Ltd the UK parent company of Ghanalight Project Ltd have been given permission in October 2015 from the Ministry of Power to proceed to full feasibility once a Preliminary and Full Licence has been obtained from the Energy Commission.

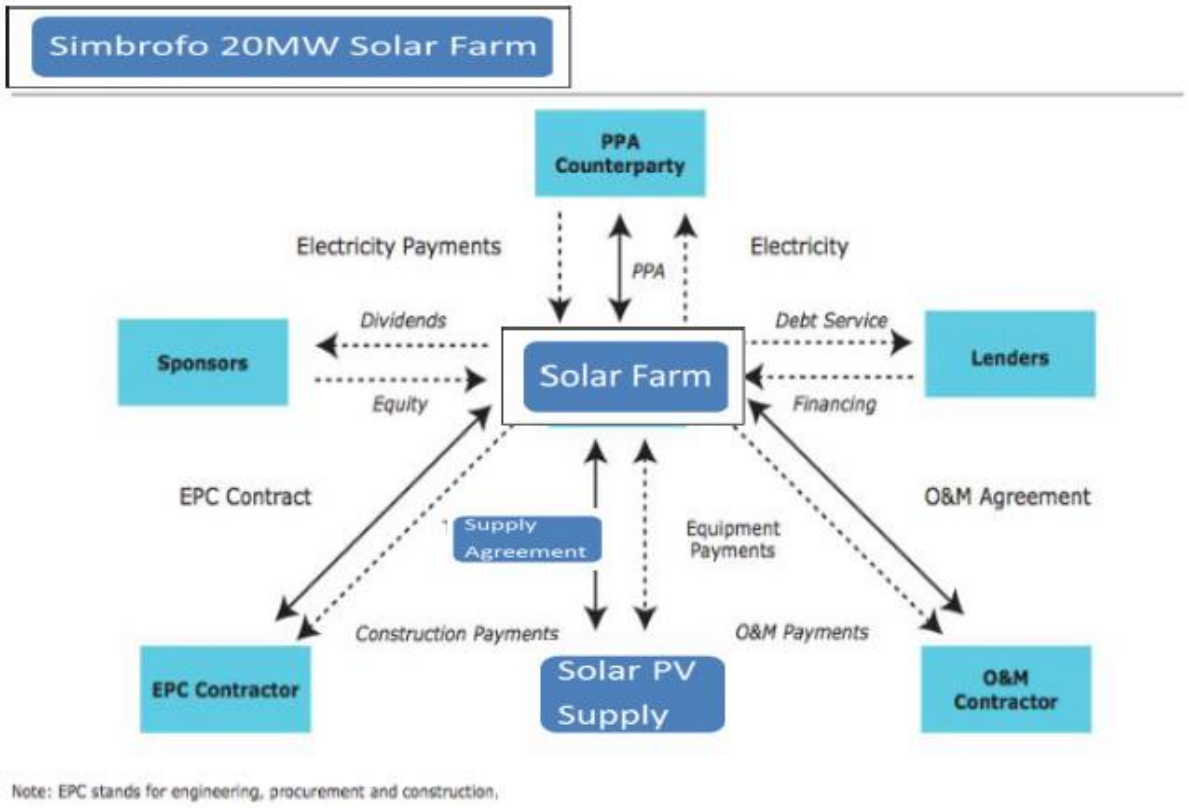
The Chiefs who own the Land in Simbrofo have given their permission and will receive part of the revenue from the solar farm, which will be used to build a school and provide FREE Solar PV panels for homes in villages around the Solar Farm together with Solar PV Water Pumps and Solar Street Lighting can be arranged.
National Development programmes in the Co u n t r y of Ghana will see increased Climate Change and Renewable Energy being produced thus making it possible for Ghana to accelerate Growth in the Country resulting in electricity. This economic, social and political changes in coming years' production, Industrializing, middle-income economic development are pillars aimed at improving the living standards for all Ghana through an economic development program, through which the country is expected to achieve a good average Gross Domestic Product (GDP) growth rate. The Solar Farm electricity, 55,000 MWh each year will be sold to ECG or Volta River Authority.

We wish to submit to the Ghana Government our Feed-In-Tariff Expression of Interest (EOI) & Pre Build Feasibility Study to gain **Preliminary Licence** for authorisation to build a 20MW Solar Farm in Gomoa Simbrofo Ghana for the great people of Ghana to receive Renewable Energy (electricity) from the Solar Farm. Our Simbrofo Solar Farm can assist the level of economic development determines the intensity of energy use; as economic systems in developing countries expand, so is the demand for energy to power production activities (Winkler, 2005; UN-Energy/Africa, 2011). The Ghana vision and strategy identifies energy as one of the key infrastructural enablers, necessary for the realization of its sustainable objectives. The Vision is expected to increase demand on Ghana's energy supply. Our other partner company Ghanalight Ltd intend to assist Ghana with 40,000 MWh per year of electricity from the Simbrofo Solar Farm. With the current energy shortages and supply disruptions in Ghana our solar farms will help. High cost remains serious obstacles to the domestic and manufacturing sector in liberalized markets, the cost of energy significantly influences the Competitiveness of local products vis.-à-vis imported goods. Consequently, a high cost of energy negatively affects domestic wealth creation, balance of payments and employment creation, as consumers opt for cheaper imports (Gok, 2012a; Karekezi and Kimani, 2009). We understand the Government of Ghana are undergoing a restructuring of the Energy sector, this scenario necessitates the establishment of new projects such as our Simbrofo Solar Farm to step-up energy supply at a

lower cost and increase efficiency in energy consumption (GoK, 2012a). Universal access to Sustainable, affordable and clean energy Renewable Energy such as Solar Farms is instrumental for the realization of Ghana. The main objective is to gain a Preliminary Licence and FIT for our Simbrofo Solar Farm project and to generate power and to feed into the National Grid and earn revenue through Power Purchase Agreements (PPA) – Government and electricity distributer "Electricity company of Ghana" Volta River Authority (VRA).



Gomoa Simbrofo 20MW Solar Farm site indicated by Blue marker, below, project interaction details.



Requirements to get to a build stage.

Phase One – This is this current stage in this Application being made

Goals

Prepare information package for Provisional License ("PL") Application.

- Obtain a FiT

-Prepare a Feasibility Studies and other required documentations for submission to Energy Commission.(primarily for PL application)

- Obtain Provisional License (PL)

Phase Two – PTL Technologies Ltd will act for us in this phase and also phase three.

Goals

Prepare information package and execute project documents for Siting and Construction Permits including:

- Environmental Permit
- Grid impact study
- PPA
- Interconnection Agreement
-Sitting Permit
- Construction Permit

Phase Three

Goals

Prepare development work for project

-Obtain Fire Permit

-Obtain Operational Licence

Introduction

This Alpin Sun 20MW Solar Farm Solar Power Generation Plant will be located in a Central region of Ghana at Gomoa Simbrofo and will provide 55,000 MWh of electricity from a Renewable Energy source with single axis trackers.

The project is intended to produce approximately 20 MW of power.

The three Chiefs who own the Land have supplied a written letter giving permission to build the solar farm on their land will receive1% of revenue from the solar farm, which will be used to aid sustainable development by building a school, a library, community centre, toilets and provide FREE Solar PV panels for homes in villages around the Solar Farm together with Solar PV Water Pumps and Solar Street Lighting can be arranged.

Project Financial Summary - The projected project cost is estimated at $18 million USD for EPC and total build costs at $19,646,515 USD and Net Profit of $11,631,401 USD over a twenty year period. It will be completed within a maximum of between 12 months to 18 months and be live for at least 20 years before any other major installation changes such as replacement of solar panels and other infrastructure is to be made. There is overhead infrastructure (power lines) for connection over a distance of about 2km from the project site.

Alpin Sun will act as EPC and Questworks or a similar Ghana company act as O&M company together with PowerGen Technologies Ltd for any Sub-station building. Considering this proposed project as a hypothetical power project with an initial one-year peak load of 20 MW and sales of 0.12 USD per KWh from the 55,000 MWh produced each year. However, the benefits of this project supersede its costs and therefore it is economically viable and therefore recommended for approval by our PTL Technologies Ltd consultants. For instance, it will earn a lot of revenue for the investors and also to the government in the form zero taxes together with International Carbon Credits of $1.030 million.

Phase one, two and three to get project to a build stage we are to undertake with PTL Technologies Ltd based in Ghana the following:

- Obtain a FiT
- Prepare a Feasibility Studies and other required documentations for submission to Energy Commission (primarily for PL application)
- Obtain Provisional License (PL) **(purpose of this submission)**
- Environmental Permit
- Grid impact study
- PPA
- Interconnection Agreement
- Sitting Permit
- Construction Permit
- Obtain Fire Permit
- Obtain Operational Licence

Our Good Practice Guidance for Solar Farms

1. We will focus on non-agricultural land or land which is of lower agricultural quality.
2. We will be sensitive to nationally and locally protected landscapes and nature conservation areas, and we welcome opportunities to enhance the ecological value of the land.
3. We will minimise visual impact where possible and maintain appropriate screening throughout the lifetime of the project managed through a Land Management and/or Ecology plan.
4. We will engage with the community in advance of submitting a planning application, including seeking the support of the local community such as in Simbrofo and listening to their views and suggestions.
5. We will encourage land diversification by proposing continued agricultural use or incorporating biodiversity measures within our projects.
6. We will do as much buying and employing locally as possible.
7. We will act considerately during construction, and demonstrate 'solar stewardship' of the land for the lifetime of the project.
8. We will offer investment opportunities to communities in their local solar farms where there is local appetite and where it is commercially viable.
9. We commit to using the solar farm as an educational opportunity, where appropriate.
10. At the end of the project life we will return the land to its former use.

Key Statistics and Facts About Our Solar Farms

- Solar farms are the most nature-friendly way of generating power for the grid – and support endangered wildlife and provide shelter for grazing animals and diversity of species.
- Solar makes virtually no noise or waste and has no moving parts
- Many solar farms are grazed by sheep or combined with other farming activities
- Solar is the most popular form of energy generation at more than 80% support
- Solar works well in Ghana – solar panels in Simbrofo generate 300% of the power they would in the UK
- Community groups can invest in or set up their own solar farms in Ghana
- Cheap electricity from solar farms could put money back into consumers' pockets through reduced energy bills by 2030
- Solar is one of the best energy sources for keeping profit in the Ghana

We requested and appointed PTL Technologies Ltd based in ACCRA, Ghana to perform an initial survey of the site in Simbrofo, an abstract of their report appears on the net two pages, full initial report can be seen on page 40.

Preliminary studies of Gomoa Simbrofo Solar Farm Site

This study was conducted by PTL Technologies by the authority of GhanaLight Ltd.

Background

GhanaLight Limited is proposing the establishment of a 20 MW commercial photovoltaic (PV) solar energy facility and associated infrastructure on a 300 acre portion of land at Gomoa Simbrofo, near Apam in the Central Region of Ghana which is located approximately 85 kilometers away from capital, Accra.

The solar energy facility is proposed to accommodate several arrays of fixed photovoltaic (PV) panels and associated infrastructure. From a regional perspective, this region of the Central Region is preferred by virtue of its climatic conditions (primarily due to the economic viability of a solar energy facility being directly dependent on the annual direct solar irradiation values for a particular area). From a local perspective, the site is preferred due to suitable topography, grid connection (as an ECG 33kV power line traverses about 2.2km from the site.

The nature and extent of this facility, as well as potential environmental impacts associated with the construction, operation and decommissioning phases will be explored in more detail later in the draft Environmental Impact Report.

Project Location

The Solar Energy Facility is proposed to be established at Gomoa Simbrofo, which falls within the Gomoa West District of the Central Region. The identified site has existing road access via the Winneba-Apam road and other secondary roads. The larger site available for the project is approximately 300 acres. The facility can therefore be appropriately placed within 100acres of the available acreage taking environmental and any other identified constraints into consideration.

Project Components

The proposed facility is envisaged to make use of photovoltaic (PV) technology with a maximum total generating capacity of ~20 MW and will include the following infrastructure:

- Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels;
- Cabling between the project components, to be lain underground where practical;
- Internal access roads and fencing;
- Workshop area for maintenance, storage, office, toilets; water storage tanks;

The FULL Preliminary study by PTL Technologies Ltd can be seen in Exhibit WS9 Feasibility

Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the preliminary findings of this EIS, it is the opinion of PTL Technologies Limited that:

1. 100acres of the proposed site be utilized for the project
2. Discussion is entered into with the off taker to ascertain the exact and size of the Gantry Unit (Switching Unit) for the evacuation of power.
3. Process of obtaining the relevant certifications and permit with the various stake holders should start as soon as possible.

Table 1: Summary of significance of the potential impacts associated with the proposed PV solar energy facility development

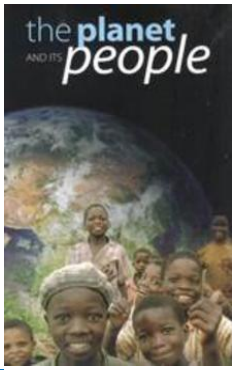
Construction / Decommissioning Impacts	Extent
Disturbance or loss of indigenous natural vegetation	L
Disturbance or loss of habitat for threatened / protected plants	L
Loss of protected trees	L
Impacts on watercourses and drainage areas	L
Establishment and spread of declared weeds and alien invader plants	L
Temporary disturbance to grazing land-use of the farm during construction	L
Soil loss/ erosion / degradation	L
Loss of heritage resources	L
Temporary visual intrusions / disturbances to people	L
Job creation and skills development of local people during construction (positive impact)	L-R
Economic spin-offs to local community.	L
Safety and security risks to site and surrounds	L
Temporary disruptions in the daily living and movement patterns to neighbouring	L
Operational Impacts	Extent
Loss of protected plant and animal species due to habitat transformation on the site.	L
Loss of low agricultural potential land on the site itself	L
Soil erosion	L
Visual impacts (intrusion, negative viewer perceptions and visibility of the facility)	R
Employment opportunities	L-R
Safety and security impacts on the site and neighbouring land.	L
Positive / negative effect on the tourism industry.	R
Contribution of clean energy.	N

L Local R Regional N National I International

One important factor of this project is the Ghanalight Ltd "Resource Ownership concept" – The Site at Gomoa Simbrofo Solar Farm, Africa and Ghana must take advantage of the Sun's Solar Resource and not be exploited by large developers. We aim to make provision of part of the Renewable Energy to help promote Sustainable Energy, Sustainable Business Development, Sustainable Education and enhance the quality of life of the people of Ghana together with mitigating against Climate Change - The Problem of Climate Change will result in significant opportunities for Ghana. People living near to each of our Solar Farms will be given FREE small Solar PV panels for their homes, the Local Chiefs or Government given Solar Street Lighting, villagers given Solar PV Water Pumps employment opportunities are also offered to the villagers.

Solar Farm electricity for towns **Village Solar Water pumps** **Each home has Free Solar panels**

Villagers get FREE Solar panel, two lights and phone charging point – in the case of Kenya this Massai woman has a charging point for her mobile phone**.** In the case of Ghana, we intend to part share the electricity with the people of Ghana and offer Solar Water pumps assisting with drinking water and food irrigation, Solar street lighting can also be arranged and small FREE Solar panel and two lights and phone charging point being made available to all villagers around each of our solar farms.



Exhibits

WS1 Scope of Operation

Provide a written description of the operational nature of the applicant's business.

Alpin Sun GmbH would like to develop with Ghanalight Ltd this first 20MW Solar Farm at Simbrofo in Ghana. This initial project will hopefully see the first of many 20MW Solar Farms in our development 125MW programme for Ghana to help assist VRA and the Government of Ghana utilise the electricity generated from the Renewable Energy resource – the sun's radiation.

The project falls within the company's abilities and is very much seen as a mutual gain, one where Alpin Sun GmbH will generate the electricity and the Ghana Government provide the Feed-In-Tariff payments, part of which will then be utilised in order for the villages around each solar farm will have FREE Solar panels and also Solar Water pumps, if required. A new school will also be built at Simbrofo, together with two toilets, a community Centre and library.

Products and services

Alpin Sun as a vertically integrated renewable energy group covers whole project phases starting with "green" idea and finishing with energy supply to end user.

Over the years Alpin Sun has established a comprehensive range of competences and experience in PV power plants. The most important element of our quality approach is related to the quality of the work as the result of the systematic application of established principles. In this respect, we refer to the Alpin Sun quality system applied to all our business division.

Adrian Ioance

Managing Director, Head of Overseas Departments

Business Plan

A. Executive Summary

Group General Overview

Alpin Sun brings together a group of Romanian- German societies, specialized in photovoltaic power plants. The foundations were laid in 2005 when Sun Farming was set up in Germany. It's a company whose activities are focused towards achieving their investment in photovoltaic plants in Germany. Sun Farming currently holds a portfolio of 40 MW, being a respected producer of renewable energy in Germany. By following the European trend of expanding the interest in renewable energy in Europe, in 2008, an international construction division broke away from the Sun Farming Company, becoming a stand-alone business, known today as the Alpine Sun GmbH.

Alpin Sun has experienced a great evolution in recent years, by following several stages of development, starting by assembling plants and, later, encompassing the design and supplying of equipment, which is called the EPC. The next step towards the ascension of Alpin Sun activity was embedding project development activities and, later, the operation and maintenance of photovoltaic parks. Since its debut and up to now, Alpin Sun has completed more than 180 photovoltaic plants in Italy, Belgium, Germany and Romania. The most representative projects are conducted between 2012-2014 in Romania, totaling 34 MW, being utility scale projects with installed capacity between 1.5 MW to 7 MW.

During this period, Alpin Sun has been very active on the development side, making up to now, more than 15 fully licensed projects, and totaling over 70 MW installed capacity. Some of these projects were sold to investors, along with EPC contracts, which constitute a part of the working basis of the company and a good source of cash. In order to streamline the operations, the Romanian society, Alpine Solar SA, was founded, taking over the Engineering and Construction activity, with over 100 employees in Romania, while the German Society still remains responsible for Procurement and international contracts. Regarding its own developed projects, they are carried out through project companies (SPV), according to the Romanian legislation, regulations related to the establishment and operation of electricity producers and specific commercial usage.

At the moment, 15 companies are integrated in the group project, 7 of them being part of the investment described in this documentation. Finally, Alpin Sun deals with energy production, the group owning two photovoltaic plants with an aggregate installed capacity of 5 MW, which are located in Codlea, Brasov County and Reci, Covasna county. In 2013, Alpin Sun projects amounted 40 million EUR and the net result was about 5 million EUR at the end of the year. The group strategy aims to strengthen the energy producer's position in Romania, by achieving and international expansion in: Asia (China and India), South America (especially Chile), MENA (Arab countries, Morocco, Tunisia), Eastern Europe (Albania, Macedonia, Serbia). The business model adopted in each country will be the same as the one successfully applied in Romania, following two directions: EPC contractor and investments. That's why, partnerships were established and in China, for example, it was set up a branch and a project company responsible for making a 50MW plants in Inner Mongolia"

The current generation has the unique opportunity - and the obligation - to position our energy system on sustainable pillars. Leaving a clean environment to our children and grandchildren is our duty. This path cannot be followed without coming to renewable energies. The employees and shareholders of Alpin Sun feel an obligation to observe this responsibility. With every newly - installed photovoltaic plant we come a small step closer to the goal of renewable energies as the key source of energy supply. We are convinced that every photovoltaic plant that currently delivers electricity to the grid is the independent energy supply for its immediate vicinity in the future. In order to optimize the use of solar electricity via the consumer we are positioning our plants near by potential end user.

At Alpin Sun, we work to make the world a better place to live, encouraging collaboration, innovations sharing, responsible use of resources and growing sustainable business to be legacy for our children. We are committed to our goal to built a photovoltaic plant is every place of the world where is needed a breath of fresh air.

C. Group structure:

Since, Alpine Sun activates on several markets and provides distinct products and services, group activities are divided into individual companies to reduce risk exposure and to be managed properly according to them on going operations.

All groups share the common shareholders and have a performing management under the careful guidance of the board of directors.

Sun Farming GmbH	Alpin Sun GmbH	Alpin Solar SA	Alpin Sun China	Electricity Production - Operational PV	SPV's ongoing PV Projects
- Electricity Production in Germany	- EPC Contractor - responsible for procurement and international contracts / wholesale equipments for photovoltaic power plants	- Project Development - EPC Contractor - engineering and construction - O&M provider	- EPC Contractor - Energy producer - Project Development	- 2MW Power Plant, Suninvest ROPV1, Reci, Covasna County, Romania - 3MW Power Plant, Energy Fond Roest, Codlea, Brasov County	- Energy Fund Bravo LLC - Energy Fund Aliseo LLC - Energy Fund Lano LLC - Energy Fund Sunivest LLC - Nea Solar LLC - Ever Solar LLC - Go East Solar LLC

Project development	EPC	O&M
- Location idetification - Purchase of real construction rights - Design Fesability - Business planning - Permits and aprouvals - Project management	- Technical projects for construction and grid connection - Procurement of materials and equipments - Construction of acces and electrical infrastructure - Ramming of steel structure - Mounting structure, panels, cables - Mounting inverters and transfpormers - Mounting AC/ DC - Cables - Grid connection	- Maintenance - Monitoring and technical assistance - Legal and administrative - Facility Management - Commercial - Managenent of the plant - Risk managenent

Trading	Electricity Production - Operational	Energy Production - Projects
- Energy trading - Green certificates trading - Invoices and payments - Financial overview - Monthly staments - Tax calculation	- 2MW Power Plant, Suninvest ROPV1, Reci, Covasna County, Romania, 2400 MWH annual production - 3MW Power Plant, Energy Fond Roest, Codlea, Brasov County, 3600 MWh annual production	- 2 MW Energy Fund Bravo - 3 MW Energy Fund Aliseo - 3 MW Nea Solar - 9 MW Go East Solar - 23 MW Suninvest RO PV1 - 9 MW Ever Solar

Customers

Alpin Sun as a comprehensive photovoltaic projects solution provider, we aim to satisfy our client needs overall or through our individual business divisions.

- **As project developer** – we focused on local markets energy demands corroborated with future perspectives and international trends and train a highly skilled development team which was able to deliver ready to built bankable projects. Through project development division we open the local utility scales market for international investors. Quality of Alpin Sun projects is proved by our client statements and not less important by the positive due diligence reports conducted by Wolf Thiess, an important European law firm. Although energy market and specific legislation are difficult, hard to tackle, constant changes being a real challenge, all our projects are updated and fully licensed. No regulatory or legal items left unsolved.
    - **In 2013, projects rights for 13,5 MW was purchased by Unisun Energy LLC Hong Kong, for EUR 2,5 millions.**
- **As EPC contractor** – join forces of Alpin Sun and Alpin Solar team, manage to deliver 34 MW turn key power plants, just in 2013, handling investments of over EUR 40 millions. Businessmen, industrialists or financial investor have chosen to work with us due to innovation, performance, low risk and high quality, attributes found in each plant that we build.
    - BaySolar AG – an leading European photovoltaic company assigned Alpin Sun to built the 6.4 MW from Cluj County at the end of 2012. Plant was successfully commissioned and nowadays supplies green energy to Transilvanian grid.

- IRUM S.A. – a 50 years old tractors manufacturer has decided to accomplish their energy needs from green resources and appointed Alpin Sun to build the 1.5 MW PV plant near by Reghin factory.
- Capidava Prodcom – for this agribusiness Romanian player we built 2,5 MW power plant inside their farm located in Mures County.
- Zhejiang New Energy Investment Co – for this Chinese leading industrial group we built two large scale 13.5 MW power plants in Brasov County, central Romania.

More about our portfolio could be found below at references.

- **As O&M provider** - Alpin Sun Operation and Management 360^0 solution has an comprehensive approach covering a full range of services: maintenance, monitoring and technical assistance, legal and administrative, commercial, facility management, risk management. For the moment Alpin Sun is in charge with a daily operation of 25 MW power plants:
  - **Setra Energy 6,3 MW/ Clue Solar 7,2 MW/ Solarfun 2,5 MW/ Topram 1.5 MW/ Capidava 2,5 MW/ Suninvest 2 MW/ E.F. Roest 3 MW/ Irum 1,5 MW.**
- **Energy and GC Trading** – marketing electricity and incentives through centralized or bilateral market is a difficult job to be handled by an unskilled energy producer, that's why we take care of that together with our commercial partners. Closing the circle assure our partners receive proper benefits from their investments.
- **Electricity producer** – by far the most satisfying of our activities is the production of electricity. Being part of this select group of renewable producers is a pride and also a duty having the responsibility of continuing the mission of growing sustainable businesses. Our energy is taken off by first class energy take offers and it is delivered directly to middle and large scale industrials.

- Electromagnetica SA - an 80 years old electrical components Romanian manufacturer, being one of the most successful examples of privatization after 1989 political regime changing. Today Electromagnetica is one of the largest LED lightning solution manufacturer from South East Europe, having around 800 employees and multiple production facilities in Bucharest. Electromagnetica has a diversified business portfolio, besides their industrial activity, are involved in real estate owning an impressive business and industrial park, is a key energy producers through its multiple hydro facilities and is the oldest energy trader on the market with more than 15 year of experience. As energy supplier they deliver to more that 150 industrials and commercial middle and large scale consumers.
- Electrica Trasilvania Sud SA – is one of the five Romanian grid operators being responsible for electricity supply to cities from central area of the country. Over the years we build a very strong

relation with this multi million energy giant.

