

THERMENERGY SERVICES
ENERGY AND TELECOMMUNICATION SERVICES

www.thermenergyservices.com

COMPANY INTRODUCTION

Thermenergy Services Limited is an established Technical Services Provider on the energy systems landscape in West Africa and was incorporated under the laws of the Republic of Ghana in 2008.

Thermenergy Services Limited with our resilient business model has adapted to the recent evolutions to become one of the country's leading technical service providers to the energy industry. When it comes to safety, there can be absolutely no compromise, no acceptance of second best.

We provide a wide portfolio of services to the Oil and Gas, Electric energy Value Chain, Mining and Extractives as well as the FMCG industry. Our scope of services spans the construction of thermal power plants and related infrastructure, the provision of operation and maintenance services for Oil and Gas and Power Plants, electrochemical construction, procurement of engineering equipment and spares as well as the provision of bespoke engineering consultancy services.

Thermenergy specializes in the provision of timely, cost effective and efficient control, measurement, and telecommunications solutions to various segments of industry. Thermenergy provides specialized services such as Fibre-Optic installations, Repair and Testing, Protective Relay Coordination and Testing, Harmonic Waveform studies as well as Generator and Transformer maintenance. Other specialized services such as Safety Audits, Environmental Impacts Assessment and Risk Analyses are also part of our portfolio services.

Our satisfied corporate clients include West African Gas Pipeline Company, Government of Ghana, Amandi Energy, Volta River Authority, Ethos Energy, Genser Power Ghana Limited, MODEC as well as GTS Energy, Top General Ltd, MillBridge Energy, BXC, CSIR, OMNI Controls and JVC Limited, SAIWEST, Sun Investment Ltd., MENERGY Ltd., Group 5, De Simone, CENPOWER, all majority players in the energy sector in the West-African sub-region.



VISION

To be the service provider of choice in the Energy and Telecommunications sectors in the West-African Sub-region.

MISSION

To create and add value to our clients and shareholders through the development of quality, timely, reliable Project Development, EPC and O&M services for the Oil & Gas, Power Generation and Telecommunications sectors.



Health Safety and the Environment

Health Safety and the Environment are at the forefront in terms of importance in everything we do on a day-to-day basis and therefore our management system has been developed to provide a structure by which the Company can effectively manage the HSE issues related to our very diverse range of activities. The philosophy is that HSE considerations should be integrated into the day-to-day work activities of the Company, so that good HSE management becomes