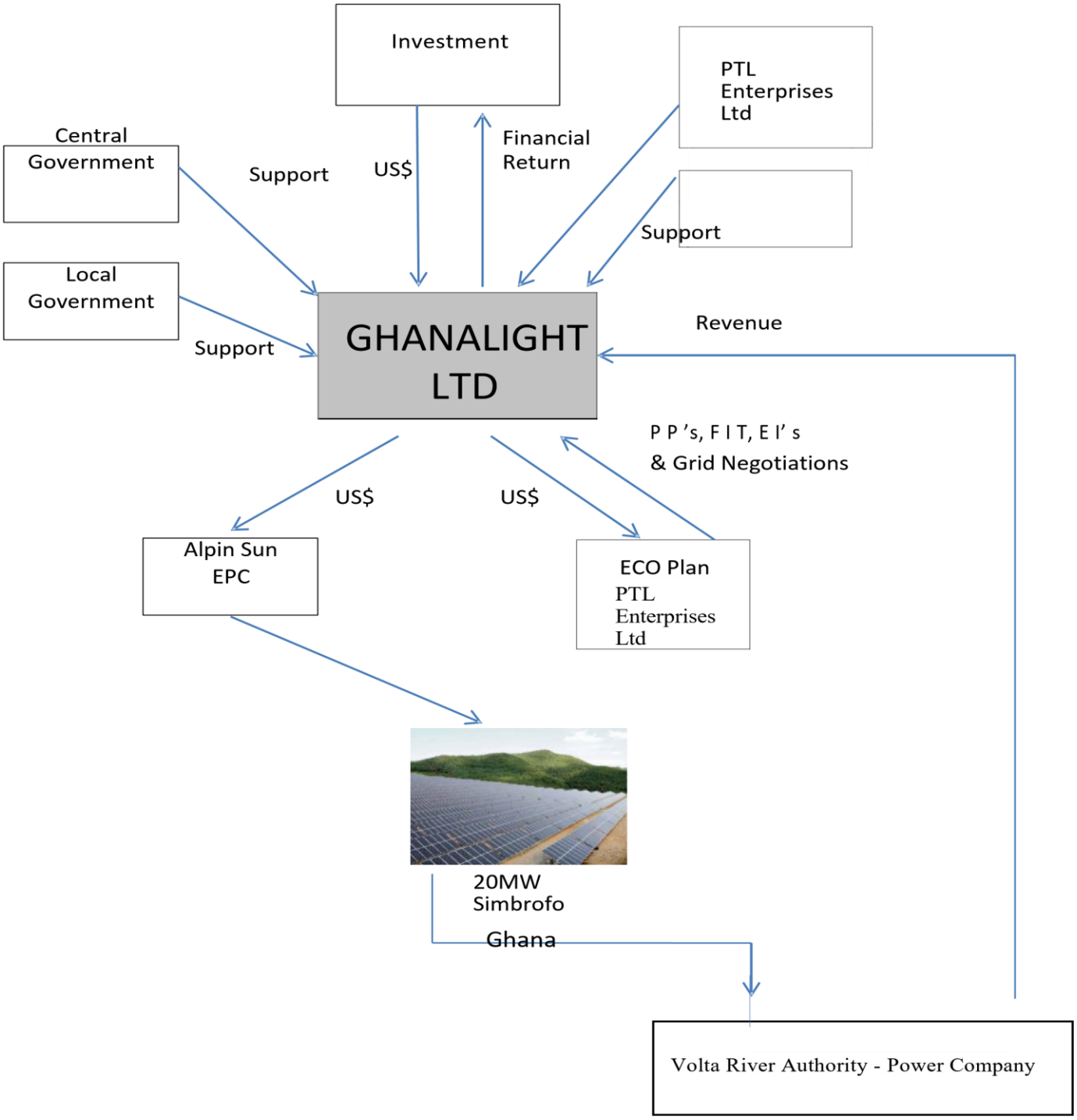
- Bepco SA – this private own company is the main electricity supplier for Tektron, Brasov centralized heating company. As they serve a city with more than 200,000 inhabitants their main source is coal and natural gas, our green electricity is very welcome.

D. Organization and Management

Organizational chart

This chart appears on page 17 & 18 under WS4 Ownership and Corporate Structure

The scope of the Simbrofo operation and its links



WS3 Principal Officers, Director and Partners

"Provide the names, titles, nationality, addresses and telephone numbers of the applicant's principal officers, directors, partners, or other similar officials."

Adrian Loance – German National Alpin Sun GmbH Senior Director

Tel
Email adrian.ioance@alpin-sun.de
Website: www.alpin-sun.de
Overseas Department
Alpin Sun GmbH
Zum Wasserwerk 12
D-15537 Erkner (bei Berlin)
Mobile: (EU) +40 736367831 / (CL): + 56 9 62733963
Fax: +40 368 453 781

Dan Walker – British Alpin Sun GmbH Project Coordinator

Tel +44 (0) 7514 676 014
Email dan.walker@alpin-sun.de
Skype: dan_walker1150

David Tamakloe Ghanaian- British Director Ghanalight Ltd & Visions Marketing Limited

Tel +44 : (0) 7951108628
(0) 7551873333
Email david@ghanalight.com and davidtamakloe@aol.com

Alan Brewer MSc – British Project Facilitator and Director Ghanalight Ltd in the UK

Tel +44 02393 786582 / +44 (0) 7763 977634
Email alan@ghanalight.com and alan@psecc.co.uk

Michael Mikado CEO – Ghana National PTL Enterprises Ltd Ghana

Tel +233 26 8243297
Email mikemikado@gmail.com

Victor Andrew – Ghana National Politician Ghana

Tel +2335 4336 3605
Email victorandrew27@yahoo.co.uk

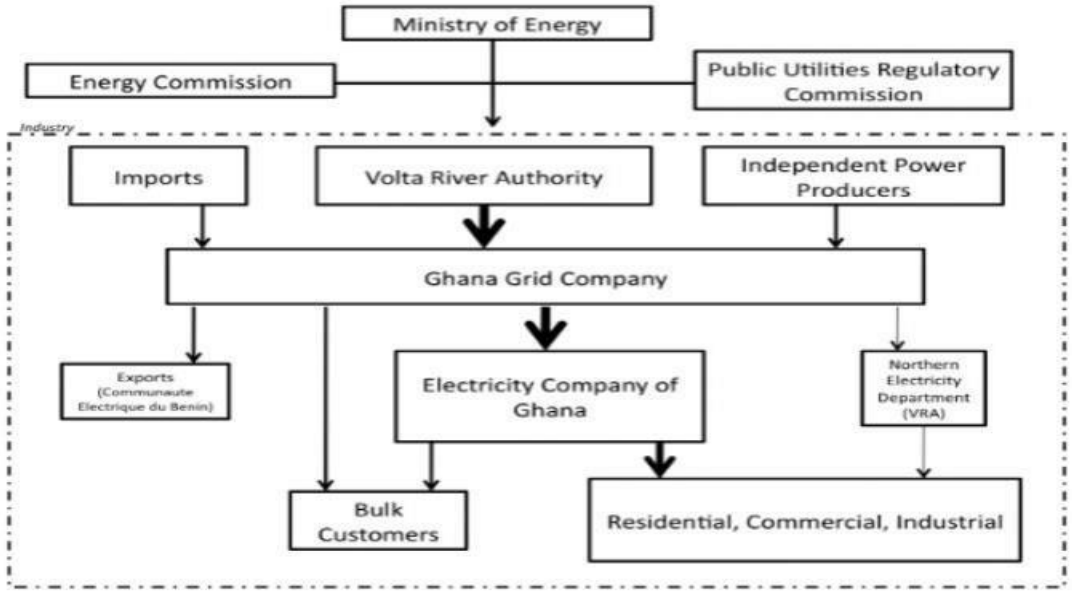
WS4 Ownership and Corporate Structure

Provide a description of the applicant's corporate and ownership structures, including in WS5 any Cross-ownership and Ring Fencing

Alpin Sun GmbH

Alpin Sun organizational structure is simple and efficient, based on a reduce hierarchy and participative management.

: *The structure of the power sector in Ghana, 2010*

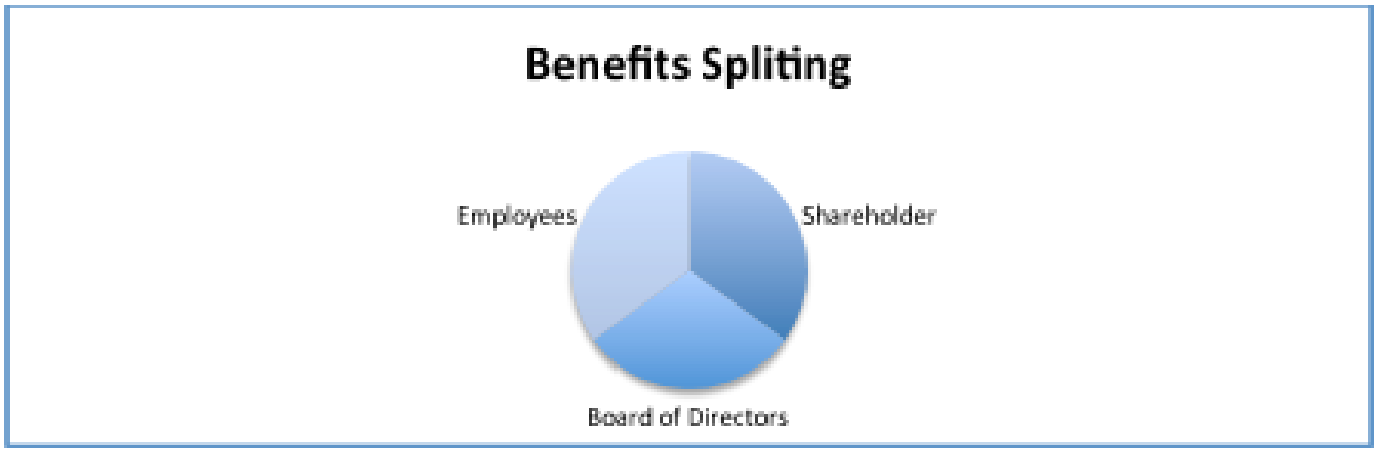


Ownership and control

Ownership and control of Alpin Sun group it is same innovative as the management.

Although the major shareholder is Mr. Micu Bogdan Marian, the group is controlled ventures with employees on common share basis. Benefits and results following group activity are shared with employees, which lead to a join interest and common participation.

Basically, at the end of the day each employee has a share from the company, according with their role and value added to the group.



GHANALIGHT LTD – Website Ghanalight.com

GHANALIGHT LTD

Name:	GHANALIGHT LTD
Registered Office:	BUILDING 1000, LAKESIDE NORTH HARBOUR, WESTERN ROAD, PORTSMOUTH, PO6 3EZ, ENGLAND
Company Type:	LIMITED BY SHARES

APPOINTMENTS

DAVID TAMAKLOE

Positions:	DIRECTOR, SHAREHOLDER
Name:	DAVID TAMAKLOE
Residential Address:	16, FAVELL DRIVE, FURZTON, MILTON KEYNES, BUCKINGHAMSHIRE, MK4 1AQ, UNITED KINGDOM
Service Address:	BUILDING 1000, LAKESIDE NORTH HARBOUR, WESTERN ROAD, PORTSMOUTH, PO6 3EZ, ENGLAND
Date Of Birth:	20 MAY 1965
Occupation:	BUSINESS DEVELOMENT
Nationality:	GHANIAN

EDITH SAMUEL

Positions:	DIRECTOR, SHAREHOLDER
Name:	EDITH SAMUEL
Residential Address:	13, MYRTLE BANK, STACEY BUSHES, MILTON KEYNES, MK12 6HH, UNITED KINGDOM
Service Address:	BUILDING 1000, LAKESIDE NORTH HARBOUR, WESTERN ROAD, PORTSMOUTH, PO6 3EZ, ENGLAND
Date Of Birth:	04 DECEMBER 1969
Occupation:	BUSINESS MANAGER
Nationality:	BRITISH

SHAREHOLDINGS

DAVID TAMAKLOE

Class:	ORDINARY
Price:	GBP1.00
Quantity:	30
Particulars:	FULL RIGHTS TO RECEIVE NOTICE OF, ATTEND AND VOTE AT GENERAL MEETINGS. ONE SHARE CARRIES ONE VOTE, AND FULL RIGHTS TO DIVIDENDS AND CAPITAL DISTRIBUTIONS (INCLUDING UPON WINDING UP).

EDITH SAMUEL

Class:	ORDINARY
Price:	GBP1.00
Quantity:	30
Particulars:	FULL RIGHTS TO RECEIVE NOTICE OF, ATTEND AND VOTE AT GENERAL MEETINGS. ONE SHARE CARRIES ONE VOTE, AND FULL RIGHTS TO DIVIDENDS AND CAPITAL DISTRIBUTIONS (INCLUDING UPON WINDING UP).

ALAN JOHN BREWER

Class:	ORDINARY
Price:	GBP1.00
Quantity:	40
Particulars:	FULL RIGHTS TO RECEIVE NOTICE OF, ATTEND AND VOTE AT GENERAL MEETINGS. ONE SHARE CARRIES ONE VOTE, AND FULL RIGHTS TO DIVIDENDS AND CAPITAL DISTRIBUTIONS (INCLUDING UPON WINDING UP).

SIC CODES

35110 PRODUCTION OF ELECTRICITY

WS5 Cross-ownership and Ring Fencing

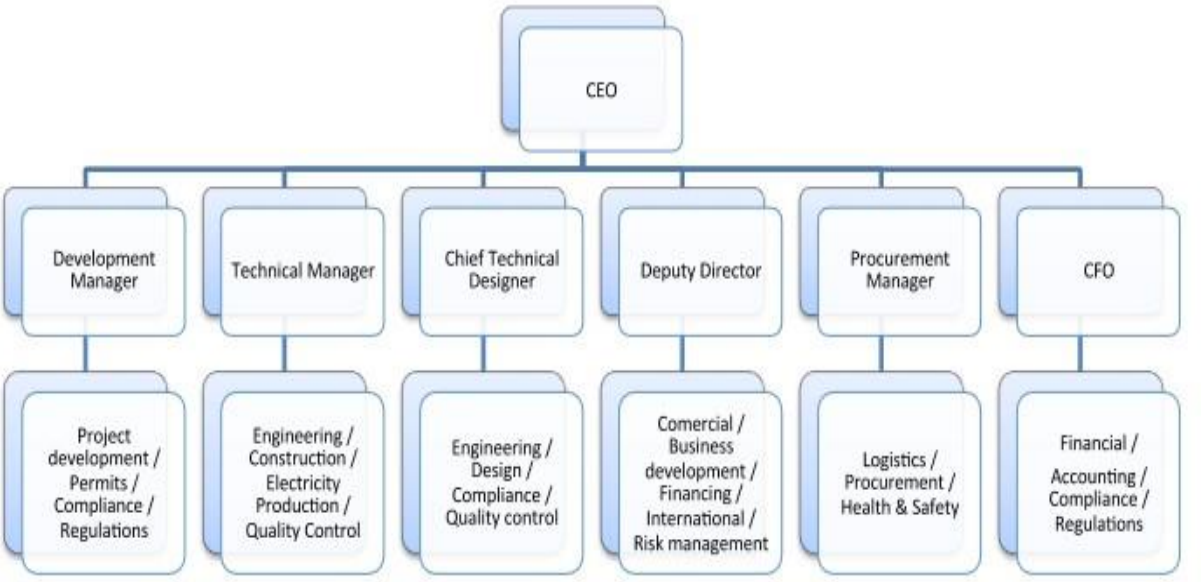
"Applicants should outline the following:

a) The basis on which services and resources will be transacted between relevant operating areas of the applicants, or the applicant and its other related entities;

The Simbrofo 20MW Solar Farm will be jointly owned by us at Alpin Sun GmbH and also Ghanalight Ltd

Management is conducted by the board, a highly qualified and comprehensive management tool. Having an activity quite extensive, management decisions can not be taken effectively by one person, which is why leadership is a shared responsibility of board members. Board members come from different areas of activity which brings to the table a diversified expertise and making decisions can be made based on complex and comprehensive analysis.

Besides their role in the board, each member has specific responsibilities in the organization, being in charge with operations according qualification, experience and native skills.



b) In the case of applicants that are wholly owned subsidiaries, information on proposed audit arrangements should be provided and also stated whether separate reports for the licensee and its parent company (if applicable) are to be prepared and made publicly available; and

Our company is Audited annually and we will make arrangements for further Audits to be done on the SPV to be formed to take forward this project at Simbrofo. All reports will be made public one the SPV has been formed and Preliminary Licence has been issued to us.

c) Other guidelines or standards relating to financial separation, ring-fencing and separate audit arrangements which the applicant intends to follow.

There will be NO Ring Fencing

WS6 Disclosure of Liabilities and Investigations

Provide a description of all existing, pending or past rulings, judgments, contingent liabilities, revocation of authority, regulatory investigations, or any other matter that could adversely impact the applicant's financial or operational status or ability to provide the services it is seeking to be certified to provide. Also include a statement whether the applicant or any of his associates, or partners, or promoters, or Directors was ever refused licence or had licence cancelled, and if so, the particulars of such application, date of making the application, date of order refusing or cancelling licence and reasons for such refusal or cancellation.

NO adverse issues

WS7 Financial Capability and Proposed Financial Plan

Provide the two most recent Annual Reports to Shareholders and copies of the applicant's three most recent years of audited financial statements (balance sheet, income statement, and cash flow statement). If audited financial statements are not available, provide officer certified financial statements.

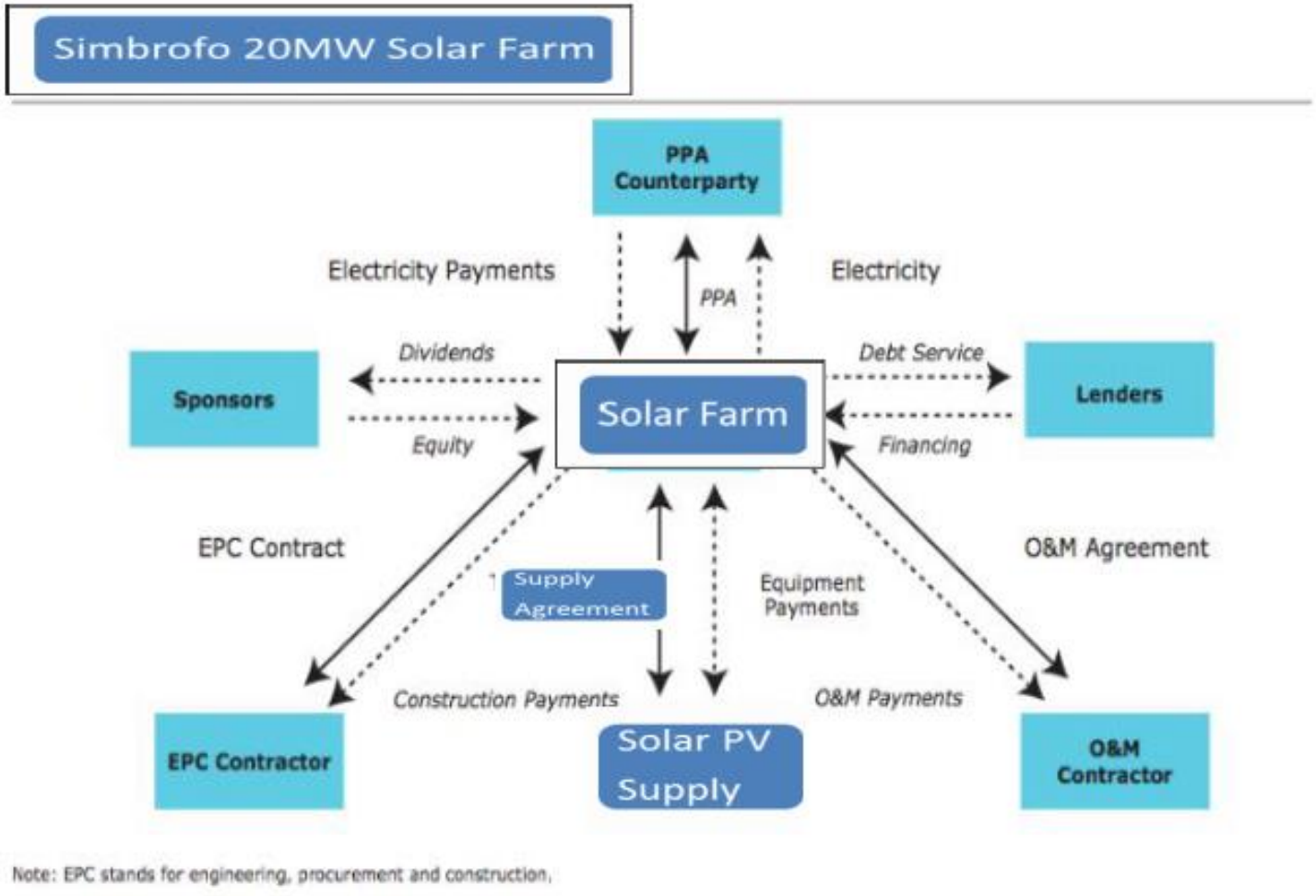
If the applicant has not been in business long enough to satisfy this requirement, it shall file audited or officer certified financial statements covering the life of the business. Provide copies of the applicant's financial arrangements to conduct electricity business as a business activity (e.g., guarantees, bank commitments, contractual arrangements, credit agreements, etc). Provide two years of forecasted financial statements (balance sheet, income statement, and cash flow statement) for the applicant's operation, along with a list of assumptions.

Revenue		
FIT Power Price (US$ per kW/h)		
Total power output degraded % life of plant		12.50%
Power produced (Mw/h) per year		
Power sales		152,674,864
Carbon credits		1,030,529
Sub-total revenue		153,705,393
Depreciation		
- annual charge	12.5%	26,062,155
Taxation		-
Corporation tax	0%	-
Sub-total taxation		26,062,155
Equity dividend		
- common shares		100,000,000
- preferred shares		11,631,401
Sub-total dividends		111,631,401

Initial Costs					
Solar Power Plant purchase					
	$ per Mw		$1,400,000		
	Total project Mw		20		$28,000,000
Licence Fee + carbon credit certification					$360,000
Grid connection					$700,000
Agent commission at 3% funds raised					$216,015
Initial land rent					$17,000
Pre-build technicals - PTL Enterprises Ltd					
		Phase 1	$64,500		
		Phase 2	$194,500		
		Phase 3	$34,500		
Management expenses and Design			$60,000		$353,500
					$29,646,515

Ratios			
Return on investment (ROI)	18.89%		
Internal rate of return (IRR)	14.68%		
Debt to equity ratio (leverage)	3.46		
Benefit to cost ratio (BCR)	3.68		
Average debt service coverage ratio (DSCR)	3.17		
Project life cover ratio (PLCR)	6.17		
Debt funding analysis			
- loan amount	23,000		
- term	12	years	
- principal grace period	2	years	
- principal repayment	annual	following grace period	
- interest rate	4.00%		
- interest periods	semi-annual		
- average life (payback)	3.24	years	
- correlation of 10yr project inflows to outflows	0.5071		

Proposed Financial Plan - *Alpin Sun GmbH have their own investors for the project*



When analyzing Solar projects from experienced sponsors they start with "Project Bankability" in mind from the very moment they design their projects. An excellent way to accomplish this and to increase the pool of potential equity and debt providers is to achieve *Investment Grade Project Rating, we have this rating in* ***Alpin Sun GmbH who have their own investors for the project.***

Our Solar project is properly structured, so we can achieve investment grade ratings. Close attention has been paid to the following:

1. **Credible Solar resource forecast.** You need an experienced solar resource consultant and an independent engineer (IE) with proven track records able to credibly forecast solar resource and power production, Alpin Sun & PVGIS data obtained for Simbrofo project.
2. **A Solar PV panel supplier** deemed investment grade.
3. **Low-to-moderate construction risk** substantially transferred to an experienced EPC contractor.
4. **Robust PPA** fully contracting project capacity with high credit quality counterparties.
5. **Moderate operating risk** retained by an experienced sponsor or contracted to a qualified third party.
6. **An equity sponsor** considered established and experienced.
7. **Fully-amortizing debt** with financial metrics and financing structures that accommodate resource variability and other downside scenarios.

The current Ghana Government investment raising, especially in the Energy Sector is viewed as encouraging for our project funders and also the VRA are seeking additional funding to stabilise their operations, also Ghana is considered one of the more stable economies in Africa.

GHANA
2015

When we reviewed Ghana as a possible Country for Solar Farm Development we considered the following:

Although Ghana registered relatively commendable economic growth in 2014, the economy faced major challenges in the form of a sharp currency depreciation, deepening energy crisis, deteriorating macroeconomic imbalance and rising inflation and interest rates. Over the medium term, the economy is projected to recover bolstered mainly by higher oil and gas production, combined with increased private sector and public infrastructure investments, as well as an improved macroeconomic framework and political stability.

Ghana's accelerated economic growth over the past decade has helped the country achieve the Millennium Development Goal (MDG) goal of halving poverty, although there is evidence of growing disparities in spatial development and income inequality across regions, especially in the three northern regions. Progress in the achievement of other MDGs remains mixed, with the 2015 targets likely to be missed.

Overview

Ghana's economy is expected to slow down for the fourth consecutive year to an estimated 3.9% growth rate in 2015, owing to a severe energy crisis, unsustainable domestic and external debt burdens, and deteriorated macroeconomic and financial imbalances. Provisional gross domestic product (GDP) figures issued by the Ghana Statistical Services (GSS) further suggest that the economy expanded by 4.2% in 2014, less than the growth of 7.3% recorded in 2013. The drivers of growth continue to be the service sectors, which constitute 50.2% of the economy, followed by industry and agriculture at 28.4% and 19.9% respectively.

In 2016 the economy is expected to recover, registering a growth of around 6%, bolstered by an increase in oil and gas production, private sector investment, improved public infrastructure and the country's political stability. Nonetheless, the prevailing low international oil prices could slow the pace of economic growth in the future. High growth rates over recent years have been accompanied by the build-up of macroeconomic imbalances. In 2014 current account and fiscal deficits widened to 9.2% and 10.4% of GDP respectively, and the rate of inflation averaged 17.0%. By the end of December 2014, foreign reserves were at 3.2 months of import cover, thanks to inflows from the Eurobond of USD 1 billion and a cocoa syndicate loan of USD 1.7 billion. The domestic currency, the cedi (GHS) depreciated by over 30% in nominal terms over the first nine months of the year compared to a depreciation of 4.1% during the corresponding period in 2013. The continued growth in the budget deficit resulted in public debt increasing from 55.8% of GDP in December 2013 to 67.1% of GDP by the end of December 2014. To address the increasingly unsustainable fiscal and current account imbalances, the Ghanaian authorities started negotiations for a stabilisation programme with the International Monetary Fund (IMF) that was expected to begin in early 2015.

While growth in Ghana has been inclusive, most of the jobs generated have been in the informal economy, with significant spatial disparities and rising income inequality. Although Ghana met the first Millennium Development Goals (MDG) target, that of eradicating extreme hunger and poverty, four of its ten regions are lagging behind. However, Ghana will not meet the MDGs related to reversing the loss of environmental resources, reducing the proportion of people without access to improved sanitation, and achieving significant improvement in the lives of people living in slum areas.

The **economy of Ghana** has a diverse and rich resource base, including the manufacturing and exportation of digital technology goods, automotive and ship construction and exportation, and the exportation of diverse and rich resources such as hydrocarbons and industrial minerals. These have given Ghana one of the highest GDP per capita in Africa. Owing to a GDP rebasement, in 2011 Ghana became the fastest growing economy in the world; differences with neighbouring economies are likely to be overstated due to underfunded statistical agencies in surrounding countries.

The Ghanaian domestic economy in 2012 revolved around services, which accounted for 50% of GDP and employed 28% of the work force. Besides the industrialization associated with minerals and oil, industrial development in Ghana remains basic, often associated with plastics (such as for chairs, plastic bags, razors and pens).

Ghana embarked on a currency re-denomination exercise, from Cedi (¢) to the new currency, the Ghana Cedi (GH¢) in July 2007. The transfer rate is 1 Ghana Cedi for every 10,000 Cedi. Ghana embarked upon an aggressive media campaign to educate the public about what re-denomination entails. Value added tax is a administered in Ghana. The tax regime which started in 1998 had a single rate but since September 2007 entered into a multiple rate regime. In 1998, the rate of tax was 10% and amended in 2000 to 12.5%. The top income tax and corporate tax rates are 25%. Other taxes included with value-added tax (VAT), are national health insurance levy, and a capital gains tax. The overall tax burden amounts to 12.1% of Ghana's total domestic income, and the budget of Ghana has fallen to the equivalent of 39.8% of GDP.

Project costs

Initial Costs					
Solar Power Plant purchase					
	$ per Mw		$1,400,000		
	Total project Mw		20		$28,000,000
Licence Fee + carbon credit certification					$360,000
Grid connection					$700,000
Agent commission at 3% funds raised					$216,015
Initial land rent					$17,000
Pre-build technicals - PTL Enterprises Ltd					
		Phase 1	$64,500		
		Phase 2	$194,500		
		Phase 3	$34,500		
Management expenses and Design			$60,000		$353,500
					$29,646,515

Borrowings						form	repayment	
Other								
Equity	Preferred stock				$6,646,515	equity	preferred dividend flow	
Debt	project finance				$23,000,000	debt	3.24	year avg life
					$29,646,515	check sum	-	
Preferred stock conversion rate				1:	0.20	following 5th year		
Preferred stock required return - initial 5 years					15%	flat per annum		
Interest Rate per annum					4.00%	rate on borrowings		
Grace period (years)					2	[0 through to 5 years]		
Full term (years)					12			
Interest periods per annum					2	[1=annual, 2=semi-annual]		
Principal repayment periods per annum					1	[1=annual, 2=semi-annual]		

Proposed Financial Plan – Project costs are $30 million

PROJECT AT A GLANCE
Return on Investment (ROI) %
18.89%
Internal Rate of Return (IRR) %
14.68%
Operational profit over 20 years $
$111,631,401
Averaged Yearly Net Profit
$5,581,570
Average life Payback in Years
3.24
Loan Amount $
$23,000,000 Debt & $6,646,515 Eqity
Deposit Amount (Eqity) $
$6,646,515
Loan Repayment in Years
12.00 years with 2 year grace
Interest Rate on Loan
4.00%

WS8 Statement of Assets, Technology & Type of Renewable Energy Resource

Provide a list of major plant and machinery to be installed, stating technology and type of renewable energy resources and proposed layout plan.

Assets

B. Portfolio

We are always expanding our portfolio to move with the direction of the market. We have established a healthy growth across Europe with the portfolio pictured below and also developin into the UK recently. We have also expanded worldwide into Turkey with a 4MW project and a 50MW project, into Chile with three large projects of 70MW, 30MW and 30MW. We are also expanding into various parts of Africa.

Harman Clue, Brasov, RO
7,314 MW

Harman Setra, Brasov, RO
6,4 MW

Jichisu de Jos, Cluj, RO
6,4 MW

Jichisu de Jos, Cluj, RO
5,8 MW

Belgium
3 MW

Codlea, Brasov, RO
3 MW

Ghindari, Mures, RO
2,5 MW

Nazna, Mures, RO
2,5 MW

Unteremphenbach, Mai...
2.2 MW

Oberempfenbach, Main...
2,2 MW

Reci, Covasna, RO
2,133 MW

Mizil, Buzau, RO
1,9 MW

Technology

Solar PV panels – Simbrofo will generate 40,000 MWh each year for twenty-five years.

alpin SUN
solar EPC

Project technical overview - 20MW Simbrofo Solar Farm Ghana

Objective: PHOTOVOLTAIC POWER PLANT

Positioning: Groud mounted Simbrofo

Ghana

Designed electrical installation

Un = 0.4 kV / 23 kV
Installed Power (kW) : Pi = 20888 kW
Maximum Output Power: Pa = 20000kW

Proposed configuration for the PV Plant consist in 83552 pieces photovoltaic panels of 250Wp placed on metal structures at an angle of **1 degree**, azimuth 0 ° (North). There will be used 3467 metal structures, with 24 PV panels each. The metal structures will be mounted with metal anchors in the ground. All panels will be connected in series of 24 panels.

To avoid self-shading of the panels during the year, a distance of 3,5 meters will be kept between the structures.

Type of Renewable Energy Resource

Solar Radiation

PVGIS Data based on 25MW as an example due to us being able to generate more than the listed PVGIS from a 20MW table. We estimate 40,000 MWh per year for 20MW.

PVGIS estimates of solar electricity generation

Location: 0°0'0" North, 36°0'0" East, Elevation: 1545 m a.s.l.,

Solar radiation database used: PVGIS-CMSAF

Nominal power of the PV system: 25000.0 kW (crystalline silicon)
Estimated losses due to temperature and low irradiance: 13.0% (using local ambient temperature)
Estimated loss due to angular reflectance effects: 2.6%
Other losses (cables, inverter etc.): 7.0%
Combined PV system losses: 21.2%

Fixed system: inclination=1°, orientation=180°				
Month	E_d	E_m	H_d	H_m
Jan	130000.00	4030000	6.66	206
Feb	137000.00	3820000	7.08	198
Mar	139000.00	4320000	7.23	224
Apr	120000.00	3600000	6.13	184
May	121000.00	3740000	6.09	189
Jun	121000.00	3620000	6.06	182
Jul	117000.00	3640000	5.91	183
Aug	123000.00	3810000	6.20	192
Sep	131000.00	3920000	6.66	200
Oct	121000.00	3760000	6.21	192
Nov	114000.00	3410000	5.78	173
Dec	122000.00	3770000	6.17	191
Yearly average	**124000**	**3790000**	**6.34**	**193**
Total for year		**45400000**		**2320**

Pre-Feasibility Study for a 20MW Solar Farm at Simbrofo - Central region

Our Gomoa Simbrofo Solar Farm will be built in such a manner to allow for small grazing animals to still use the land.

Why Ghana is an attractive Country for us - Our Simbrofo Solar Farm can assist the level of economic development determines the intensity of energy use; as economic systems in developing countries expand, so is the demand for energy to power production activities (Winkler, 2005; UN-Energy/Africa, 2011). The Ghana vision and strategy identifies energy as one of the key infrastructural enablers, necessary for the realization of its sustainable objectives. The Vision is expected to increase demand on Ghana's energy supply. Ghanalight Ltd intend to assist Ghana with 40,000 MWh per year of electricity from the Simbrofo Solar Farm.

With the current energy shortages and supply disruptions in Ghana coupled with high cost remain serious obstacles to the domestic and manufacturing sector in liberalized markets, the cost of energy significantly influences the Competitiveness of local products vis.-à-vis imported goods. Consequently, a high cost of energy negatively affects domestic wealth creation, balance of payments and employment creation, as consumers opt for cheaper imports (Gok, 2012a; Karekezi and Kimani, 2009). We understand the government of Ghana are undergoing a restructuring of the Energy sector, this scenario necessitates the establishment of new projects such as our Simbrofo Solar Farm to step-up energy supply at a lower cost and increase efficiency in energy consumption (GoK, 2012a). Universal access to Sustainable, affordable and clean energy Renewable Energy such as Solar Farms is instrumental for the realization of Ghana

Ghana, Africa a combination of huge solar resources, three times radiation levels compared to Europe limited grid capacity and growing demand for power driven by one of the world's fastest growing economies provides all the right ingredients for an African solar explosion such as in Ghana and specifically Simbrofo. In the same way that mobile phones have taken off in Africa, so solar, with its potential for off-grid and decentralised deployment, offer similar opportunities for propelling forward the continent's development of Solar Farms. The largest share of Ghana's electricity supply currently comes from hydroelectric stations at dams along various River systems, however when drought reduces water flow, electricity supply is threatened. 1997 and 2000, for example, drought prompted severe power rationing, with economically damaging 12-hour blackouts. Frequent outages, as well as high cost, remain serious obstacles to economic activity, hence the strong Government support for solar farms. Simbrofo will see an additional 40,000 MWh each year produced by the Simbrofo Solar Farm.

There is a growing and urgent need for Solar Farms in Ghana, electricity demand is significantly rising mainly due to accelerated productive investment and increasing population. Historically, energy demand is positively correlated with economic and population growth rates, an opportunity that GHANALIGH LTD are developing will take advantage of these growth rates. In 1994, Ghana's total generating capacity was about 1,187 megawatts, and annual production totalled approximately 4,490 million kilowatts and the main source of supply is the Volta River Authority with six 127-megawatt turbines.

The Volta River Authority's Akosombo Hydroelectric Project provided the bulk of all electricity consumed in Ghana, some 60 percent of which is purchased by Volta Aluminium Company (Valco)for its smelter. The power plant export amounted to an estimated equivalent of 180,000 tons of oil in 1991. The balance of Ghana's electricity is produced by diesel units owned by the Electricity Corporation of Ghana, by mining companies, and by a 160-megawatt (210,000 hp) hydroelectric plant at Kpong, about 40 kilometers downstream from Akosombo. A third dam at Bui on the Black Volta River had been under study for some time, with the aim of increasing power supplies in northern Ghana and for export; the project is as of 2013 in the late stages of construction. Other sites with the potential for power generation, on the Pra River (Ghana), the Tano River, the White Volta River, and the Ankobra River, would also require substantial investment. Simbrofo will enhance this supply to VRA and will be more Sustainable.

Our Solar Farms will assist Volta River Authority in supplying much needed Renewable Energy sources and also help the Government of Ghana meet their Renewable Energy Targets with 40,000 MWh from Simbrofo Solar Farm.

Design Features.

Project technical overview - 20MW Simbrofo Solar Farm Ghana

Objective: PHOTOVOLTAIC POWER PLANT

Positioning: Groud mounted Simbrofo

Ghana

Designed electrical installation

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To avoid self-shading of the panels during the year, a distance of 3,5 meters will be kept between the structures.

Technical details of PV panels:

- Power Pmpp: 250 Wp
- Type of cell: poly-crystalline 60 pcs / panel
- Open circuit voltage Uoc: 37.3 V
- Short circuit current Isc: 8.9 A
- VMP voltage: 30.3 V
- Impp current: 8.26 A
- Efficiency: 15.37 %
- Dimensions: 1640 mm x 992 x 50 mm
- The total area of the panel: 1.627 m²
- Maximum system voltage: 1,000 V
- Temperature coefficient:
  - Open circuit voltage: -0.33 %/ °C
  - Pmpp: -0.39 %/ °C
  - Isc: +0.033 %/ °C

To connect the photovoltaic panels between each other, special solar cables will be used with the dimension of 6 square millimeters (sqmm). The panels have incorporated solar cables of 4 sqmm with a length of 90 cm for each terminal but to complete the connection to the inverter it will require additional solar cable. Solar cables have a voltage of 1800 VDC and are resistant to UV radiation, high temperatures, adverse weather conditions, oil and other corrosive substances.

Electrical connection of the panels will be done as follows:

- 24 photovoltaic panels will be connected in series to form a string, with a power of 6 kW per string, operating voltage 727.2 Vd.c., open circuit voltage Vo.c. of 895.2 Vd.c., working current of 8.26 A and open circuit current of 8.9 A.
- The strings formed will be connected in parallel on each inverter used. In total 5 strings will be connected on each inverter with a total power of 30 kWd.c. per inverter. For this project string inverters have been selected.
- The solar cable will be positioned on the metal structures and in the ground on the path to the inverters. When they will be placed in the ground they will be at a depth of 0.6 meters protected by PVC corrugated tube. Also they will be placed in sand with a layer of 10 cm all around the cables. The connections will be done to the inverter with MC4 connection plugs "mother" and "father".
- The distance between the strings and the inverters will have a maximum connection length which will give electrical losses due to distances higher than 2.5 % on the D.C. side.

In order to evacuate the energy produced to the Grid, the panels will be connected to 865 string inverters type Trio 27.6 TL - OUTD - S2X.

Technical details of Inverters are:

- Maximum D.C. voltage 1000 V D.C.
- Start voltage 250 Vc.c
- Maximum power D.C. 30 kWp
- Maximum output power A.C. 28.6 kW
- Output A.C. voltage 400 V
- Maximum efficiency 98.2%
- Industrial surge arrester for D.C. and A.C.
- Internal protection fuses for D.C.
- A.C. and D.C. switch.
- Dimensions 1061 x 702 x 292 mm / 80 kg

Inverter analyzes the status of the grid (voltage, frequency, etc.) before it synchronizes and starts delivering the electrical energy into the grid. The inverters have anti-islanding protection so there is no risk of injecting electrical energy in case of fault or grid is offline. The inverter will supply energy at the voltage and frequency requested by the network without threatening network and equipment.

Inverters will be placed behind the metal structures, under the PV panels on the support pillars of the structures. With this positioning it will be protected by the heat of the sun and also will benefit from extra cooling due to the temperature differences that appear between the top of the metal structures and underneath the PV panels. The inverters will be positioned at a height that allows a distance of 40 cm minimum between the ground and the nearest part of the inverter.

Inverters are provided from the factory with surge protection on the A.C. and D.C. side. Also on the D.C. side the strings of the PV panels are protected by PV fuses of 15A-2P-1000V and have 2 MPPT trackers. The protection on the A.C. side will be done in the General Electrical Panel (GEP) situated inside the Transformer Station. The protection will be made with highly rapid fuses of type 50A-3P-400V.
For the connection with the GEP, cables of type NAYY-f RM 4 x 25 sqmm will be used being positioned in the earth at a depth of 0.6 meters protected in a 10 cm all around sand filling. Inverters will be monitored remotely via dedicated communication, which exists inside the inverters. They will be connected with RS485 cable to the local router mounted inside the concrete booth of the transformer stations. The routers will be connected to a media converter and the rest of the connection to the local internet provider will be done by fiber optics. This solution will give the beneficiary the possibility to monitor and control the inverters from any ware in the world.

2.1. Technical details of the transformer stations and connection to the grid.

For evacuating the produced energy in the National Grid a total 4 concrete booth transformer stations will be used. From this 4 transformer stations all 10 pieces will be of 2000 kVA.

The transformer stations will a radial connection between each other. In total 5 radial connections will be used with the following configuration:

- Transformer stations with numbers from 1 to 2 will form Radial Connection Nr. 1
- Transformer stations with numbers from 2 and 4 will form Radial Connection Nr. 2

The transformers in the radial connections will be connected between each other with medium voltage cable of type NA2XS(FL)2Y 3 x 1 x 240/25 sqmm positioned in the earth at a depth of 0.8 meters in a 10 cm all around sand filling.

All radial connections will connect to the High Voltage Substation (HVS), which will be built in the vicinity of the Overhead Gantry 2KM away in Simbrofo.
The configuration of the 5 transformer stations of 2000 kVA - 24 kV will be as follows:

- 2 medium voltage line cells of 24 kV - 630 A - 24 kA in SF6 for connecting the transformer stations between each other and from the last transformer station to the HVS fitted with separator, grounding knife, the driving mechanism of the separator lever mounted on the front of the cell, heating resistance, capacitive indicator to signal the presence of voltage with auxiliary contact, capacitive indicator for signaling mono-phased and tri-phased short circuits. The first transformer from the radial connection will be fitted with only 1 medium voltage cell.
- Medium voltage transformer cell of 24 kV - 630 A - 16 kA in SF6 / vacuum, fixed separator and vacuum circuit breaker with manual activation, heating resistance, grounding knife, capacitive indicator to signal the presence of

voltage with auxiliary contact, current transformers CT 3 x 300/5/5A, protection relay with protection functions in ANSI code 50-51, including technological transformer protections.

- All medium voltage cells are made from 1 uniform metal casing and insulated air copper rods. The cells will be connected to a ground plug that is connected to the grounding system of the concrete booth.
- Medium voltage oil transformer with normal losses 24/0.4 kV, 2500 kVA, Dyn 5, short-circuit voltage of 6%
- General Electrical Panel (GEP) equipped with 80 pieces circuits equipped with separators with ultra-fast fuses of 50A-3P-400V for each inverter, 3 circuits equipped with empty separators for reserve purposes for a maximum fuse of 63A-3P-400V, 1 circuit equipped with separators and fuses of 40A-3P-400V for supplying the Internal Services Electrical Panel (ISEP), general protection of the GEP made up off a withdrawable circuit breaker In=4000A, Ir=3500, 3P, 400V with included protection and signaling for the transformer. The GEP will also be equipped with surge protection device.
- The GEP of transformer station will be different from the rest being equipped with 69 pieces circuits equipped with separators with ultra-fast fuses of 50A-3P-400V for each inverter, 3 circuits equipped with empty separators for reserve purposes for a maximum fuse of 63A-3P-400V, 1 circuit equipped with separators and fuses of 40A-3P-400V for supplying the Internal Services Electrical Panel (ISEP), general protection of the GEP made up off a withdrawable circuit breaker In=4000A, Ir=3000, 3P, 400V with included protection and signaling for the transformer. The GEP will also be equipped with surge protection device.
- The GEP of transformer station will be different from the rest being equipped with 69 pieces circuits equipped with separators with ultra-fast fuses of 50A-3P-400V for each inverter, 3 circuits equipped with empty separators for reserve purposes for a maximum fuse of 63A-3P-400V, 1 circuit equipped with separators and fuses of 40A-3P-400V for supplying the Internal Services Electrical Panel (ISEP), general protection of the GEP made up off a withdrawable circuit breaker In=4000A, Ir=3000, 3P, 400V with included protection and signaling for the transformer. The GEP will also be equipped with surge protection device.
- Smoke sensor with acoustic and optical warning, relay for transmitting the signal at a distance, 3 internal batteries of 1.5 V, supplied for the ISEP at 230Va.c.
- Space reserved at least for an extra medium voltage transformer cell meaning a minimum of 750 mm.
- The concrete booth will have airtight and water tight orifices for cables entering and exiting the booth, foundation for the transformer, space for oil accumulation for the transformer and 2 hot air extraction ventilators for keeping the transformer temperature within working conditions.

2.2. Grounding protection system and lighting protection system

Grounding protection system will be made up of flat band St-Zn 40x4 mm placed in the earth at a depth of 0.9 meters and earthing electrodes placed in the earth at a depth of 0.9 meters of St-Zn of h=2.5 meters, d=2.5". The system will be placed around the metal structures of the photovoltaic park.

The metal fence which protects the PV park at Simbrofo from intruders will be connected to the grounding system in at least 6 points.

Each concrete booth of the transformer stations will have it's own grounding protection system made up of flat band St-Zn 40x4 mm placed in 3 rings at different depths within the earth. Also part of this system, 8 grounding electrodes will be used of type St-Zn of h=2.5 meters, d=2.5" placed at maximum 5 meters between each other. The grounding system of the concrete booth's will be connected in 2 points to the entire grounding system of the Simbrofo PV park.

All the inverters used in the installation have surge protection on the D.C. and A.C. and also all the GEP inside the transformer stations will have a general surge protection. These surge protections have the primary role of limiting and stopping the damage made by possible lighting strikes. Also

The value of the entire grounding system must have a value of less than 1 ohm due to the fact that the system is designed as to act as a grounding protection and as a lighting protection for all the equipment's in the PV park.

2.3. Conclusions

The current described solution was chosen instead of the use of central inverters due to the following aspects:

- High efficiency in energy production due to small number of strings on individual MPPT trackers (2 or 3 strings per MPPT tracker) which lead to high efficiency per string in energy generation even in the earliest minutes of light in the morning or latest minutes of light in the evening. Overall efficiency of the park will be of about 95% with losses taken into consideration on the entire installed power.
- High viability of the entire park. Changes of an inverter permanent malfunction are extremely low. Even in case of inverter breakdown several inverters will be available on stock on the PV park for immediate intervention and replacement. Energy losses in case of failure are almost zero.
- From the electrical point of view string inverters have low value short circuit currents, causing less stress on other equipment's within the installation (GEP, transformer)

Technical and commercial proposal: Simbrofo Ghana

The Contractor undertakes itself or through its subcontractors to provide the Beneficiary with the following equipment and services as detailed below:	
Turn key power plant: Installed power DC: 20888 kwp; **Output power AC: 20000 kwp**;	
Equipment	Pieces
❖ Photovoltaic panels: Polycrystalline 250 Wp 60 cells, certified and tested, 25 years linear production guarantee. Tier 1 manufacturers: Risen Energy, Jinko, Yngli, Trina, Cecep depending on current stock availability and preference of the investor.	83552 pcs
❖ Inverters: string inverters 27,6 KV ABB Trio 27,6 TL or German made Refusol 27.6 KWp	692 pcs;
❖ Transformers: ABB 2000 KV	10 pcs;
❖ AC / DC cables: German made 15 years warranty HIS Renewables / Prysmian	ml; ml / kg;
❖ Support structure: galvanized steel – according with resistance technical project provided by the buyer with minimal 15 years warranty;	ml/ kg;
❖ Fences and gates: galvanized steel according with the technical/ architecture project;	
❖ Security system: CCTV;	
❖ LED Perimeter lighting;	
❖ Medium voltage cable- in site;	
❖ Auxiliary equipment;	
❖ Data logger and meteo station;	
❖ Production monitoring system – web	

based application; ❖ Technical project of the plant;	
Free Spare parts offered as a discount for this site only (to be left on the client custody): ❖ Photovoltaic panels: 200 pcs; ❖ Inverters: 20 pcs; ❖ Cables, boxes, connectors, fuses;	
Carried works: ❖ Equipment supply on site; ❖ Material supply on site; ❖ Structure ramming; ❖ Structure mounting; ❖ Panels installation; ❖ Invertors installation; ❖ DC/ AC cables installation; ❖ Cables trenches, roads and other civil works; ❖ Transformers installation; ❖ Fences and gates installation; ❖ Perimeter lightning installation; ❖ Security system installation; ❖ Medium voltage installation – inside of the plant; ❖ Grid connection operations (jointly with grid operator); ❖ Testing; ❖ Commissioning and putting in operation;	
Workforce: ❖ 6-12 Ramming machines; ❖ 5 Lifting equipment; ❖ 3 Backhoe loaders; ❖ 2 Digging machines; ❖ 100 Electric and hand tools; ❖ Up to 200 peoples: engineers, site managers, installers, electricians, (construction workers from Simbrofo)	

Guarantees: ❖ System integrator – overall power plant EPC guarantee: 2 years standard or 5 years (with O&M contract); ❖ Photovoltaic panels: 25 years linear production guarantee; ❖ Inverters: 10 years guarantee; ❖ Transformers: 2 years guarantee with extended program offered by ABB; ❖ Steel structure guarantee: 15 years against corrosion;
Insurances: ❖ Construction All Risk Insurance 30 million USD; ❖ Construction Bond/ Surety Bond according with Ghana regulations; ❖ ALOP (advance loss of profit insurance) covering potential delays of minimum 1 mil USD; ❖ Third Liability Insurance: 3 mil USD; ❖ Legal Liabilities according with Ghana laws; ❖ O&M provider liability; ❖ Operational All Risk Insurance – *optional with O&M;*

4 Solar energy technology

4.1 Solar generating stations – how they work

Solar power stations convert daylight into electricity. The output is then conditioned to match the utility supply and connected to the electricity grid.

The electricity is created in arrays of solar panels. The active devices are solar cells as further described in section 4.2 below. They convert light to DC electricity silently with no moving parts and no emissions. In fact they are just larger versions of the cells used in solar calculators. In large solar parks the solar panels are configured in banks of sub-arrays as illustrated for this solar farm in Germany. These blocks are spaced both to allow access and to ensure that one sub-array does not cast a shadow over the one behind.

The electricity is cabled to inverters, which convert DC power to AC, synchronised to the electricity grid. The output is connected through various switchgear, protection devices and meters to local users and the grid.

On-site power users benefit from the solar power, whenever it is available. At times when the solar system produces more power than is being used locally, the surplus is fed back to the grid. When there is a shortfall, the extra power required is drawn from the grid in the usual way. This all happens automatically without any disruption to local power users.

DESCRIPTION OF PROJECT AREA

Physical & Salient features of the project site

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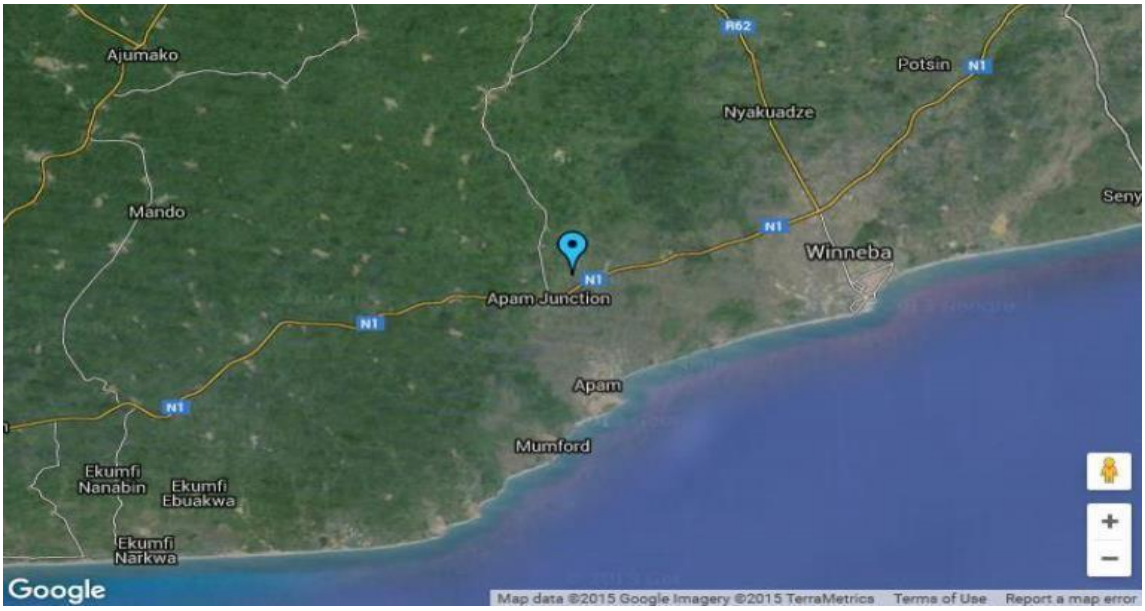
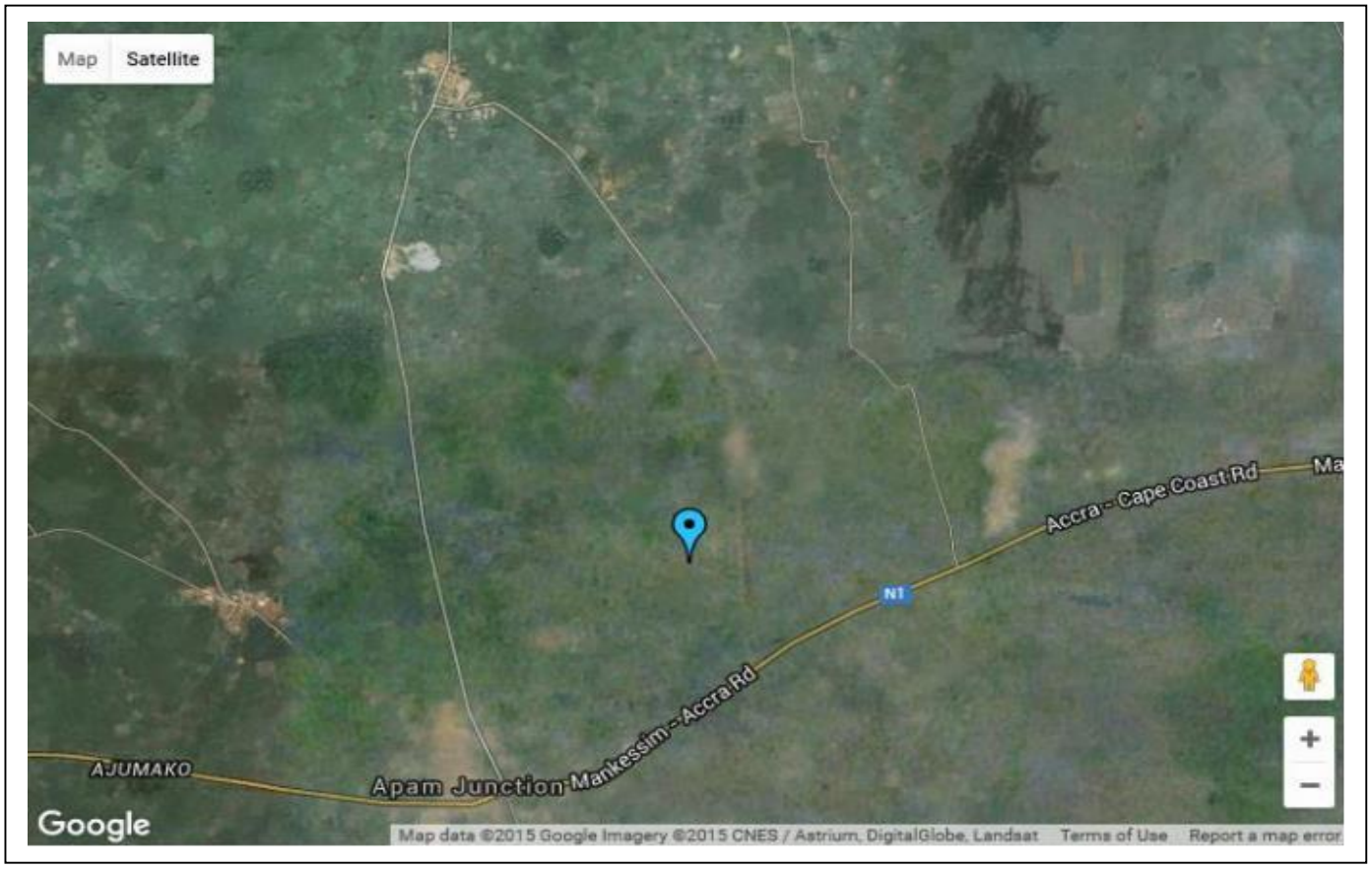
The project will be located on a 300 acres' piece of land set aside in Gomoa Simbrofo in Central Region Simbrofo in the Gomoa District of the Central Region of Ghana in West Africa The 20MW Solar Farm will only use approximately 80 acres of the land and will be designed in a square format. Simbrofo is a populated place and is located in Ghana. The estimate terrain elevation above sea level is 20 metres and is scrub land with minimal tree cover & bushes.





The vegetation cover

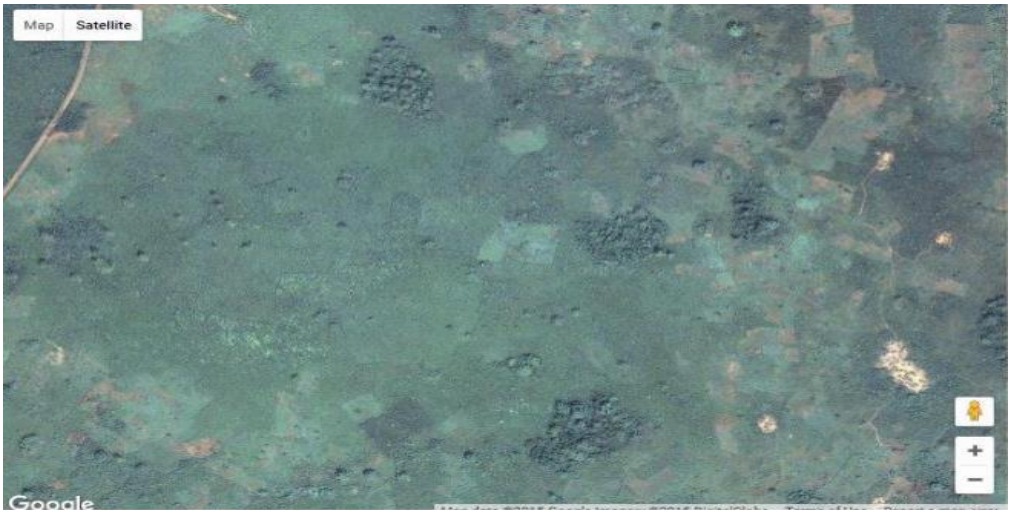
The vegetation existing on the land comprises of short thorny bushes which is a characteristic of a semi-arid climate. Some of the species of plants found in the area include Acacia, Cactusm and short grass among other dry areas plants. The Photo Plate below show the type of vegetation cover on suitable land – below is a village to the West and below that a village to the North of Simbrofo in the Gomoa District of the Central Region of Ghana.

Villagers will be given FREE small Solar PV 10W panels for their homes suitable for two lamps and a phone charger together with Solar Water Pumps & Street lighting. Also a school will be built here with electricity supply. Caught up in their families' daily battle to get food on the table, the children of Gomoa Simbrofo often run from classes during the day to help parents work on the farm or to carry back the day's harvest. By the time they are free from chores, school is over and so being the daylight and the chance to catch up with their studies.

Until September 2006, their learning was limited to a few precious hours in the morning. With no electricity in the village homework was impossible – some child's dream possibly, but not that of the children of Gomoa Simbrofo.

Much to smile about for the children of Gomoa Simbrofo, now able to do their homework in the evenings thanks to the village's solar lamps. Today, street lamps powered by solar panels line the road that divides the village in two and along the school building. Ghanalight Ltd will be able to enhance the Solar in Simbrofo by giving Solar PV panels, Water pumps and further street lighting.

The Vegetation cover is ideal for a solar farm and poses minimal problems with good access road use for construction purposes.



Preliminary Environmental Impact Assessment (EIA)

Assessment that will follow after the investor is granted an Expression of Interest Permit by the Ministry of Energy; Being an English Developer and German EPC company we have followed the procedures below most will be applicable to Ghana. The following templates represents the "proto type" case study of the Environmental Impact of the Simbrofo Solar Farm. After the Preliminary Licence is issued to us we will instruct our appointed Consultants PTL Enterprises Ltd to perform FULL EIA.

Nearby Village

Typical Solar Farm

Preliminary studies of Gomoa Simbrofo Solar Farm Site

This study was conducted by PTL Technologies by the authority of GhanaLight Ltd.

Background

GhanaLight Limited is proposing the establishment of a 20 MW commercial photovoltaic (PV) solar energy facility and associated infrastructure on a 300 acre portion of land at Gomoa Simbrofo, near Apam in the Central Region of Ghana which is located approximately 85 kilometers away from capital, Accra.

The solar energy facility is proposed to accommodate several arrays of fixed photovoltaic (PV) panels and associated infrastructure. From a regional perspective, this region of the Central Region is preferred by virtue of its climatic conditions (primarily due to the economic viability of a solar energy facility being directly dependent on the annual direct solar irradiation values for a particular area). From a local perspective, the site is preferred due to suitable topography, grid connection (as an ECG 33kV power line traverses about 2.2km from the site.

The nature and extent of this facility, as well as potential environmental impacts associated with the construction, operation and decommissioning phases will be explored in more detail later in the draft Environmental Impact Report.

Project Location

The Solar Energy Facility is proposed to be established at Gomoa Simbrofo, which falls within the Gomoa West District of the Central Region. The identified site has existing road access via the Winneba-Apam road and other secondary roads. The larger site available for the project is approximately 300 acres. The facility can therefore be appropriately placed within 100acres of the available acreage taking environmental and any other identified constraints into consideration.

Project Components

The proposed facility is envisaged to make use of photovoltaic (PV) technology with a maximum total generating capacity of ~20 MW and will include the following infrastructure:

- Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels;
- Cabling between the project components, to be lain underground where practical;
- Internal access roads and fencing;
- Workshop area for maintenance, storage, office, toilets; water storage tanks;

The overarching objective for the solar energy facility is to maximize electricity production through exposure to the solar resource, while minimizing infrastructure, operational and maintenance costs, as well as social and environmental impacts. In order to meet these objectives local level environmental and planning issues will be assessed through a full EIA through site-specific studies in order to delineate of sensitivity within the broader site; this will serve to inform the design of the facility.

Project site coordinates from Google Earth

Evaluation of the Proposed Project

The main issues identified through this preliminary EIS study associated with the proposed solar energy facility are summarized in Table 1.

As can be seen from the table above, the majority of potential impacts identified to be associated with the construction of the solar energy facility are anticipated to be localized and restricted to the proposed site itself (apart from social impacts – job creation which could have more of a regional positive impact; and visual impacts which would extend beyond the site boundaries), while operational phase impacts range from local to regional and national (being the positive impact of contribution of clean energy as part of the energy mix in Ghana; and visual impacts which would extend beyond the site boundaries). No environmental fatal flaws or no go areas have been identified to be associated with the site.

In order to assess potential impacts within sensitive areas, the preliminary layout for the PV solar energy facility has been considered in this EIS. This preliminary sensitivity analysis of the site was considered by PTL Technologies in understanding which area of the site was least impacted by the development of a PV solar energy facility in order to inform the preliminary infrastructure layouts.

Evaluation of the Potential Issues with Associated Infrastructure - Invertors, Upgrade of Substation and Internal Access Roads

In order to connect the solar energy facility to the power grid, inverters will be used, which will connect to a Gantry Unit which can be located about 2km from the site. This has become necessary due to the fact that the main substation which is located Gomoa Pomadze about 20km away from the site, (10km above the internationally acceptable distance of 10km)

A substation is a part of an electrical generation, transmission, and distribution system. Substations transform voltage from high to low, or the reverse, or perform any of several other important functions. Between the generating station and consumer, electric power may flow through several substations at different voltage levels. A Gantry Unit is a switching station that will likewise play a role of a substation in interfacing the Solar Power from the site into the National Grid.

Potential issues identified to be associated with the internal access roads and invertors include impacts on flora, fauna and ecological processes and visual impacts. Recommendations regarding a preferred location for this infrastructure and appropriate mitigation measures (if required) will be made.

Table 1: Summary of significance of the potential impacts associated with the proposed PV solar energy facility development

Construction / Decommissioning Impacts	Extent
Disturbance or loss of indigenous natural vegetation	L
Disturbance or loss of habitat for threatened / protected plants	L
Loss of protected trees	L
Impacts on watercourses and drainage areas	L
Establishment and spread of declared weeds and alien invader plants	L
Temporary disturbance to grazing land-use of the farm during construction	L
Soil loss/ erosion / degradation	L
Loss of heritage resources	L
Temporary visual intrusions / disturbances to people	L
Job creation and skills development of local people during construction (positive impact)	L-R
Economic spin-offs to local community.	L
Safety and security risks to site and surrounds	L
Temporary disruptions in the daily living and movement patterns to neighbouring	L
Operational Impacts	**Extent**
Loss of protected plant and animal species due to habitat transformation on the site.	L
Loss of low agricultural potential land on the site itself	L
Soil erosion	L
Visual impacts (intrusion, negative viewer perceptions and visibility of the facility)	R
Employment opportunities	L-R
Safety and security impacts on the site and neighbouring land.	L
Positive / negative effect on the tourism industry.	R
Contribution of clean energy.	N

L Local R Regional N National I International

Once the Preliminary License has been issued then full EIA and Feasibility Study will be done.

alpin SUN
solar EPC

Project technical overview

Objective: PHOTOVOLTAIC POWER PLANT

Positioning: Groud mounted
Ghana

Designed electrical installation

Un = 0.4 kV / 23 kV
Installed Power (kW) : Pi = 20888 kW
Maximum Output Power: Pa = 20000 kW

Proposed configuration for the PV Plant consist in 83552 pieces photovoltaic panels of 250Wp placed on metal structures at an angle of 1 degree, azimuth 0 ° (North). There will be used 3467 metal structures, with 24 PV panels each. The metal structures will be mounted with metal anchors in the ground. All panels will be connected in series of 24 panels.

To connect the photovoltaic panels between each other, special solar cables will be used with the dimension of 6 square millimeters (sqmm). The panels have incorporated solar cables of 4 sqmm with a length of 90 cm for each terminal but to complete the connection to the inverter it will require additional solar cable. Solar cables have a voltage of 1800 VDC and are resistant to UV radiation, high temperatures, adverse weather conditions, oil and other corrosive substances.

2.1 Typical arrangements

The primary constituent of the installation is the array of solar photovoltaic (or 'PV') modules, which convert incident sunlight directly to electricity. These are configured in rows across the majority of the site, interspaced to minimise shading.

As a rule of thumb in the UK the space between rows is about three times the width of the row. Typically an installation of one megawatt (1MW – one thousand kilowatts under full sunlight) would require 2 to 2½ hectares.

2.2 Rationale for development

Solar park developments are generating stations producing clean renewable energy for local consumers and/or electricity users in general. This contributes to the national policy objectives described below and also to local and national energy security.

2.3 Contribution to sustainable energy supply

In a good sunshine area a 1MW installation would generate about 1,000 MWh (one million kilowatt hours) per annum. This is equivalent to the total annual electrical consumption of some 240 typical households[3].

A suitable substation is normally required located near to the solar farm and in the case of Simbrofo site there is a connection possible at a Gantry Unit 2KM from the site, which is suitable and results in minimal transmission losses.

2.1. Technical details of the transformer stations and connection to the grid.
For evacuating the produced energy in the National Grid a total 4 concrete booth transformer stations will be used. From this 4 transformer stations all 10 pieces will be of 2000 kVA.

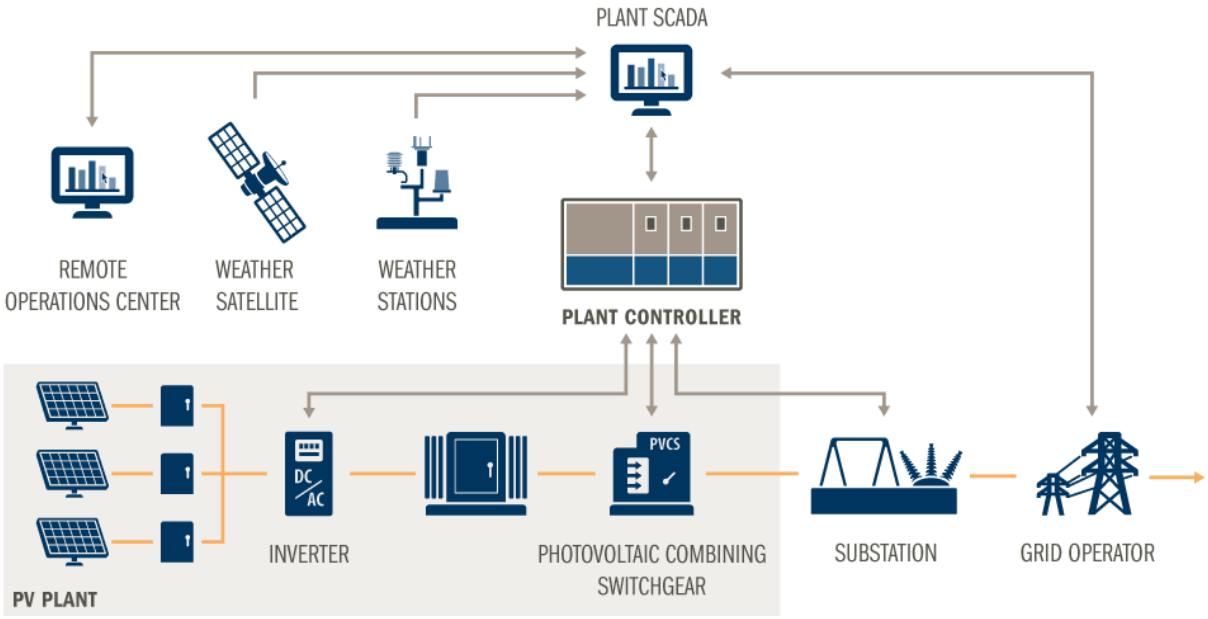
The transformer stations will a radial connection between each other. In total 5 radial connections will be used with the following configuration:

- Transformer stations with numbers from 1 to 3 will form Radial Connection Nr. 1
- Transformer stations with number from 4 will form Radial Connection Nr. 2

The transformers in the radial connections will be connected between each other with medium voltage cable of type NA2XS(FL)2Y 3 x 1 x 240/25 sqmm positioned in the earth at a depth of 0.8 meters in a 10 cm all around sand filling.

All radial connections will connect to the High Voltage Substation (HVS), which will be built in the vicinity of the EL Salitral PV park.
The configuration of the 5 transformer stations of 2000 kVA - 24 kV will be as follows:

- 2 medium voltage line cells of 24 kV - 630 A - 24 kA in SF6 for connecting the transformer stations between each other and from the last transformer station to the HVS fitted with separator, grounding knife, the driving mechanism of the separator lever mounted on the front of the cell, heating resistance, capacitive indicator to signal the presence of voltage with auxiliary contact, capacitive indicator for signaling mono-phased and tri-phased short circuits. The first transformer from the radial connection will be fitted with only 1 medium voltage cell.



- The GEP of transformer station will be different from the rest being equipped with 69 pieces circuits equipped with separators with ultra-fast fuses of 50A-3P-400V for each inverter, 3 circuits equipped with empty separators for reserve purposes for a maximum fuse of 63A-3P-400V, 1 circuit equipped with separators and fuses of 40A-3P-400V for supplying the Internal Services Electrical Panel (ISEP), general protection of the GEP made up off a withdrawable circuit breaker In=4000A, Ir=3000, 3P, 400V with included protection and signaling for the transformer. The GEP will also be equipped with surge protection device.
- Smoke sensor with acoustic and optical warning, relay for transmitting the signal at a distance, 3 internal batteries of 1.5 V, supplied for the ISEP at 230Va.c.
- Space reserved at least for an extra medium voltage transformer cell meaning a minimum of 750 mm.
- The concrete booth will have airtight and water tight orifices for cables entering and exiting the booth, foundation for the transformer, space for oil accumulation for the transformer and 2 hot air extraction ventilators for keeping the transformer temperature within working conditions.

Example of a solar farm designed in a square array, which will be the design shape for Simbrofo.

General Climate & vegetation of Ghana

Climate

The South-eastern coastal plain of Ghana, which is one of the hottest and driest parts of the country. Temperatures are however subjected to occasional and minimal moderating influences along the coast.

Temperatures at Simbrofo are appreciably high for most parts of the year with the highest during the main dry season (November - March) and lowest during the short dry season (July - August). They average a few degrees lower on the coast than they do over most of the plains. The absolute maximum temperature is 40° C. The most complete absence of cloud cover for most parts of the year will be very good for electricity production at Simbrofo and gives way to very high rates of evaporation which leaves most parts of the district dry and with parched soils. The combined effects of high temperatures and high insulation levels, on the other hand, are of invaluable asset to the salt-making industry, as they account for the high and rapid rates of salinization and crystallization crucial for the winning of salt. They also provide enormous potentials for solar power development.

Rainfall is generally very low with most of the rains, very erratic in nature and coming mostly between September and November. Mean annual rainfall increases from 762.5 millilitres on the coast to 1220 millilitres to the North and Northeast.

The unreliability and dependence of farmers on the rainy seasons makes farming a vulnerable occupation. Periodic main crop failures are common phenomena even in the better- watered northern parts. It is obvious therefore that the provision of irrigation facilities would be of great value in the district. This should be accompanied by soil salinit control measures.

Vegetation at Simbrofo

Preliminary investigation here will be followed by a full EIA. The predominant vegetation type found in the district is of the short grass savannah interspersed with shrubs and short trees, a characteristic of the Sub-Sahelin type. A large portion of vegetation remains dry for most parts of the year particularly towards the south except for the short rainy season. The ravaging effects of seasonal bushfires that sweep across most parts of the district especially during the dry season further depreciate the quality of the vegetation. Along some stream courses however, higher vegetation type ranging from thickets to light forest are common.

Large strands of Borassus Palm are found around the eastern portions, isolated stands of baobab trees are common all over the plain. There is a main urban town – Winneba to the South East of Simbrofo that will benefit from the Solar Farm and Renewable Energy together with opportunities for Solar PV Off Grid schemes, Solar Street Lighting and Solar PV for dwellings.

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We have developed the **"Resource Ownership**" concept for Ghana at the solar farm at Simbrofo, where the Local Government and peoples in an area of the solar farm will benefit from Solar PV water pumps, Solar PV panels for their dwellings also going to the Local Government will be solar street lighting – this ensures Sustainable Energy development for Ghana. This initial request for the FIT is a request for one solar farm in Simbrofo in Ghana.

GHANALIGHT LTD have created, over a three-year development period a Solar PV market opportunity in Ghana for Alpin Sun GmbH who will fund, build and operate the solar farm. The solar farm projects will form part of a 500MW capacity that we targeted for Ghana under our Ghanalight Ltd development programme. well positioned to build the solar farm alongside our German partner of choice and EPC company Alpin Sun GmbH (Alpin), to provide very significant revenue streams and profit margins. Alpin are known by them peers as one of the best companies in the solar farm sector due to their technology choice, pricing and delivery values. GHANALIGHT LTD has had discussions with the Minister at Central Government.

GHANALIGHT LTD has also garnered major political support in principal from the Ghana Government who have stated its aim is to oversee solar as a major contributor to the country's electrical generation requirements and specifically has aligned himself to the success of GHANALIGHT LTD's development programme.

In addition to Central Government support from the Ministry of Power, GHANALIGHT LTD has alliances with the chiefs of the 300 acre sites at Gomoa Simbrofo.

Just how is Alpin Sun & GHANALIGHT LTD going to achieve its development programme? Having established in Country links and the entry route, GHANALIGHT LTD works closely with PTL Technologies Ltd and is now positioned to attract investment to its project in Simbrofo which is ready for Preliminary Licence & Feed-In-Tariff (FIT) Applications. The identified location at Simbrofo is optimal to generate the maximum capacity of electricity over a 25-year life cycle directly into the central electricity grid. – for this 20MW Solar Farm project in Simbrofo we require $30 million for the build phase (Alpin Sun GmbH) costs, and all other costs including start-up costs bring total build stage costs to $30 million, which includes $1.986,800 Pre Build phase with investment in the form of either debt, equity of some form of negotiated hybrid to suit; refer to Financial section and also the separate financial xls. For further details,

The very significant revenues from a solar farm are generated due to the Feed-In-Tariff and in the case of the 20 MW project $80 million over twenty-five years, the most obvious benefit of the feed-in tariff in Ghana is the potential for added capacity for renewables. According to the European Investment Bank Renewable Energy Performance Platform REPP the maximum capacity that the feed-in tariff will subsidize is 1,750MW added over the course of 20years. According to the United Nations Environment Program UNEP, it is reasonable to expect that the feed-in tariffs will stimulate 1,300MW of installed power capacity. The African continent arguably has the most to gain from the deployment of solar as an energy source as radiation levels are over three times that of Europe and Ghanalight is positioned to take advantage of this factor.

This Resource Ownership concept – As stated earlier the Site of the Gomoa Simbrofo Solar Farm – Africa and Ghana must take advantage of the Sun's Solar Resource. We aim to make provision of part of the Renewable Energy to help promote Sustainable Energy, Sustainable Business Development, Sustainable Education and enhance the quality of life of the people of Ghana together with mitigating against Climate Change - The Problem of Climate Change will result in significant opportunities for Ghana. People living near to each of our Solar Farms will be given FREE Solar PV panels for their homes, the Local Chiefs or Government given Solar Street Lighting, villagers given Solar PV Water Pumps employment opportunities are also offered to the villagers.

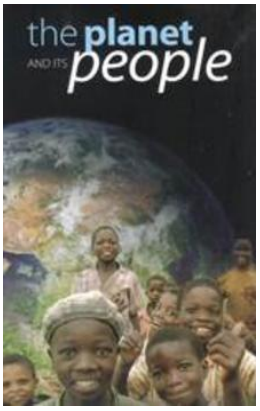
Solar Farm electricity for towns

Village Solar Water pumps

Each home has Free Solar panel

Villagers get FREE Solar panel, two lights and phone charging point – in the case of Kenya this Massai woman has a charging point for her phone.

In the case of Ghana, we intend to part share the electricity with the people of Ghana and offer Solar Water pumps assisting with drinking water and food irrigation, Solar street lighting can also be arranged and small FREE Solar panel and two lights and phone charging point being made available to all villagers around each of our solar farms.



GHANALIGHT - PROJECT

We have already secured an authorisation letter from the Chiefs of Simbrofo (Appendix one) land and obtained from Government Ministry of Power support a support letter after discussions with the main Energy Ministry in Ghana (Appendix two). We aim to develop the Simbrofo 20MW Solar Farm and offer FREE Solar PV panels to villagers around each Solar Farm, Solar Water Pumps and also Solar Street lighting together with building a new school. GHANALIGHT Ltd - Alpin Sun GmbH team who we have appointed as our EPC company to build the solar farms, they will be exempt of any TAX for imported equipment associated with technology required for all equipment including the PV panels. The Solar Farm will also attract Zero Tax to aid Sustainable Energy programmes in Ghana. A good access road exists for the movement of construction material and technologies and we will also be providing a new school, community centre and library together with two toilets.

ENVIRONMENTAL AND SOCIAL PARAMETERS

The environmental impact at Simbrofo and its social impact implications will be put into consideration during the development of this project.

The Initial Environmental Impact Assessment will be done in order to determine whether the proposed project will have adverse or mild effects on the environment and to tell whether to carry out a full Environmental Impact Assessment or a full Environmental Impact Study. Either of the two will be accompanied by a Comprehensive Mitigation Plan which describes the arrangements for implementing mitigation measures to reduce the 'would be' impacts on the surrounding environment.

Areas to be covered in a Full EIA after the Preliminary Licence has been issued

1 Site location

The energy source for a 'solar park' or 'solar farm' is daylight, so the range of potential sites is almost endless.

1.1 Local energy usage

Many solar farms are merchant generating systems feeding power straight into the national electricity grid.

Under the present Feed-In Tariffs regime, further described in 3.2.1 below, the viability of projects can be enhanced by supplying electricity to on-site users. This also benefits the local economy, and so site near to industrial estates and power-consuming agricultural installations, such as dairies, can prove particularly suitable.

2.1 Typical arrangements

The primary constituent of the installation is the array of solar photovoltaic (or 'PV') modules, which convert incident sunlight directly to electricity. These are configured in rows across the majority of the site, interspaced to minimise shading.

As a rule of thumb in the UK the space between rows is about three times the width of the row. Typically an installation of one megawatt (1MW – one thousand kilowatts under full sunlight) would require 2 to 2½ hectares.

2.2 Rationale for development

Solar park developments are generating stations producing clean renewable energy for local consumers and/or electricity users in general. This contributes to the national policy objectives described below and also to local and national energy security.

2.3 Contribution to sustainable energy supply

In a good sunshine area a 1MW installation would generate about 1,000 MWh (one million kilowatt hours) per annum. This is equivalent to the total annual electrical consumption of some 240 typical households[3].

2.4 Contribution to the environment

Solar generation reduces the need for traditional sources of power generation. Therefore 1,000 MWh displaces electricity, which if it had been produced at the UK's average grid mix[4] would have produced over 544 tons of carbon emissions.

2.5 Contribution to the social economy

Solar installations also reduce the dependence of local economies on energy imports. The installation and maintenance, though modest, can generally be provided by local workers.

3 Relevant local and national policies

3.1 Planning Policy

Because solar systems are physically inert and environmentally benign, as described below, they present few planning concerns. Indeed for many applications they fall within the scope of permitted development[ii].

Local and National Planning Policy will be followed in the case of this Simbrofo Solar Farm proposal

3.1.2 Agricultural land

Because of the spacing of solar arrays within a solar farm, as described above, it is possible to retain agricultural usage of the land on which they are sited.

Although arable application would generally prove difficult, grazing remains possible within array fields and indeed is particularly synergistic as it prevents plant growth which may in due course shadow the solar arrays.

For similar reasons array fields can also play a part in nature conservation plans, as further described in 6.1 below.

The government's planning policy statement on sustainable development PPS7[v] requires the presence of land in grades 1, 2 and 3a of the Agricultural Land Classification to be taken into account alongside other sustainability considerations. This suggests that classifications 3b, 4 and 5 will generally be more suitable for solar parks, though the statement also recognises the need to support diversification of agricultural land that helps to sustain an agricultural enterprise.

3.2 National energy Policy

In addition to the planning issues described above, the government is encouraging a positive approach to renewables as detailed in its draft National Policy Statement[vi].

This policy is supported by a range of incentive mechanisms. One of these in particular has stimulated the demand for solar park installations.

3.2.1 Feed-In Tariffs

This project will be supported by the Feed-In Tariffs
Feed-In Tariffs are payments to anyone producing renewable electricity (a 'generator') for every kilowatt-hour (kWh) of power that they produce. They have two elements:

- The generation tariff for every kWh of electricity generated (whether consumed on site or exported); and
- An export tariff for kWhs not used, but fed back into the grid.

In addition, generators get a third benefit in that every kWh of electricity that they generate and use themselves saves having to buy that electricity from their supplier.

3.3 Local development policy

Most regional and local development frameworks include policies on the development of renewable generation. Many have set targets for the level of renewable energy generation they intend to achieve in future years.

The benign nature of solar photovoltaic generation, in particular makes it compatible with virtually all such plans.

Our Simbrofo 20MW Solar Farm will enhance the already plant in the area by the Chinese Developer.

4 Solar energy technology

4.1 Solar generating stations – how they work

Solar power stations convert daylight into electricity. The output is then conditioned to match the utility supply and connected to the electricity grid.

The electricity is created in arrays of solar panels. The active devices are solar cells as further described in section 4.2 below. They convert light to DC electricity silently with no moving parts and no emissions. In fact they are just larger versions of the cells used in solar calculators. In large solar parks the solar panels are configured in banks of sub-arrays as illustrated for this solar farm in Germany. These blocks are spaced both to allow access and to ensure that one sub-array does not cast a shadow over the one behind.

The electricity is cabled to inverters, which convert DC power to AC, synchronised to the electricity grid. The output is connected through various switchgear, protection devices and meters to local users and the grid.

On-site power users benefit from the solar power, whenever it is available. At times when the solar system produces more power than is being used locally, the surplus is fed back to the grid. When there is a shortfall, the extra power required is drawn from the grid in the usual way. This all happens automatically without any disruption to local power users.

4.2 Description of the solar arrays

The largest and most visible elements of the system are the arrays of solar modules. Solar modules are solid state semiconductor devices with no moving parts. They convert light directly into DC electricity silently and with no emissions.

The solar cells themselves are made from silicon, which is the most abundant element in the surface of the earth (the primary constituent of rock and sand). It

is treated to become a semiconductor – essentially a large light-sensitive diode.

The front surface of the solar modules is toughened glass with an anti-reflective coating to maximise the light captured by the solar cells. From the front, the modules look predominantly black in appearance, though from close-up a grid of silver contacts is visible.

Modules are framed with anodised aluminium, and will be mounted as sub-arrays on frames of anodised aluminium and hot-dipped galvanised steel.

4.3 Other equipment

The inverters, switchgear and other electrical equipment are standard items as used for a wide range of industrial applications.

The other major operating component of the system is the inverter, which converts the DC power produced by the solar modules into AC power which can be used by local users and fed into the grid. Depending on the size and configuration of the overall system, this may either be a single unit or a number of separate inverters, each handling a part of the overall solar array.

Sensitive equipment will typically be housed in equipment shelters within the solar array field, similar to telecommunications and power equipment visible in many locations around the countryside.

5 Potential impacts on the local environment

5.1 Landscape and Visual Change

Because there are no adverse environmental impacts, planning considerations tend to focus on the physical and visual impacts of solar systems – principally the solar array.

Designs proposed by Ownergy minimise such visual impacts by limiting the height of the solar arrays, even at their steepest angle, to typically less than 4m – so they are often no higher than surrounding hedgerows.

Rows of arrays can be arranged to follow local topography. The arrangement of discrete array blocks at staggered intervals and with spacing in between breaks up any potential visual monotony and avoids undue wind concentration or turbulence.

5.2 Light reflection

Solar panels are designed to absorb, not reflect, irradiation. They are therefore responsible for only limited levels of either 'glint' or 'glare', as the photographs in this document show, and are substantially less reflective than glass-houses for example.

Glint may be produced as a direct reflection of the sun in the surface of the PV solar panel, but will be substantially reduced by the anti-reflective coating that most modules incorporate to maximise the light capture of the solar cells as the photograph in section 3.1.2 above illustrates. Glare is a continuous source of brightness, relative to diffused lighting. This is not a direct reflection of the sun, but rather a reflection of the bright sky around the sun. Glare is significantly less intense than glint.

5.3 Ground Conditions and Contamination

Solar arrays are typically installed using screw piled, piled or ballast supported systems. They therefore cause no adverse impact on the ground and no contamination.

The effect on wildlife is also minimised as further discussed in 6.1 below.

Only where necessary will concrete plinths or other more intrusive foundations be used.

5.4 Noise and Vibration

Solar cells are inert solid state devices which convert light into electricity. The systems therefore produce virtually no noise and no emissions.

The inverters require some cooling, so there is a slight fan noise perceptible only if standing immediately adjacent to the housing.

Otherwise there are no moving parts, except in the minority of systems, which may be designed to be manually adjusted twice per annum.

5.5 Air Quality

The panels do not give rise to any emissions which will impact on air quality.

The level of traffic generation is minimal as discussed in 7.1 below.

5.6 Surface Water Drainage and Flooding

Solar panels drain to the existing ground, and (except in unusual circumstances where substantial concrete plinths are used) runoff should be no greater for the developed site than it was for the pre-developed site.

If suitably designed, solar farms can be located in flood plains and offer a good applications for such areas.

5.7 Safety

5.7.1 Electrical safety

The electrical aspects of the system are covered by Engineering Standard G59[ix], which sets down requirements for electrical safety and grid-connection of generating systems.

Cross-site cabling is typically led underground between equipment housings.

5.7.2 Security Fencing

Generally there is a need to ensure solar facilities are adequately secured to reduce theft and vandalism risk and protect passers-by.

The requirements will vary from site to site and designs produced to avoid unacceptable landscape or visual impact. This includes utilising existing hedges, minimising the height of security fencing, using natural features and appropriate measures for continued access by larger mammals, such as badgers and foxes.

6 Ecology, Nature Conservation and Cultural Heritage

6.1 Nature conservation

Solar farms have the potential to increase the biodiversity value of a site if the land was previously intensively managed. Sheep grazing or an autumn cut with removal of grass cuttings could increase the botanical diversity of the site.

The solar park at Kobern-Gondorf in Germany, for example, is used as a nature reserve for endangered species of flora and fauna.

Solar parks typically present no negative environmental impact to the surrounding area and wildlife. They, of course, make a substantial positive contribution towards the country's efforts to achieve a reduction in CO_2 emissions as described in 2.4 above, and this has a positive impact on ecology generally.

6.2 Environmental Impact Assessments

Solar arrays are not expressly listed in Schedule 2 to the EIA Regulations 1999.

Some authorities consider that solar developments appear similar to greenhouses and therefore follow Annex A to the EIA Circular 02/99:

> 'Development (such as greenhouses, farm buildings etc.) on previously uncultivated land is unlikely to require EIA unless it covers more than five hectares'

6.3 Cultural Heritage

The impact of solar park developments on local heritage assets will be very site dependent.

A recent approval on a previous airfield site, for example, was adjudged "a very effective re-use of the heritage assets, in character with the innovative technological history of the site".

6.4 Archaeology

The support structures for the solar arrays typically protrude up to 1.5 metres into the ground. In a minority of cases of known archaeological interest, therefore it might be necessary to commission a geophysical evaluation of the site or an appropriate programme to ensure that any archaeological interests are safeguarded and if necessary mitigated.

It is possible to employ ballasted support systems, which do not penetrate the ground.

7 Traffic and Transport

7.1 Traffic movements

During the construction stage, each MW of capacity may generate a few dozen movements for the delivery of the equipment.

Thereafter there will be visits by service personnel typically twice per annum.

The systems need no refuelling or other routine provisions so will generate no additional traffic movements in the area.

7.2 Aviation

Systems are designed to avoid adverse effects from reflected light and thus to conform to the Air Navigation Order 2009, particularly articles 137, 221 and 222

The Civil Aviation Authority (CAA) is seeking to develop its policy on the installation of solar photovoltaic systems and their impact on aviation[x].

Above Articles only apply to UK but Ghana policies will be followed for the Simbrofo site.

Between 100 and 200 local Jobs will be provided to construct the Solar Farm

8 Community engagement

Solar parks are still virtually unknown in the UK and developers are advised to inform local communities about the characteristics and benefits of this technology as part of the engagement process.

Because solar systems are silent, clean and unobtrusive, they have proven to be one of the most acceptable of the renewable energy technologies, and substantially less contentious than, for example, wind power. The lack of traffic movements also avoids the objections sometimes raised against thermal technologies, like anaerobic digestion and biomass.

Attention normally centres on the potential visual impact. Because as detailed in 5.2 above there are no substantial reflection issues, and well-designed schemes maintain the height of the systems below that of surrounding hedges and landscaping, Ownergy has found that its proposed developments have met with widespread support from local communities.

This document has been prepared in part to contribute to such community education initiatives.

9 Legacy issues

Solar farms are regarded as a temporary use of land.

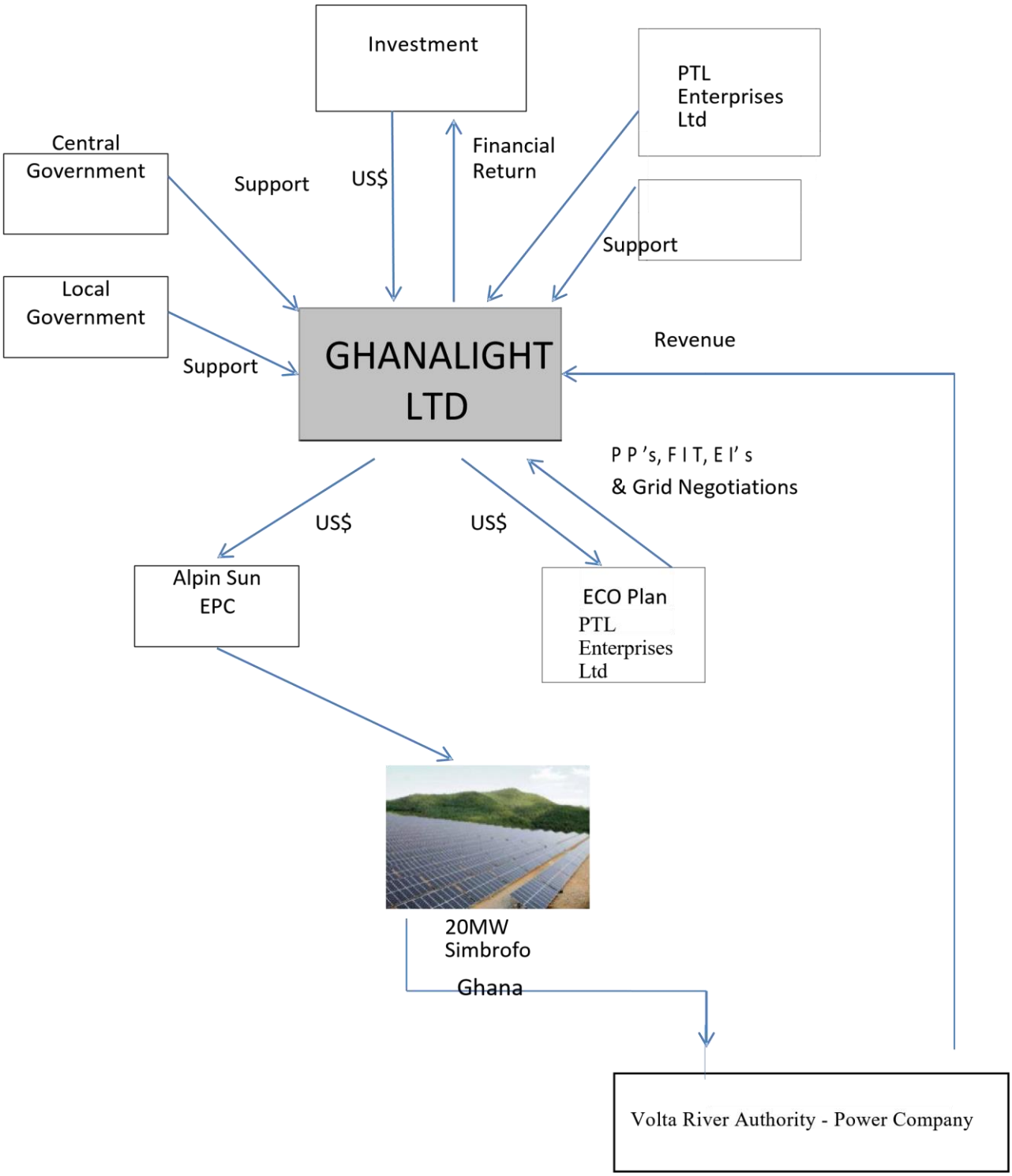
Solar facilities developed on agricultural ground are 'reversible', allowing the site to be easily restored to a more intensive agricultural use. Intrusive development, such as trenching and foundations, are minimised.

Some planning consents apply the condition that the land be permanently reinstated to its original condition at the end of the project life, and Ownergy's projects can meet such a condition.

The equipment can be recycled at the end of its useful life.

WS10 Business Plan

Provide a written explanation of the company's business model for the venture.



Business Plan - Financials

FINANCIAL AND ECONOMIC PARAMETERS OF THE PROJECT BENEFIT ANALYSIS

-

PRELIMINARY COST - $30 million

The fundamental question of whether the Simbrofo Solar Farm Solar photovoltaic (PV) makes economic sense as a power resource can be addressed with a basic economic benefit-cost (B/C) analysis, in which the levelled cost of electricity produced with a PV system is compared to the levelled value of its output.

In addition, the nature and magnitude of subsidies such as a Zero Tax rating for the Central Region of Ghana, impact of the solar power production on electric rates, and the degree of cost shifting among utility customers are also important factors to consider. There are numerous ways to think about economic benefits of a given project such as Simbrofo, but one common approach is to derive a Benefit/Cost ratio with the net present value (NPV) of project benefits in the numerator and the NPV of project costs in the denominator.

B/C Ratio = Net present value of project benefits Net present value of project costs
B/C ratio>1 means the project is economic, as benefits exceed costs.
B/C ratio<1 means the project is uneconomic, as costs exceed benefits.

The relative cost-effectiveness of project at $30 million can be assessed by comparing their benefit -cost ratios; the higher the B/C ratio, the greater the economic value of the project and therefore the more viable the project is However, it is important to note that there is no any single, standard cost -benefit modelling approach that is accepted by all as a blue print. The results and conclusions might be different depending on how the analysis is conducted. For that reason, this pre-feasibility study considered at least three key case scenarios of the modelling that will crucially affect the results:

(i) The perspective of the solar power customers in gauging the costs and benefits of the project
(ii) The perspective of the non - solar power customers in gauging the costs and benefits of the project
(iii) The perspective of the general society in gauging the costs and benefits of the project

In principle, all the three groups of people examined the project in terms of the advantages and the disadvantages it is going to have on them (“affected people”) per se. In this respect, now that the installation will not be a stand-alone project but it will rather be fed to the national grid, all the 3 groups mentioned above are affected.

The benefit-cost assessment can differ across the stakeholder groups because the specific terms included in the respective benefit-cost equations vary across the groups. As discussed below, there are a number of reasons for this, but one factor is the presence of subsidies.

Many solar projects benefit from various types of “societal” subsidies from the governments of those particular countries. In that line, Ghana is one of the 60 countries who are committed to promote the usage of renewable energy such as solar and wind power in terms of tax reliefs and other forms of government subsidies. This shows that subsidies exist for solar PV, and they might affect the B/C ratio in a positive way for this particular proposed project.

The projected project EPC cost is estimated at $28 Million USD and total build costs at $30 million USD and it will be completed within a maximum of 12 months and be live for at least 25 years before any other major installation such as replacement of solar panels and other infrastructure to be made. The overhead infrastructure (power lines) will be constructed over a distance of about 2km from the project site.

Considering this proposed project as a hypothetical power project with an initial one year peak load of 20 MW and sales of 0.12 USD per KWh, producing 55,000 MWh per year using single axis trackers. However, the benefits of this project supersede its costs and therefore it is
economically viable and therefore recommended for approval. For instance, it will earn a lot of revenue to the investors and also to the government in form zero taxes together with International Carbon Credits of $1.030 million. Total Net Profit will be $111,631,401 million over the 20year period.
It will also benefit the local communities in form of Free Solar PV panels for homes and street lighting together with occasional Solar PV water pumps for villages around SOLAR FARM, corporate social responsibilities projects by the power company.

Project costs - $30 million

Initial Costs					
Solar Power Plant purchase					
	$ per Mw		$1,400,000		
	Total project Mw		20		$28,000,000
Licence Fee + carbon credit certification					$360,000
Grid connection					$700,000
Agent commission at 3% funds raised					$216,015
Initial land rent					$17,000
Pre-build technicals - PTL Enterprises Ltd					
		Phase 1	$64,500		
		Phase 2	$194,500		
		Phase 3	$34,500		
Management expenses and Design			$60,000		$353,500
					$29,646,515

Borrowings						form	repayment					
Other												
Equity	Preferred stock				$6,646,515	equity	preferred dividend flow			debt to equity ratio:		78%
Debt	project finance				$23,000,000	debt	3.24	year avg life				
					$29,646,515	check sum	-					
Preferred stock conversion rate				1:	0.20	following 5th year						
Preferred stock required return - initial 5 years					15%	flat per annum						
Interest Rate per annum					4.00%	rate on borrowings						
Grace period (years)					2	[0 through to 5 years]						
Full term (years)					12							
Interest periods per annum					2	[1=annual, 2=semi-annual]						
Principal repayment periods per annum					1	[1=annual, 2=semi-annual]						

PROJECT AT A GLANCE
Return on Investment (ROI) %
18.89%
Internal Rate of Return (IRR) %
14.68%
$Operational Profit over 20 years
$111,631,401
Averaged Yearly Net Profit
$5,581,570
Average life payback in years
3.24
Loan Amount $
$23,000,000 Debt & $6,646,515
Deposit Amount $
$6,646,515
Loan Repayment in Years
12.00 with 2 year grace period
Interest Rate on Loan
4.00%

Accumulated return for Preferred Share holder years 1 to 5			
	investment	cumulative	return
year 0	$6,646,515		
Year 1	$0	$6,646,515	$996,977
Year 2	$0	$6,646,515	$996,977
Year 3	$0	$6,646,515	$996,977
Year 4	$0	$6,646,515	$996,977
Year 5	-$6,646,515	$0	$996,977
sum	$0		$4,984,886

Operating Expenses														
Debt service - interest		6,900,000			920,000	920,000	920,000	828,000	736,000	644,000	552,000	460,000	368,000	276,000
Contingency and local projects		500,000			250,000	250,000								
Operation and maintenance		1,214,868			50,000	51,000	52,020	53,060	54,122	55,204	56,308	57,434	58,583	59,755
Insurance		1,312,058			54,000	55,080	56,182	57,305	58,451	59,620	60,813	62,029	63,270	64,535
Staffing and wages		4,859,474			200,000	204,000	208,080	212,242	216,486	220,816	225,232	229,737	234,332	239,019
office expenses/security		2,429,737			100,000	102,000	104,040	106,121	108,243	110,408	112,616	114,869	117,166	119,509
legal and accounting		1,214,868			50,000	51,000	52,020	53,060	54,122	55,204	56,308	57,434	58,583	59,755
Vehicles		30,000			15,000									15,000
Ongoing land rent		68,000							17,000					17,000
financial adviser		200,000			10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Sub-total operating expenses		18,729,006		-	1,649,000	1,643,080	1,402,342	1,319,788	1,254,424	1,155,253	1,073,278	991,503	909,933	860,572
Debt service - principal		23,000,000			-	-	2,300,000	2,300,000	2,300,000	2,300,000	2,300,000	2,300,000	2,300,000	2,300,000
Revenue														
FIT Power Price (US$ per kW/h)					0.1203595	0.1227667	0.1252220	0.1277265	0.1302810	0.1328866	0.1355443	0.1382552	0.1410203	0.1438407
Total power output degraded % life of plant		12.50%												
Power produced (Mw/h) per year					55,000.00	54,725.00	54,450.00	54,175.00	53,900.00	53,625.00	53,350.00	53,075.00	52,800.00	52,525.00
Power sales		152,674,864			6,619,772	6,718,407	6,818,339	6,919,581	7,022,145	7,126,044	7,231,290	7,337,896	7,445,873	7,555,235
Carbon credits		1,030,529			45,000	45,900	46,818	47,754	48,709	49,684	50,677	51,691	52,725	53,779
Sub-total revenue		153,705,393			6,664,772	6,764,307	6,865,157	6,967,335	7,070,855	7,175,728	7,281,968	7,389,587	7,498,598	7,609,014
Depreciation														
- annual charge	12.5%	26,062,155			3,500,000	3,062,500	2,679,688	2,344,727	2,051,636	1,795,181	1,570,784	1,374,436	1,202,631	1,052,302
Taxation		-												
Corporation tax	0%	-			-	-	-	-	-	-	-	-	-	-
Sub-total taxation		26,062,155			-	-	-	-	-	-	-	-	-	-
Equity dividend														
- common shares		100,000,000								4,000,000	4,000,000	5,000,000	5,000,000	6,000,000
- preferred shares		11,631,401							11,631,401					
Sub-total dividends		111,631,401			-	-	-	-	11,631,401	4,000,000	4,000,000	5,000,000	5,000,000	6,000,000
Net cash flow				-29,646,515	5,015,772	5,121,227	3,162,815	3,347,547	-8,114,971	-279,525	-91,310	-901,916	-711,335	-1,551,558
Cumulative cash flow					5,015,772	10,136,999	13,299,814	16,647,361	8,532,390	8,252,865	8,161,555	7,259,639	6,548,304	4,996,746
				Year -->										
				0	1	2	3	4	5	6	7	8	9	10
EBITD (Earnings before Interest, Taxes & Depreciation)					5,935,772	6,041,227	6,382,815	6,475,547	6,552,430	6,664,475	6,760,690	6,858,084	6,956,665	7,024,442
DSCR					6.45	6.57	1.98	2.07	2.16	2.26	2.37	2.48	2.61	2.73

184,000	92,000	-	-	-	-	-	-	-	-
60,950	62,169	63,412	64,680	65,974	67,293	68,639	70,012	71,412	72,841
65,826	67,142	68,485	69,855	71,252	72,677	74,130	75,613	77,125	78,668
243,799	248,675	253,648	258,721	263,896	269,174	274,557	280,048	285,649	291,362
121,899	124,337	126,824	129,361	131,948	134,587	137,279	140,024	142,825	145,681
60,950	62,169	63,412	64,680	65,974	67,293	68,639	70,012	71,412	72,841
				17,000					17,000
10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
747,423	666,492	585,782	597,297	626,043	621,024	633,245	645,710	658,424	688,392
2,300,000	2,300,000	-	-	-	-	-	-	-	-
0.1467176	0.1496519	0.1526449	0.1556978	0.1588118	0.1619880	0.1652278	0.1685323	0.1719030	0.1753411
52,250.00	51,975.00	51,700.00	51,425.00	51,150.00	50,875.00	50,600.00	50,325.00	50,050.00	49,775.00
7,665,992	7,778,158	7,891,743	8,006,761	8,123,223	8,241,141	8,360,526	8,481,390	8,603,745	8,727,601
53,779	53,779	53,779	53,779	53,779	53,779	53,779	53,779	53,779	53,779
7,719,771	7,831,937	7,945,523	8,060,541	8,177,003	8,294,920	8,414,305	8,535,170	8,657,524	8,781,380
920,765	805,669	704,960	616,840	539,735	472,268	413,235	361,580	316,383	276,835
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
6,000,000	6,000,000	7,000,000	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000	9,000,000
6,000,000	6,000,000	7,000,000	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000	9,000,000
-1,327,652	-1,134,555	359,741	-536,757	-449,041	-326,104	-218,939	-110,540	-900	-907,012
3,669,093	2,534,538	2,894,279	2,357,522	1,908,481	1,582,377	1,363,438	1,252,898	1,251,998	344,986
11	12	13	14	15	16	17	18	19	20
7,156,348	7,257,445	7,359,741	7,463,243	7,550,959	7,673,896	7,781,061	7,889,460	7,999,100	8,092,988
2.88	3.03								

WS11 Company History and Existing Activities

Provide a concise description of the applicant's company history and principal business interests. It should include all jurisdictions in which the applicant or any affiliated interest of the applicant is, at the date of filing the application with respect to licensing or otherwise authorisation to provide retail or wholesale electric services.

Alpin Sun GmbH

Adrian Ioance

Managing Director, Head of Overseas Departments

Business Plan

A. Executive Summary

Group General Overview

Alpin Sun brings together a group of Romanian- German societies, specialized in photovoltaic power plants. The foundations were laid in 2005 when Sun Farming was set up in Germany. It's a company whose activities are focused towards achieving their investment in photovoltaic plants in Germany. Sun Farming currently holds a portfolio of 40 MW, being a respected producer of renewable energy in Germany. By following the European trend of expanding the interest in renewable energy in Europe, in 2008, an international construction division broke away from the Sun Farming Company, becoming a stand-alone business, known today as the Alpine Sun GmbH.

Alpin Sun has experienced a great evolution in recent years, by following several stages of development, starting by assembling plants and, later, encompassing the design and supplying of equipment, which is called the EPC. The next step towards the ascension of Alpin Sun activity was embedding project development activities and, later, the operation and maintenance of photovoltaic parks. Since its debut and up to now, Alpin Sun has completed more than 180 photovoltaic plants in Italy, Belgium, Germany and Romania. The most representative projects are conducted between 2012-2014 in Romania, totaling 34 MW, being utility scale projects with installed capacity between 1.5 MW to 7 MW.

During this period, Alpin Sun has been very active on the development side, making up to now, more than 15 fully licensed projects, and totaling over 70 MW installed capacity. Some of these projects were sold to investors, along with EPC contracts, which constitute a part of the working basis of the company and a good source of cash. In order to streamline the operations, the Romanian society, Alpine Solar SA, was founded, taking over the Engineering and Construction activity, with over 100 employees in Romania, while the German Society still remains responsible for Procurement and international contracts. Regarding its own developed projects, they are carried out through project companies (SPV), according to the Romanian legislation, regulations related to the establishment and operation of electricity producers and specific commercial usage.

At the moment, 15 companies are integrated in the group project, 7 of them being part of the investment described in this documentation. Finally, Alpin Sun deals with energy production, the group owning two photovoltaic plants with an aggregate installed capacity of 5 MW, which are located in Codlea, Brasov County and Reci, Covasna county. In 2013, Alpin Sun projects amounted 40 million EUR and the net result was about 5 million EUR at the end of the year. The group strategy aims to strengthen the energy producer's position in Romania, by achieving and international expansion in: Asia (China and India), South America (especially Chile), MENA (Arab countries, Morocco, Tunisia), Eastern Europe (Albania, Macedonia, Serbia). The business model adopted in each country will be the same as the one successfully applied in Romania, following two directions: EPC contractor and investments. That's why, partnerships were established and in China, for example, it was set up a branch and a project company responsible for making a 50MW plants in Inner Mongolia"

The current generation has the unique opportunity - and the obligation - to position our energy system on sustainable pillars. Leaving a clean environment to our children and grandchildren is our duty. This path cannot be followed without coming to renewable energies. The employees and shareholders of Alpin Sun feel an obligation to observe this responsibility. With every newly - installed photovoltaic plant we come a small step closer to the goal of renewable energies as the key source of energy supply. We are convinced that every photovoltaic plant that currently delivers electricity to the grid is the independent energy supply for its immediate vicinity in the future. In order to optimize the use of solar electricity via the consumer we are positioning our plants near by potential end user.

At Alpin Sun, we work to make the world a better place to live, encouraging collaboration, innovations sharing, responsible use of resources and growing sustainable business to be legacy for our children. We are committed to our goal to built a photovoltaic plant is every place of the world where is needed a breath of fresh air.

B. Portfolio

We are always expanding our portfolio to move with the direction of the market. We have established a healthy growth across Europe with the portfolio pictured below and also developin into the UK recently. We have also expanded worldwide into Turkey with a 4MW project and a 50MW project, into Chile with three large projects of 70MW, 30MW and 30MW. We are also expanding into various parts of Africa.

Harman Clue, Brasov, RO

7,314 MW

Harman Setra, Brasov, RO

6,4 MW

Jichisu de Jos, Cluj, RO

6,4 MW

Jichisu de Jos, Cluj, RO

5,8 MW

Rotem, BE

500 KW

Opglabeek, BE

500 KW

Kinrooi, BE

300 KW

Belgium

3 MW

Codlea, Brasov, RO

3 MW

Ghindari, Mures, RO

2,5 MW

Nazna, Mures, RO

2,5 MW

Unteremphenbach, Mai...

2.2 MW

Oberempfenbach, Main...

2,2 MW

Reci, Covasna, RO

2,133 MW

Mizil, Buzau, RO

1,9 MW

Reghin, Mures, RO

1,5 MW

Bottrop 2, DE

1,5 MW

Ergolding, Munchen, DE

1,420 MW

Eschelbach, Mainburg, DE

1,4 MW

Bottrop, DE

1,3 MW

Rostock, DE

1 MW

Bottrop + Langenfeld, DE

1 MW

Langenfeld, DE

800 KW

Ghanalight Ltd

. History

Senior staff now at GHANALIGHT LT D, namely Alan Brewer MSc was asked in 2012 by David Tamakloe Managing Director of Ghanalight Ltd to assist the Simbrofo project and in 1995 he was asked to research and write one of the first UK City Energy Policies and Strategies to combat Climate Change. This work led onto his coordination of the Hampshire County Council Energy Network in 2002, progressing onto Sustainable Energy in the County Schools sector. The concept of Resource Ownership was born.

Following a period of time researching solar in the UK, developing PV in both domestic and business environments it became apparent that for true sustainability and commercial profitability, solar technology really needed greater radiation levels to optimize its benefits than that available in the climate across the UK and the majority of Europe. Africa was an ideal location and given Ghana's past history as a British Colony and political system similar to that of the UK, the country became the target of Alan's interest, later Ghana came to the fore in his development programme.

He formed the GHANALIGHT LTD a company partnering with David Tamakloe a Ghanaian businessman with an interest in environmental work and climate change mitigation and today a joint

Director of Ghanalight Ltd. Both Alan and David put their undoubted Solar expertise and local knowledge to work in aid of the indigenous people of Ghana. The worthy cause was to assist in replacing the use of dangerous and toxic kerosene used for lighting with small solar PV panels, enough for each household to run a light and perhaps telephone charger. The project was successful and Alan and Joe learnt a lot about the Ghana electricity issues and made valuable contact. Alan was approached in 2012 by Tobias Panofen Project Coordinator of the Frankfurt School of Finance & Management gemeinnützige GmbH, an appointed organisation of the United Nations Environment Programme – Renewable Energy Performance Platform to assist in the development of Solar PV First Mover projects and they fed into this programme technical information on Solar Farms. The UNEP-REPP programme has enabled the current development of sixteen First Mover solar farm tender projects in Kenya. Alan s hands – on work eventually lead them to an introduction to the Ministry in Nairobi and discussion for their development work took place to understand the Governments opinions. Following numerous meetings and discussions we will develop the 25MW Solar Farm at Nakuru.

As indicated we have developed the Resource Ownership concept for our Kenya solar farm, where the Local Government and peoples in an area of the solar farm would receive 0.5% of revenue from the solar farm together with 0.5% revenue share also going to the landowner – this ensures Sustainable Energy development for Kenya and now possible Ghana in 2016.

WS12 Industry Participation

Provide general information about its existing activities, both within and outside the renewable energy industry. The application should summarise the reasons why the applicant intends to participate in the Ghanaian renewable energy industry, and the broad nature of that participation. In providing the above explanation, the applicant should address the Commission's objectives as set out in Section 2 of the Act and the objects of the Act, and explain how the granting of a licence would be consistent with those requirements?

Alpin Sun have Eleven years in the Solar Farm and Solar PV installation and **Ghanalight Ltd** staff have over twenty years in the Sustainable Energy & Waste sectors.

Reasons for participation in the Ghana Renewable Energy sector are twofold:

One Ghana is seen as a sound Country to do business in, although like many African Countries financial matters of doing business in Africa in general often poses project investment problems BUT Ghana is more stable than most other African Countries and therefore poses minimal risk to our investors. We do understand that the Energy Sector I Ghana is undergoing change and restructuring and we see this as a very positive move towards VRA being able to take much of the electricity generated from our solar farms.

With the recent introduction of the Ghana feed-In-Tariff (FIT) ten Solar Farms do offer a good return on investment and that is seen as a good reason to build Solar Farms in Ghana.

Our twenty years Sustainable Energy development on an International basis will help assist the Government of Ghana in meeting electricity generating targets from Renewable Energy sources, in the case of this Simbrofo 20MW Solar farm then 40,000 MWh of electricity will be generated.

In 1997 the government accepted recommendations or the Ghanaian power sector to restructured á lathe standard model of reform. The vertically integrated Volta River Authority (VRA) would be unbundled into a separate transmission and system operations company, VRA would retain generation and the national distributor of electricity, the Electricity Corporation of Ghana would be horizontally unbundled Also, independent power producers (IPPs) would be allowed to enter the market such as Ghanalight Ltd and Solar Farm developments. The need to reform had been brought about by a debilitating electricity crisis in readiness for privatisation that started in the early 1980s, and spanned over two decades. It was caused primarily by the effect of poor rainfall on a power sector that relied exclusively on hydropower–essentially a power-system planning failure. A poorly performing distribution sector and a general lack of investment were additional factors driving reform. **This restructuring is seen by Alpin Sun and also Ghanalight Ltd as a very positive move by the Government, one that will lead to a very stable Energy sector and therefore offers a very attractive market.**

Two industry regulators, the Public Utilities Regulatory Commission (PURC) and the Energy Commission (EC) were subsequently formed charged with undertaking economic and technical regulation respectively. And soon thereafter the country's first IPP entered into service in 2000. But beyond this, reform proceeded slowly and it was only in 2008 that the VRA was unbundled.

Although rainfall has generally been sufficient since 2007, the threat of drought is always present. Faced with this, and an ever- increasing demand for electricity brought about by an economic turnaround, the government of Ghana has pronounced that intends to bring into service an additional 5000MW of mainly IPP generation by 2015. For a system with an installed capacity in 2010 of approximately 2000MW this is clearly an ambitious target. But given the discovery of oil in the Jubilee field off the Ghanaian coast, and the emergence of Chinese investors (bringing alternative funding models, seeking to unlock previously shelved projects and becoming important partners for Africa), this goal may yet be achieved. The PURC and the EC must take their place and facilitate what could be one of Africa's greatest successes. Ghanalight Ltd can also assist in bringing additional support from Solar Farm developments in Ghana.

As we have seen in all the other countries covered, the government through the Ministry of Energy is responsible for policy formulation and aspects of its implementation. Ghanalight Ltd have been given permission to proceed to full feasibility from the Ministry once a Licence has been obtained. Uniquely for Ghana, regulatory oversight of the power sector is undertaken by two separate bodies, the Public Utilities Regulatory Commission (PURC) and the Energy Commission (EC), loosely referred to as the 'economic regulator's and the 'technical regulator.

Ghana and Namibia are the only two countries in this volume where there is no specialist agency for to spearhead rural electrification. Ghanalight Ltd can assist with our Solar Farms.

Once again at industry level all the features of a hybrid power market are evident and of interest to Ghanalight Ltd. It is dominated by state owned entities; Volta River Authority (VRA), Ghana Grid Company (GridCo) and the Electricity Company of Ghana (ECG), while independent power producers (IPPs) have begun to enter on the margins of the industry. The VRA is a power generation company but also carries out some limited distribution through its Northern Electricity Department division, GridCo is responsible for transmission and system operations whereas the ECG is the national distribution utility company. Few companies have embarked on a major solar power generating installations in Ghana which is fed to the national grid through PPA and FiT agreements and therefore the Ghanalight Ltd, hereby referred to as the applicant for the FIT will be the pioneer company to venture in to this kind of a worthy investment from Alpin Sun GmbH funders. Discussions will take place with the University of Wiinneba in Ghana to gain valuable support to GHANALIGHT LTD and the Gomoa Simbrofo Solar Farm.

The biggest photovoltaic (PV) and largest solar energy plant in Africa, the Nzema project, based in Ghana, shall be able to provide electricity to more than 100,000 homes. The 155 megawatt plant shall increase Ghana's electricity generating capacity by 6%. Construction work on the GH¢ 740 million (GB£ 248 million) and the 4th largest solar power plant in the world, is being developed by Blue Energy, a UK-based renewable energy investment company, majority owned and funded by members of the, Stadium Group, a large European private asset and development company with GB£ 2.5 billion under management. Project director is Douglas Coleman, from Mere Power Nzema Ltd, Ghana.

Two Ghanalight Ltd staff have over twenty years in the Sustainable Energy sector in the UK and are able to bring their experience of writing City Energy Policy & Strategy, Coordinating County Energy Networks and have developed the "**Resource Ownership"** concept.

This Resource Ownership concept - Site of the Gomoa Simbrofo Solar Farm – Africa and Ghana must take advantage of the Sun's Solar Resource. We aim to assist once more your Government and make provision of the Renewable Energy to help promote Sustainable Energy, Sustainable Business Development, Sustainable Education and enhance the quality of life of the people of Ghana together with mitigating against Climate Change - The Problem of Climate Change will result in significant opportunities for Ghana. People living near to each of our Solar Farms will be given FREE Solar PV panels for their homes, the Local Chiefs or Government given Solar Street Lighting, villagers given Solar PV Water Pumps employment opportunities are also offered to the villagers.

Solar Farm electricity for towns

Village Solar Water pumps

Each home has Free Solar panels

Villagers get FREE Solar panel, two lights and phone charging point – in the case of Kenya this Massai woman has a charging point for her phone.

WS13 Operational Experience and Expertise

"Provide names, titles, e-mail addresses, telephone numbers, and the background of key personnel involved in the operational aspects of the applicant's business. Provide the following information:

Dan Walker Alpin Sun GmbH

Tel +44 (0) 7514 676 014
Email dan.walker@alpin-sun.de
Project Co-ordinator
Overseas Department
Alpin Sun GmbH
Zum Wasserwerk 12
D-15537 Erkner (bei Berlin)
Mobile: +44 7514 676 014
Fax: +40 368 453 781
E-mail: dan.walker@alpin-sun.de
Website: www.alpin-sun.de
Skype: dan_walker1150

Adrian Loance Alpin Sun GmbH Director

Tel mbl - (EU) +40 736367831 / (CL): + 56 9 62733963
Email adrian.ioance@alpin-sun.de

David Tamakloe Director Ghanalight Ltd & Visions Marketing Limited U

Tel +44 : (0) 7951108628
(1) 7551873333
Email david@ghanalight.com and davidtamakloe@aol.com

Alan Brewer MSc Project Facilitator and Director Ghanalight Ltd in the UK

Tel +44 02393 786582 / +44 (0) 7763 977634
Email alan@ghanalight.com and alan@psecc.co.uk

Michael Mikado CEO PTL Enterprises Ltd Ghana

Tel +233 26 8243297
Email mikemikado@gmail.com

Victor Andrew Politician Ghana

Tel +2335 4336 3605
Email victorandrew27@yahoo.co.uk

(a) details of their experience in and knowledge of the renewable energy industry;
(b) a summary of the skills and experience of the directors and senior managers, and them relevance to meeting the requirements of the licence;

Adrian Loance Alpin Sun GmbH

Tel **(EU) +40 736367831 / (CL): + 56 9 62733963**
Email adrian.ioance@alpin-sun.de

Mr. Adrian Ioance, Deputy Director

Mr. Ioance joined Alpin Sun after more than 7 years of management experience within LMC Group, a business conglomerate active in insurance, real estate, green energy and business consultancy. Between 2005 and 2013, Mr. Ioance held several positions: Project Manager – real estate branch, Head of Investment – real estate consultancy branch, Deputy Director – green energy division, CEO –insurance brokerage branch, Managing Partner – risk management and business consultancy division. Mr. Ioance has proven expertise in: business development, financing, business management, sales, leadership, risk management, marketing, renewable energy. Mr. Ioance holds a degree in Management and several postgraduate courses in business administration, risk management, risk assessment, loss control, marketing, leadership, and negotiation. At Alpin Sun, Mr. Ioance is in charge with business development, international markets, marketing, project financing and risk management.

Based currently in Chile developing large scale 250MW Solar Farm Utilities.

Dan Walker Alpin Sun GmbH

Tel **+44 (0) 7514 676 014**
Email dan.walker@alpin-sun.de

Responsible for International Solar Farm development and management of projects. Appointed to the UK Solar sector by Alpin Sun to spearhead their UK market penetration and also International market penetration. He has worked very closely with Alan Brewer of both Kenyalight Project Ltd on Solar Farm developments in Kenya and now with him at Ghanalight Ltd to develop solar farms. Excellent Technical & Project Management abilities together with funding and O&M knowledge.

David Tamakloe Ghanalight Ltd Director

Tel +44 **(o) 7951108628**
Email david@ghanalight.com **and** davidtamakloe@aol.com

A National of Ghana and UK Businessman with a passion for Renewable Energy. He has worked diligently with Alan Brewer and formed Ghanalight Ltd in 2015 to take forward Solar Farm developments in Ghana. He has established good business relations in Ghana and excellent Political connections with the Government and also Volta River Authority. HE has organised the project at Gomoa Simbrofo, bringing in a major Political Figure Victor

Alan Brewer MSc Project Facilitator and Director Ghanalight Ltd in the UK

Tel +44 (0) 7763 977634
Email alan@ghanalight.com **and** alan@psecc.co.uk

Twenty years Sustainable Energy & Renewable Energy Development experience. Mr Alan Brewer MSc, has been engaged on Energy Policy & Strategy formulation under the Sustainable Development - Agenda 21 programme in the UK and on International Renewable Energy Development programmes since 1995.

In 1995, Mr Brewer researched and helped write the Portsmouth City Energy Policy & Strategy and in 2010 he formed PSECC – Portsmouth Sustainable Energy & climate Change Centre in the UK in order to offer Climate Change Mitigation advice, Renewable Energy technologies such as Solar Farms and had been asked by Hampshire County Council (HCC) in the UK to be the Energy Coordinator for the Hampshire Natural Resources Initiative (HNRI) in 2001. He was in addition, requested to look at Renewable Energy developments for HCC schools from 2008 in the UK. Alan Brewer MSc was asked in 2012 by David Tamakloe Managing Director of Ghanalight Ltd to assist the Simbrofo project and in 1995 he was asked to research and write one of the first UK City Energy Policies and Strategies to combat Climate Change. This work led onto his coordination of the Hampshire County Council Energy Network in 2002, progressing onto Sustainable Energy in the County Schools sector. The concept of Resource Ownership was born. Following a period of time researching solar in the UK, developing PV in both domestic and business environments it became apparent that for true sustainability and commercial profitability, solar technology really needed greater radiation levels to optimize its benefits than that available in the climate across the UK and the majority of Europe. Africa was an ideal location and given Ghana's past history as a British Colony and political system similar to that of the UK, the country became the target of Alan's interest, later Ghana came to the fore in his development programme. Alan facilitated the Gomoa Simbrofo project with David Tamakloe at Ghanalight Ltd.

Michael Mikado CEO PTL Enterprises Ltd Ghana

Tel +233 26 8243297
Email mikemikado@gmail.com

Our core business is:

Solar Power Systems:-Design, Installation and maintenance of industrial, domestic and

COMBINED HEAT AND POWER SOLAR FARM

Commercial systems, we also run consultancy for companies that require professional approach to Utility Scale Solar projects, Mini-Grids, and other renewable power projects.

Electrical Accessories: We are manufacturer's representative for Automatic Transfer Switches, Cable Management Systems, Underwater and various Cable, Low-Voltage Controls and Distribution, industrial plugs and other related industrial Electrical components.



Global Footprint:

PTL Technologies Ltd is has a worldwide network of strategic alliances, with customers and other partners within the sub region, global leader across its renewable energy, lighting and lifestyle portfolio:

- We have strategic partners with varied interests in USA, Taiwan, China, Spain, Dubai, Canada, Tanzania, Liberia, Nigeria etc.
- Our knowledge of the West African sub region gives us an advantage and a wider sub regional spread.
- We are leading with sub regional spread and we know the terrain well.

Businesses:

Michael M. Mikado
President and Chief Executive Officer of PTL Technologies Ltd

Michael Mikado was a member of the Renewable Energy Review Committee that review the Renewable Law document of Ghana

Office Location:
Hse. # C97/3 Faanofa Rd,
Adjacent Iran Clinic,
Adabraka, Accra Ghana

Contacts:
PTL Technologies Ltd
P.O. Box LG 678 Legon,
Tel:- +233 26 8243297, +233 20 4218532.
Email: - ptltecno@gmail.com, info@ptlghana.com
Website: www.ptlghana.com

Victor Andrew

Email victorandrew27@yahoo.co.uk

Victor is a senior Politician in Ghana (retired) who has been our man on the ground organising the Simbrofo project with the three Chiefs who own the land. He has good connections in Ghana and is able to see the project through by working closely with Michael Mikado, David and Alan at Ghanalight and also Dan Walker at Alpin Sun.

(c) evidence that the applicant has the capacity to comply with the licence conditions, codes and guidelines relevant to its application

alpin sun

Customers

Alpin Sun as a comprehensive photovoltaic projects solution provider, we aim to satisfy our client needs overall or through our individual business divisions.

- **As project developer** – we focused on local markets energy demands corroborated with future perspectives and international trends and train a highly skilled development team which was able to deliver ready to built bankable projects. Through project development division we open the local utility scales market for international investors. Quality of Alpin Sun projects is proved by our client statements and not less important by the positive due diligence reports conducted by Wolf Thiess, an important European law firm. Although energy market and specific legislation are difficult, hard to tackle, constant changes being a real challenge, all our projects are updated and fully licensed. No regulatory or legal items left unsolved.
    - **In 2013, projects rights for 13,5 MW was purchased by Unisun Energy LLC Hong Kong, for EUR 2,5 millions.**
- **As EPC contractor** – join forces of Alpin Sun and Alpin Solar team, manage to deliver 34 MW turn key power plants, just in 2013, handling investments of over EUR 40 millions. Businessmen, industrialists or financial investor have chosen to work with us due to innovation, performance, low risk and high quality, attributes found in each plant that we build.
    - BaySolar AG – an leading European photovoltaic company assigned Alpin Sun to built the 6.4 MW from Cluj County at the end of 2012. Plant was successfully commissioned and nowadays supplies green energy to Transilvanian grid.
    - IRUM S.A. – a 50 years old tractors manufacturer has decided to accomplish their energy needs from green resources and appointed Alpin Sun to build the 1.5 MW PV plant near by Reghin factory.
    - Capidava Prodcom – for this agribusiness Romanian player we built 2,5 MW power plant inside their farm located in Mures County.
    - Zhejiang New Energy Investment Co – for this Chinese leading industrial group we built two large scale 13.5 MW power plants in Brasov County, central Romania.

  More about our portfolio could be found below at references.
- **As O&M provider** - Alpin Sun Operation and Management 360^0 solution has an comprehensive approach covering a full range of services: maintenance, monitoring and technical assistance, legal and administrative, commercial, facility management, risk management. For the moment Alpin Sun is in charge with a daily operation of 25 MW power plants:
    - **Setra Energy 6,3 MW/ Clue Solar 7,2 MW/ Solarfun 2,5 MW/ Topram 1.5 MW/ Capidava 2,5 MW/ Suninvest 2 MW/ E.F. Roest 3 MW/ Irum 1,5 MW.**
- **Energy and GC Trading** – marketing electricity and incentives through centralized or bilateral market is a difficult job to be handled by an unskilled energy producer, that's why we take care of that together with our commercial partners. Closing the circle assure our partners receive proper benefits from their investments.
- **Electricity producer** – by far the most satisfying of our activities is the production of electricity. Being part of this select group of renewable producers is a pride and also a duty having the responsibility of continuing the mission of growing sustainable businesses. Our energy is taken off by first class energy take offers and it is delivered directly to middle and large scale industrials.
    - Electromagnetica SA - an 80 years old electrical components Romanian manufacturer, being one of the most successful examples of privatization after 1989 political regime changing. Today Electromagnetica is one of the largest LED lightning solution manufacturer from South East Europe, having around 800 employees and multiple production facilities in Bucharest. Electromagnetica has a diversified business portfolio, besides their industrial activity, are involved in real estate owning an impressive business and industrial park, is a key energy producers through its multiple hydro facilities and is the oldest energy trader on the market with more than 15 year of experience. As energy supplier they deliver to more that 150 industrials and commercial middle and large scale consumers.

The applicant and this entity, including any formal agreements to provide services, and a summary of this other entity's experience in and knowledge of the renewable energy industry, and technical capacity to meet the relevant requirements of the licence should be provided."

alpinSUN ISO 9001, ISO 14001, ISO 18001 Zertifierung www.alpin-sun.de

Alpin Sun GmbH
Zum Wasserwerk 12
D-15537 Erkner (bei Berlin)

The Managing Director,
Ghanalight Ltd
1000 Lakeside,
Western Road,
Portsmouth,
PO6 3EN

15th September 2015

LETTER OF INTENT FOR GHANALIGHT PROJECTS

Dear Mr Alan Brewer,

We hereby express our interest to work together with Ghanalight Ltd and affliated companies and projects to establish the generation of secure, environmentally friendly, long term electricity generation to the country.

We are interested in a partnership for the EPC work of Ghanalight Ltd projects in Ghana. Initially working on the Volta 125MW project and then subsequent solar farms with the company. Alpin Sun are able to carry out the full EPC work for projects up to 250MW. Alpin Sun hereby, express an interest to work alongside the above company to develop all projects in Ghana to their full potential.

We propose to undertake the EPC work of the projects and can offer all technical support, drawings, calculations for grid connections and further understanding of the electrical and technical aspects of the design. These will all be charged, along with construction, we can also offer the construction work and will hold full rights to undertake all aspects of construction. This work can then be sub-contracted to local companies and workers as Alpin Sun feels is worthwhile for the project. Alpin Sun can also offer considerable project planning, business accumen and consulting.

We require each Ghanalight project to have the following list regarding their projects:

- A secured company and SPV.
- A Lease agreement with the landowner.
- The Grid connection quotation.
- The agreed PPA for each project guarenteed.
- Surveys and permits to enable the construction of the project.

All funding related to the pojects will be dealt with per project. Funding can be gained from a variety of sources. The funders will be given all information, including grid connections, design layout and proposed projections, along with the PPA and FiT to make full evaluation of the project and the terms of their committment to Ghanalight Ltd directly and to the project through the government secured PPA and Feed-in-Tariff. Alpin Sun will offer to buy out the rights to any project at any given time.

Alpin Sun, by signing this agreement, hold the rights to be of first refusal, the EPC work for the projects with the above companies.

Alpin Sun look forward to working with you in the future of these companies and projects.

Alpin Sun GmbH

Adrian Ioance
Managing Director, Head of Overseas Departments

Ghanalight Limited

Alan Brewer MSc
Managing Director

- Steady Ventures (Electrical and Electronics Engineers with presence in Ghana and Nigeria)
- GamsMultib Services (Renewable Energy Business Development Consultants, with presence in most African countries)
- UDM Ltd.(Project Impact Assessment & Analysis/Management Consultants)
- Alvarez Beltran; Spain (European Representatives of Siemens, General Cable etc)
- BXC Company (Ghana) Limited. (Electrical, Utility Scale Solar Power providers and System Integrators with presence in China, South Africa and Ghana.)
- Jetpro Technologies; Taiwan (Manufacturers of Small wind turbines)
- Multifit Electricals; China (Manufacturers of Solar Panels and accessories)
- Siginik Ghana Ltd; Utility Scale Solar Power providers
- Bloomwood Ltd; Representatives of Solar Century, Solar Outdoor Lighting SOL®
- Savannah Solar International Inc; USA. (Solar EPC contractors and developers)

Success stories:

Success stories:

- In the past couple of years, we have successfully installed over 100 solar home power and street lighting systems in Ghana and Nigeria with plans of venturing into the Liberian energy sector.
- We have installed a completely solar powered traffic lighting system in Akosombo for VRA to mark their 50th anniversary.
- We are the consultants to Siginik Ghana Ltd; (a subsidiary of Siginik Canada) for the building of a 50MW Utility Scale Solar Plant in Northern Ghana.
- We are also the consultants to BXC Company (Ghana) Limited; for the building of a 20MW Utility Scale Solar Plant in the Greater Accra Region of Ghana.(currently the first of its kind in West Africa)

COMMERCIAL SOLAR PLANT

COMBINED HEAT & POWER SOLAR DISH

Questworks our **partner in Kenya for Solar Farm Technicians** and for rooftop solar pv installations. is a real estate consultancy and integrated project delivery (IPD) firm. We provide solutions to companies and individuals who want to undertake significant construction projects. In addition to pioneering the IPD approach to construction in the region, we have developed the expertise that allows us to walk with our clients from concept design through to project completion enabling us to take full responsibility for the quality and cost of our client's projects.

partner in Kenya for O&M Technicians

PowerGen Technologies Ltd.

Provision for building any new sub stations

or Local Ghana companies will be used

WS14 Specific Licence Conditions and Exemptions

Where the applicant is seeking particular licence conditions, the nature and reasons for seeking those conditions should be explained. In such circumstances, the applicant should also provide a draft outline of the proposed licence condition(s) or exemptions. The Commission may waive any of the requirements for a licence in respect of a particular applicant provided the waiver does not compromise on public safety.

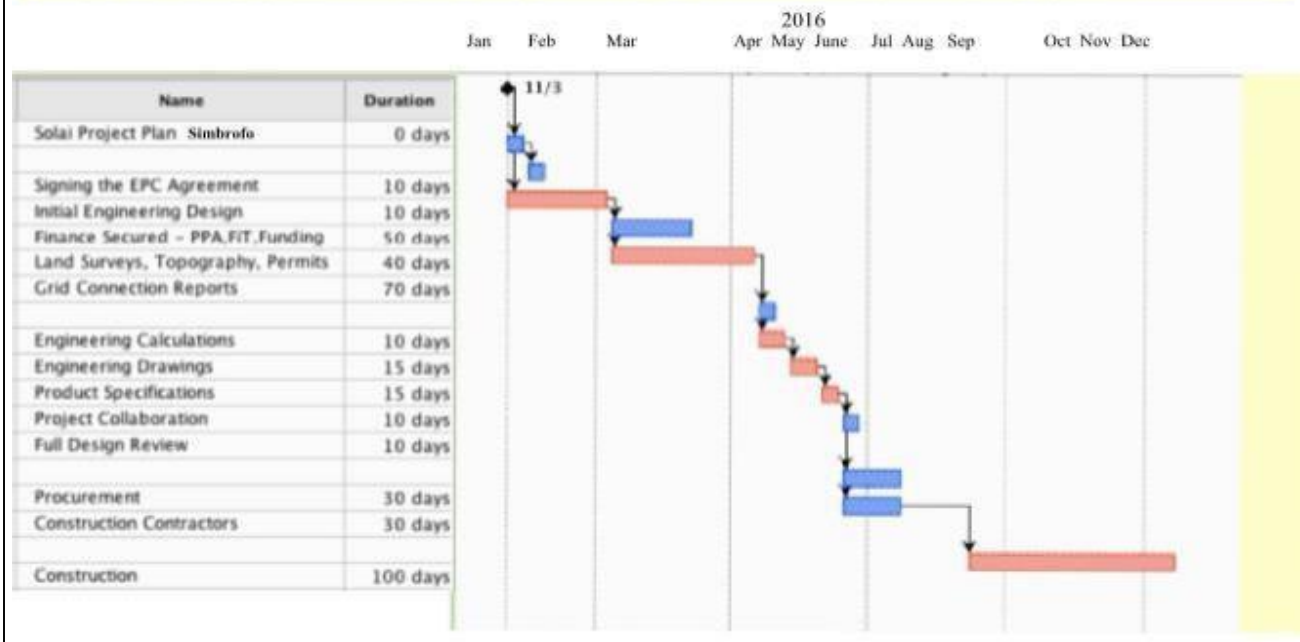
<u>NO particular licence conditions</u>

WS15 Indicative Implementation Plan

Provide indicative timelines for the specific activities that must be performed to produce the various project deliverables, establishing interdependences and sequencing.

Project Plan

Below is an approximate Project Plan for Simbrofo to outline the number of weeks each activity will need to be completed. This plan is for each project, however there may be able to be some level of overlap for the five projects.



Name	Duration
Solai Project Plan Simbrofo	0 days
Signing the EPC Agreement	10 days
Initial Engineering Design	10 days
Finance Secured – PPA,FIT,Funding	50 days
Land Surveys, Topography, Permits	40 days
Grid Connection Reports	70 days
Engineering Calculations	10 days
Engineering Drawings	15 days
Product Specifications	15 days
Project Collaboration	10 days
Full Design Review	10 days
Procurement	30 days
Construction Contractors	30 days
Construction	100 days

Distribution of responsibilities between Ghanalight Ltd & and Alpin Sun on a project flow chart

	1. Site development	2. Due Diligence, Financing	3. EPC
Investor		Signing project contracts and agreement to provide financing	Evaluation and acceptance of construction work
Ghanalight Ltd	Site inspection and development incl. geological & topographical survey Feasibility study incl. generated AutoCAD Set up SPV (Ghanalight Ltd UK & Ghana) Lease contracts (incl. registration) All permits and authorizations Building cost subsidies PPA or FiT Grid connection offer	Collect and send all project documents: • Soil conditions ✓ • Feasibility study, AutoCAD-files ✓ • Certificate of incorporation (SPV) ✓ • Lease contracts and registration ✓ • All permits and authorizations ✓ • Apply and approval of PPA • Acceptance of PPA or FiT cost subsidies ✓ ✓ • Acceptance of grid connection ✓	Supporting role; channelling communication with local authorities, DNO, e.g.
Alpin Sun	Supporting Role: • Dimensioning on basis of AutoCAD (dwg/dxf) • Indicative calculation of EPC-costs • Technical support Yield simulation and data sheets & possible funding search	Due diligence on basis of completed documents Financial modeling Negotiation with potential banks and investors → If due diligence and financing positive, set up project contracts and initiate transition of SPV from kenyalight to investor	Detailed engineering and technical design incl. pull & pile tests Energy yield analysis Procurement, purchase agreements Logistic services, just-in-time deliveries Coordinating suppliers & sub-contractors Site supervisions, quality inspections Commissioning Coordination of acceptance by investor
	← 4 to 6 months →	← 2 to 3 months →	← 2 to 3 months →

WS16 Commercially Sensitive Information

The Commission may make public the information included in an application for a licence. Where the applicant considers information contained in an application to be commercially sensitive, the applicant should clearly identify such information and state the reasons why they are to be regarded as commercially sensitive, to enable the Commission determine its consideration of the confidentiality request.

NO ISSUES HERE WITH MAKING PUBLIC ANY INFORMATION

WS17 Generating Plant Technology and Type of Renewable Energy Resource

Provides details as per Schedule III – Generating Plant Technology and Description.

TECHNICAL PARAMETRES & SCHEDULE for 20MW Solar Farm at Simbrofo

Ghana receives a considerable amount of solar radiation Early assessment by Ministry of Energy indicated that the country received on average 4.5 kWh per square meter per day

The said project location at Simbrofo has considerable amount of solar radiation and therefore it is a good site for the first solar installation of the 20MW project. It is hoped that we can install in phase two another 125MW of Solar Farms. The technology to be used and all the technical aspect, which include drawings and tables of expected solar irradiation levels are attached to this report.

alpin sun

Project Proposal

Enclosed in this document are the figures, timings and responsibilities for the EPC work for the 125MW Solar Farm projects in the Central and Volta region, commencing with Simbrofo.
Alpin Sun GmbH is offering a wide range of skills and experience to Ghanalight Ltd to accomplish the outlined works below.The following document when signed, agrees both parties, until both mutually agree to break the contract, is a contract for all the works included below, unless not adhered to by one of the parties.

Alpin Sun will become the main contractor to Ghanalight Ltd and retains the right to sub contract out any part of the below agreement. Alpin Sun will oversee all of their work from their main office.

Engineering Design

- Detailed drawings from our experienced design engineers, including accessibly and logistical requirements.
- All structural Calculations.
- Capacity Calculations.
- All electrical calculations.
- Design decisions will be discussed and made which are best for the system in terms of maintenance, efficiency, cost and the environment.

Procurement

Using a well-researched and tested supply Chain, Alpin Sun will utilize its relationships to provide the smooth running of the procurement procedures. Alpin Sun, as outlined below, will provide all the parts for the construction of the site, whether through existing or new contacts.

Construction

For the construction work, Alpin Sun will be the primary contractor for the work; so will take care of other contractors and responsibility for the work carried out on site. This will also be solely down to Alpin Sun, regarding who they choose and the volume of work they contract out. However, Ghanalight Ltd can recommend and assist with the search for local contractors, if this work is needed to be carried out.

Communication will need to be frequent between Ghanalight Ltd and Alpin Sun to ensure all permits, surveys and land layouts are produced by Ghanalight Ltd and they can be transmitted to Alpin Sun to ensure compliance, so both parties can ensure agreement with the design and local authority regulations and electrical contractors.

Maintenance

- All equipment comes with guaranteed manufacture Warrenties. Operation and Maintenance can be quoted for the duration of the initial stages of the project.

Project technical overview - 20MW Simbrofo Solar Farm Ghana

Objective: PHOTOVOLTAIC POWER PLANT

Positioning: Groud mounted Simbrofo

Ghana

Designed electrical installation

Un = 0.4 kV / 23 kV
Installed Power (kW) : Pi = 20888 kW
Maximum Output Power: Pa = 20000kW

Proposed configuration for the PV Plant consist in 83552 pieces photovoltaic panels of 250Wp placed on metal structures at an angle of **1 degree**, azimuth 0 ° (North). There will be used 3467 metal structures, with 24 PV panels each. The metal structures will be mounted with metal anchors in the ground. All panels will be connected in series of 24 panels.

To avoid self-shading of the panels during the year, a distance of 3,5 meters will be kept between the structures.

Technical details of PV panels:

- Power Pmpp: 250 Wp
- Type of cell: poly-crystalline 60 pcs / panel
- Open circuit voltage Uoc: 37.3 V
- Short circuit current Isc: 8.9 A
- VMP voltage: 30.3 V
- Impp current: 8.26 A
- Efficiency: 15.37 %
- Dimensions: 1640 mm x 992 x 50 mm
- The total area of the panel: 1.627 m²
- Maximum system voltage: 1,000 V
- Temperature coefficient:
  - Open circuit voltage: -0.33 %/ °C
  - Pmpp: -0.39 %/ °C
  - Isc: +0.033 %/ °C

To connect the photovoltaic panels between each other, special solar cables will be used with the dimension of 6 square millimeters (sqmm). The panels have incorporated solar cables of 4 sqmm with a length of 90 cm for each terminal but to complete the connection to the inverter it will require additional solar cable. Solar cables have a voltage of 1800 VDC and are resistant to UV radiation, high temperatures, adverse weather conditions, oil and other corrosive substances.

Electrical connection of the panels will be done as follows:

- 24 photovoltaic panels will be connected in series to form a string, with a power of 6 kW per string, operating voltage 727.2 Vd.c., open circuit voltage Vo.c. of 895.2 Vd.c., working current of 8.26 A and open circuit current of 8.9 A.
- The strings formed will be connected in parallel on each inverter used. In total 5 strings will be connected on each inverter with a total power of 30 kWd.c. per inverter. For this project string inverters have been selected.
- The solar cable will be positioned on the metal structures and in the ground on the path to the inverters. When they will be placed in the ground they will be at a depth of 0.6 meters protected by PVC corrugated tube. Also they will be placed in sand with a layer of 10 cm all around the cables. The connections will be done to the inverter with MC4 connection plugs "mother" and "father".
- The distance between the strings and the inverters will have a maximum connection length which will give electrical losses due to distances higher than 2.5 % on the D.C. side.

In order to evacuate the energy produced to the Grid, the panels will be connected to 865 string inverters type Trio 27.6 TL - OUTD - S2X.

Technical details of Inverters are:

- Maximum D.C. voltage 1000 V D.C.
- Start voltage 250 Vc.c
- Maximum power D.C. 30 kWp
- Maximum output power A.C. 28.6 kW
- Output A.C. voltage 400 V
- Maximum efficiency 98.2%
- Industrial surge arrester for D.C. and A.C.
- Internal protection fuses for D.C.
- A.C. and D.C. switch.
- Dimensions 1061 x 702 x 292 mm / 80 kg

Inverter analyzes the status of the grid (voltage, frequency, etc.) before it synchronizes and starts delivering the electrical energy into the grid. The inverters have anti-islanding protection so there is no risk of injecting electrical energy in case of fault or grid is offline. The inverter will supply energy at the voltage and frequency requested by the network without threatening network and equipment.

Inverters will be placed behind the metal structures, under the PV panels on the support pillars of the structures. With this positioning it will be protected by the heat of the sun and also will benefit from extra cooling due to the temperature differences that appear between the top of the metal structures and underneath the PV panels. The inverters will be positioned at a height that allows a distance of 40 cm minimum between the ground and the nearest part of the inverter.

Inverters are provided from the factory with surge protection on the A.C. and D.C. side. Also on the D.C. side the strings of the PV panels are protected by PV fuses of 15A-2P-1000V and have 2 MPPT trackers. The protection on the A.C. side will be done in the General Electrical Panel (GEP) situated inside the Transformer Station. The protection will be made with highly rapid fuses of type 50A-3P-400V.
For the connection with the GEP, cables of type NAYY-f RM 4 x 25 sqmm will be used being positioned in the earth at a depth of 0.6 meters protected in a 10 cm all around sand filling. Inverters will be monitored remotely via dedicated communication, which exists inside the inverters. They will be connected with RS485 cable to the local router mounted inside the concrete booth of the transformer stations. The routers will be connected to a media converter and the rest of the connection to the local internet provider will be done by fiber optics. This solution will give the beneficiary the possibility to monitor and control the inverters from any ware in the world.

2.1. Technical details of the transformer stations and connection to the grid.

For evacuating the produced energy in the National Grid a total 4 concrete booth transformer stations will be used. From this 4 transformer stations all 10 pieces will be of 2000 kVA.

The transformer stations will a radial connection between each other. In total 5 radial connections will be used with the following configuration:

- Transformer stations with numbers from 1 to 2 will form Radial Connection Nr. 1
- Transformer stations with numbers from 2 and 4 will form Radial Connection Nr. 2

The transformers in the radial connections will be connected between each other with medium voltage cable of type NA2XS(FL)2Y 3 x 1 x 240/25 sqmm positioned in the earth at a depth of 0.8 meters in a 10 cm all around sand filling.

All radial connections will connect to the High Voltage Substation (HVS), which will be built in the vicinity of the Overhead Gantry 2KM away in Simbrofo.
The configuration of the 5 transformer stations of 2000 kVA - 24 kV will be as follows:

- 2 medium voltage line cells of 24 kV - 630 A - 24 kA in SF6 for connecting the transformer stations between each other and from the last transformer station to the HVS fitted with separator, grounding knife, the driving mechanism of the separator lever mounted on the front of the cell, heating resistance, capacitive indicator to signal the presence of voltage with auxiliary contact, capacitive indicator for signaling mono-phased and tri-phased short circuits. The first transformer from the radial connection will be fitted with only 1 medium voltage cell.
- Medium voltage transformer cell of 24 kV - 630 A - 16 kA in SF6 / vacuum, fixed separator and vacuum circuit breaker with manual activation, heating resistance, grounding knife, capacitive indicator to signal the presence of

voltage with auxiliary contact, current transformers CT 3 x 300/5/5A, protection relay with protection functions in ANSI code 50-51, including technological transformer protections.

- All medium voltage cells are made from 1 uniform metal casing and insulated air copper rods. The cells will be connected to a ground plug that is connected to the grounding system of the concrete booth.
- Medium voltage oil transformer with normal losses 24/0.4 kV, 2500 kVA, Dyn 5, short-circuit voltage of 6%
- General Electrical Panel (GEP) equipped with 80 pieces circuits equipped with separators with ultra-fast fuses of 50A-3P-400V for each inverter, 3 circuits equipped with empty separators for reserve purposes for a maximum fuse of 63A-3P-400V, 1 circuit equipped with separators and fuses of 40A-3P-400V for supplying the Internal Services Electrical Panel (ISEP), general protection of the GEP made up off a withdrawable circuit breaker In=4000A, Ir=3500, 3P, 400V with included protection and signaling for the transformer. The GEP will also be equipped with surge protection device.
- The GEP of transformer station will be different from the rest being equipped with 69 pieces circuits equipped with separators with ultra-fast fuses of 50A-3P-400V for each inverter, 3 circuits equipped with empty separators for reserve purposes for a maximum fuse of 63A-3P-400V, 1 circuit equipped with separators and fuses of 40A-3P-400V for supplying the Internal Services Electrical Panel (ISEP), general protection of the GEP made up off a withdrawable circuit breaker In=4000A, Ir=3000, 3P, 400V with included protection and signaling for the transformer. The GEP will also be equipped with surge protection device.
- The GEP of transformer station will be different from the rest being equipped with 69 pieces circuits equipped with separators with ultra-fast fuses of 50A-3P-400V for each inverter, 3 circuits equipped with empty separators for reserve purposes for a maximum fuse of 63A-3P-400V, 1 circuit equipped with separators and fuses of 40A-3P-400V for supplying the Internal Services Electrical Panel (ISEP), general protection of the GEP made up off a withdrawable circuit breaker In=4000A, Ir=3000, 3P, 400V with included protection and signaling for the transformer. The GEP will also be equipped with surge protection device.
- Smoke sensor with acoustic and optical warning, relay for transmitting the signal at a distance, 3 internal batteries of 1.5 V, supplied for the ISEP at 230Va.c.
- Space reserved at least for an extra medium voltage transformer cell meaning a minimum of 750 mm.
- The concrete booth will have airtight and water tight orifices for cables entering and exiting the booth, foundation for the transformer, space for oil accumulation for the transformer and 2 hot air extraction ventilators for keeping the transformer temperature within working conditions.

2.2. Grounding protection system and lighting protection system

Grounding protection system will be made up of flat band St-Zn 40x4 mm placed in the earth at a depth of 0.9 meters and earthing electrodes placed in the earth at a depth of 0.9 meters of St-Zn of h=2.5 meters, d=2.5". The system will be placed around the metal structures of the photovoltaic park.

The metal fence which protects the PV park at Simbrofo from intruders will be connected to the grounding system in at least 6 points.

Each concrete booth of the transformer stations will have it's own grounding protection system made up of flat band St-Zn 40x4 mm placed in 3 rings at different depths within the earth. Also part of this system, 8 grounding electrodes will be used of type St-Zn of h=2.5 meters, d=2.5" placed at maximum 5 meters between each other. The grounding system of the concrete booth's will be connected in 2 points to the entire grounding system of the Simbrofo PV park.

All the inverters used in the installation have surge protection on the D.C. and A.C. and also all the GEP inside the transformer stations will have a general surge protection. These surge protections have the primary role of limiting and stopping the damage made by possible lighting strikes. Also

The value of the entire grounding system must have a value of less than 1 ohm due to the fact that the system is designed as to act as a grounding protection and as a lighting protection for all the equipment's in the PV park.

2.3. Conclusions

The current described solution was chosen instead of the use of central inverters due to the following aspects:

- High efficiency in energy production due to small number of strings on individual MPPT trackers (2 or 3 strings per MPPT tracker) which lead to high efficiency per string in energy generation even in the earliest minutes of light in the morning or latest minutes of light in the evening. Overall efficiency of the park will be of about 95% with losses taken into consideration on the entire installed power.
- High viability of the entire park. Changes of an inverter permanent malfunction are extremely low. Even in case of inverter breakdown several inverters will be available on stock on the PV park for immediate intervention and replacement. Energy losses in case of failure are almost zero.
- From the electrical point of view string inverters have low value short circuit currents, causing less stress on other equipment's within the installation (GEP, transformer)

Technical and commercial proposal: Simbrofo Ghana

The Contractor undertakes itself or through its subcontractors to provide the Beneficiary with the following equipment and services as detailed below:	
Turn key power plant: Installed power DC: 20888 kwp; **Output power AC: 20000 kwp**;	
Equipment	Pieces
❖ Photovoltaic panels: Polycrystalline 250 Wp 60 cells, certified and tested, 25 years linear production guarantee. Tier 1 manufacturers: Risen Energy, Jinko, Yngli, Trina, Cecep depending on current stock availability and preference of the investor.	83552 pcs
❖ Inverters: string inverters 27,6 KV ABB Trio 27,6 TL or German made Refusol 27.6 KWp	692 pcs;
❖ Transformers: ABB 2000 KV	10 pcs;
❖ AC / DC cables: German made 15 years warranty HIS Renewables / Prysmian	ml; ml / kg;
❖ Support structure: galvanized steel – according with resistance technical project provided by the buyer with minimal 15 years warranty;	ml/ kg;
❖ Fences and gates: galvanized steel according with the technical/ architecture project;	
❖ Security system: CCTV;	
❖ LED Perimeter lighting;	
❖ Medium voltage cable- in site;	
❖ Auxiliary equipment;	
❖ Data logger and meteo station;	
❖ Production monitoring system – web	

based application; ❖ Technical project of the plant;	
Free Spare parts offered as a discount for this site only (to be left on the client custody): ❖ Photovoltaic panels: 200 pcs; ❖ Inverters: 20 pcs; ❖ Cables, boxes, connectors, fuses;	
Carried works: ❖ Equipment supply on site; ❖ Material supply on site; ❖ Structure ramming; ❖ Structure mounting; ❖ Panels installation; ❖ Invertors installation; ❖ DC/ AC cables installation; ❖ Cables trenches, roads and other civil works; ❖ Transformers installation; ❖ Fences and gates installation; ❖ Perimeter lightning installation; ❖ Security system installation; ❖ Medium voltage installation – inside of the plant; ❖ Grid connection operations (jointly with grid operator); ❖ Testing; ❖ Commissioning and putting in operation;	
Workforce: ❖ 6-12 Ramming machines; ❖ 5 Lifting equipment; ❖ 3 Backhoe loaders; ❖ 2 Digging machines; ❖ 100 Electric and hand tools; ❖ Up to 200 peoples: engineers, site managers, installers, electricians, (construction workers from Simbrofo)	

Guarantees: ❖ System integrator – overall power plant EPC guarantee: 2 years standard or 5 years (with O&M contract); ❖ Photovoltaic panels: 25 years linear production guarantee; ❖ Inverters: 10 years guarantee; ❖ Transformers: 2 years guarantee with extended program offered by ABB; ❖ Steel structure guarantee: 15 years against corrosion;
Insurances: ❖ Construction All Risk Insurance 30 million USD; ❖ Construction Bond/ Surety Bond according with Ghana regulations; ❖ ALOP (advance loss of profit insurance) covering potential delays of minimum 1 mil USD; ❖ Third Liability Insurance: 3 mil USD; ❖ Legal Liabilities according with Ghana laws; ❖ O&M provider liability; ❖ Operational All Risk Insurance – *optional with O&M;*

(Appendix One) Authorization Letter from the Chiefs of Simbrofo

Ghanalight Ltd
David Tamakloe & Alan Brewer MSc
Managing Director
Western Road
Portsmouth
Hampshire
PO6 3EZ
England
UK

Gomoa Simbrofo

Post Office Box 9

Simbrofo-Ankamu

3rd February, 2016

Dear Sir,

ASSURANCE LETTER

On behalve of Aboradzse Royal family in GomoaSimbrofo led by the chief Nana Kum Ababio IV, Ebusuapayin Kofi Kum and Abusuabaatan Kofi Donkor have agreed on the out come of the previous minutes of a meeting held on the 1st of February, 2016 with Mr. Victor Noonoo.

We have decided to release 300 acres of land for the **Solar Energy Project** for 20 years for which the payment will be renewed every 5years and the first five years (1st years) will be amounted to 17,000 pounds.

There are other ameneties that will be discussed later on your arrival.

We assure you that the land is without any litigation what so ever.

We also request that the following will be made available for the entire township/youth , that is community center,community library and two community public toilets, community school or renovation of the old school building, and renovation of the chief palace (to enhance worth living and also curtail the unemployment in the area)

Deeds of the Land:

- The indenture only will be issued to the company on the arrival of the representative of your company from England.

We hope this our humble appeal will be considered.
Thank you.

Yours faithfully,

Nana Kum Ababio IV (Chief) **Sign** .....

kofi Kum (Abusuapayin) **Sign** .....

Kofi Donkoh (Abusuabaatan) **Sign** .....

(Appendix Two) Ministry of Power support letter

MINISTRY OF POWER

Tel: 683961-4
Fax: 668262
IDD Code (233-302)
E-mail: renewable@energymin.gov.gh
Website: www.energymin.gov.gh

Post Office Box MB 330
Ministries Post Office
Accra, Ghana.

Republic of Ghana

Our Ref:

19th October, 2015

THE MANAGING DIRECTOR
GHANALIGHT LIMITED
1000 LAKESIDE - REGUS
WESTERN ROAD, PORTSMOUTH
P06 3EN

Tel: +44 77951 108628

Dear Sir,

RE: 125MW SOLAR FARM - LETTER OF EXPRESSION OF INTEREST (EOI)

We acknowledge receipt of your letter dated 16th September, 2015 requesting for authorization to undertake a feasibility study for the development of a 125MW solar farm.

The Ministry of Power in principle has no objection to your intent to undertake feasibility study at your own cost.

The policy of Government is to encourage investment as an Independent Power Producer. The Renewable Energy Act 2011, (Act 832) provides the fiscal incentives including the feed-in-tariff among others to guarantee return on your investment.

Kindly contact the Energy Commission (http://www.energycom.gov.gh/) for the procedure for investing as an Independent Power Producer.

Thank you for your interest in the renewable energy sector.

Yours faithfully,

WISDOM AHIATAKU-TOGOBO
DIRECTOR, RENEWABLE & ALTERNATIVE ENERGY
FOR: MINISTER

cc.: The Ag. Executive Secretary, Energy Commission, Accra

(Appendix Three) indicates the experience references of Alan Brewer MSc of PSECC Ltd and Ghanalight Ltd in the UK.

Portsmouth
City Council

PORTSMOUTH
THE FLAGSHIP CITY

Contact Mr Johnston
Our reference DJ/GAS/LA21
Your reference
Telephone 01705 834247

Fax
DX

19 October 1995

TO WHOM IT MAY CONCERN

RE: ALAN BREWER, MSc CANDIDATE, PORTSMOUTH UNIVERSITY 94-95
161 SYDENHAM COURT, BERKSHIRE CLOSE, FRATTON, PO1 1RQ

I confirm that Alan Brewer has been engaged on his MSc project "Sustainable Development in Local Authorities", full-time from early May 1995, until 13 October 1995.

Whilst engaged on this project he has also been assisting a City Council Team engaged on developing an Energy Policy and Strategy which forms an essential part of a Sustainable Development Strategy in Terms of Local Agenda 21. Alan has attended all meetings of this internal team which started on 12 April 1995 and has provided a positive knowledgeable contribution.

Furthermore, during this period he has also assisted me with other workgroups and Local Agenda 21 issues.

The City Council has benefitted from Alan's voluntary assistance and I, personally, have benefitted not only by his ready assistance but also from his expert knowledge of the full range of environmental issues embraced by Local Agenda 21.

I would have no hesitation in recommending Alan for any post in the sphere of environmental management and control.

Yours faithfully

D M R Johnston
Environmental Co-ordinator

Environmental Health Service
Civic Offices
Guildhall Square
Portsmouth
PO1 2AZ

Head of Environmental Health ■ Alan Higgins

Hampshire
County Council

Environment
The Castle, Winchester, Hampshire SO23 8UD
Telephone 01962 841841
Fax 01962 847055
Fax (abnormal loads) 01962 854045

Mr A Brewer
IMG Ltd & International Agenda 21 Ltd
Suite F9
Venture Tower,
Fratton Road, Portsmouth
PO1 5DL

Enquiries to: Heidi Hack

Direct Line: (01962) 847732

Date: 25 June 2002

My reference:

Your reference:

E-mail: heidi.hack@hants.gov.uk

Dear Mr Brewer

INITIAL COORDINATOR FOR ENERGY NETWORK FOR NRI PROJECT

Thank you for your time in coming to Winchester and meeting with us on 6 June. As requested, I am confirming the outcome of that meeting in writing.

As you recall, we discussed the natural resources initiative which is currently being undertaken by Hampshire County Council. The NRI project aims to develop business practices and individual lifestyle changes that achieve the efficient use and conservation of natural resources. It aims to facilitate the development of a virtuous circle of production and consumption of goods being reused, recycled and reprocessed, minimising overall energy use.

An integral part of this process will be to work with existing networks and to develop new opportunities. At the meeting we discussed whether you would like to act as initial co-ordinator for the NRI energy network, pulling in the key players in the field under the NRI project.

If you have any further queries please do not hesitate to contact me on the above details.

Printed on 100% recycled paper

Yours sincerely

for County Surveyor

Beacon Council 2000-2001 Dealing with Waste

County Surveyor
John Ekins OBE FREng FICE

ALAN BREWER - 11 JUNE 2002

Alpin Sun GmbH
Zum Wasserwerk 12
D-15537 Erkner (bei Berlin)

The Managing Director,
Ghanalight Ltd
1000 Lakeside,
Western Road,
Portsmouth,
PO6 3EN

15th September 2015

LETTER OF INTENT FOR GHANALIGHT PROJECTS

Dear Mr Alan Brewer,

We hereby express our interest to work together with Ghanalight Ltd and affliated companies and projects to establish the generation of secure, environmentally friendly, long term electricity generation to the country.

We are interested in a partnership for the EPC work of Ghanalight Ltd projects in Ghana. Initially working on the Volta 125MW project and then subsequent solar farms with the company. Alpin Sun are able to carry out the full EPC work for projects up to 250MW. Alpin Sun hereby, express an interest to work alongside the above company to develop all projects in Ghana to their full potential.

We propose to undertake the EPC work of the projects and can offer all technical support, drawings, calculations for grid connections and further understanding of the electrical and technical aspects of the design. These will all be charged, along with construction, we can also offer the construction work and will hold full rights to undertake all aspects of construction. This work can then be sub-contracted to local companies and workers as Alpin Sun feels is worthwhile for the project. Alpin Sun can also offer considerable project planning, business accumen and consulting.

We require each Ghanalight project to have the following list regarding their projects:

- A secured company and SPV.
- A Lease agreement with the landowner.
- The Grid connection quotation.
- The agreed PPA for each project guarenteed.
- Surveys and permits to enable the construction of the project.

All funding related to the pojects will be dealt with per project. Funding can be gained from a variety of sources. The funders will be given all information, including grid connections, design layout and proposed projections, along with the PPA and FiT to make full evaluation of the project and the terms of their committment to Ghanalight Ltd directly and to the project through the government secured PPA and Feed-in-Tariff. Alpin Sun will offer to buy out the rights to any project at any given time.

Alpin Sun, by signing this agreement, hold the rights to be of first refusal, the EPC work for the projects with the above companies.

Alpin Sun look forward to working with you in the future of these companies and projects.

Alpin Sun GmbH

Adrian Ioance
Managing Director, Head of Overseas Departments

Ghanalight Limited

Alan Brewer MSc
Managing Director

Ghanalight Ltd Enhancement Document
SIMBROFO 20MW Solar Farm – other technologies offered

Hydroponic food production

Graduate Renewable Energy Course

Solar PV LED Street Lighting

Solar PV Water Pumps

New Schools

New University Technician Courses

Local Employment

Ghanalight Project Ltd &

Contents

Ghanalight Ltd offices at parent company PSECC Ltd offices in UK

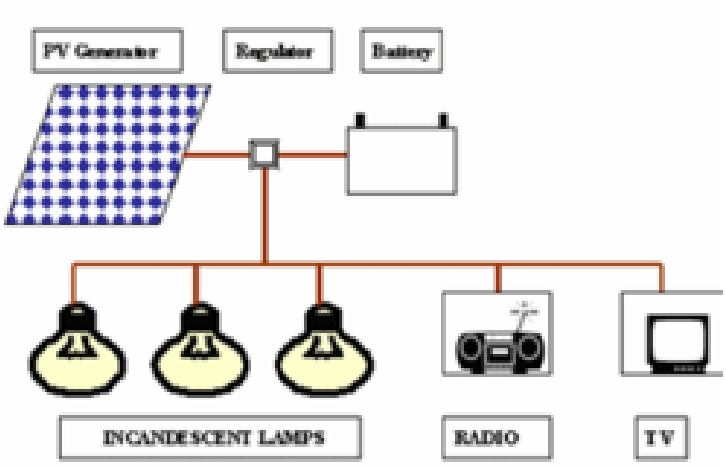
1. Solar Farm at Simbrofo 20MW

The Solar Farm will form the basis for the financial input stream for the other Enhanced Renewable Energy Technologies that will be given FREE to the Local Government and Villagers in the area of our Solar Farm at Simbrofo.
It has been agreed that a percentage of the solar farm profits will go to the Local Government and Ghana Project Ltd will provide FREE Solar PV for Homs in the villages near to the solar farm and also offer FREE Solar PV Water Pumps, Solar PV LED Street Lighting together with knowledge of production of Hydroponic Food and also a New School, library, toilets and community centre will be built at no cost to the Government or the Chiefs.
Wiinneba University could provide training courses to train local people in Technician services and also offer a higher Degree Course in Renewable Energy & Climate Change Mitigation.

Enhancement - **FREE** Technology from Ghanalight project Ltd

2 Solar PV for Homes – small 10W to 20W Solar Panel

Larger 250W Solar Panels can be provided on a finance scheme basis so the villager can have a large Solar PV system for TV, Radio and more lights.



Each Home in the villages near to the solar farm will be given FREE Solar PV panel and lighting system together with a mobile phone charging point.

3 Solar PV Water Pumps

To assist the villagers in Simbrofo with water being made available more easily. Pumping water is a sensible and effective use of solar electric power. During the hot months, when water requirements are highest, a solar pump will provide a reliable water source for the farm. A solar water pumping system is essentially an electrically driven pumping system. Electricity, in this instance is produced by the sunlight energizing photovoltaic (Solar) modules.
A solar pumping system is available for almost all applications where an electric pump can be used. Because solar energy varies from one location to another, and over the course of a day, system design is important. Adequate water storage ensures that water is available whenever needed, and balances daily variations in water supply and demand. Thus a small pump only running when the sun shines, plus water storage, can provide the average requirement for water supply.

Solar Pumping Systems

Although solar water pumps have been developed from some fairly sophisticated ‘hi-tech’ components they are relatively simple, uncomplicated packages of equipment.

Solar water pumping systems consist of three basic components:

Power source (photovoltaic solar modules), Motor/pump assembly, and Power controller (maximizers / optimizers / MPPT's) for matching the changing electrical output of the array to suit the motor/pump.

Benefits of Solar Pumping

Solar pumping uses a free, easily accessible and renewable source of energy.
Power bills are eliminated. With solar pumping, maintenance costs are minimized.
Solar modules are strong, robust and encapsulated into toughened glass, in a sturdy, aluminum frame that will last even in harsh environmental conditions of drought.
Using solar allows opportunities for livestock, vegetables, trees and other crop production to be developed in areas where other forms of pumping are impractical.
Solar water pumping systems are reliable and perform at their best and provide water throughout summer months when demand is greatest. Solar water pumping systems need little supervision requiring only periodic checking.

Solar pumps automatically start soon after sunrise and continue to work unattended until sunset.
Solar water pumping systems operate all year round, even on cloudy dull days with little or no direct sunlight.
Solar modules have no moving parts and an expected working life of at least 30 years.

4 New School

With each Solar Farm for Ghana that Ghanalight Project Ltd & Riara University build we will also FREELY build a school in the area of the Solar Farm.

The students and the new school will also be able to have electricity from Solar Panels and Solar PV Water Pumps. It may also be possible to supply Laptops for each child to enhance their learning capabilities and might continue their educational pathway at Winneba University at a later stage.

5 Solar PV LED Street Lighting

6 Hydroponic Food Production could be possible

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Education for Service

could be a possible partner

7 Winneba University Local Employment & Technician Courses

Local workforce can be trained up by Winneba University at Technician Level to install all our Renewable Energy Technologies. Ghanalight Project Ltd have arranged assistance in training course formation from three UK Universities – Portsmouth, Southampton and Southampton Solent University in Hampshire, UK.

The benefit to Ghana will be to have a skilled workforce for the 21st Century in the area of Renewable Energy.

8 Winneba University Course in Renewable Energy

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Education for Service

Alan Brewer MSc of PSECC Ltd in the UK the parent company of Kenya Light Project Ltd has formed links with three Hampshire based UK Universities who wish to work alongside Riara University and License Structured Renewable Energy & Climate Change Degree Courses & possibly offer student placements & exchange.

The benefit once more to Kenya will be to have a highly educated Graduate student who can assist Kenya in Renewable Energy but also understand Environmental Law and Climate Change Mitigation.

UNIVERSITY OF Southampton

Professor AbuBakr S Bahaj
Bsc, PhD, CPhys, Minstp, FICE, FRSA
Head of Division
Chief Scientific Advisor to Southampton City

Energy and Climate Change Division
Tel: +44 (0)23 8059 2051 Fax: +44 (0)23 8067 7519
Email: a.s.bahaj@soton.ac.uk
www.energy.soton.ac.uk
Engineering and the Environment, Highfield Campus,
Southampton SO17 1BJ United Kingdom

UNIVERSITY OF Southampton

Dr Luke S Blunden
MEng, MRes, PhD
Research Engineer

Sustainable Energy Research Group
Tel: +44 (0)23 8059 3940 Fax: +44 (0)23 8067 7519
Email: lsb1@soton.ac.uk
www.civil.soton.ac.uk www.energyfordevelopment.net
School of Civil Engineering & the Environment
Highfield Campus, Southampton SO17 1BJ United Kingdom

University of Portsmouth
Faculty of Technology

Professor Mark Gaterell
BEng MPhil (Cantab) PhD DIC CEnv MCIWEM
Professor of Sustainable Construction and
Associate Dean Research

University of Portsmouth
Environment Network (UPEN)

Tom Greenwood
Environment Network Coordinator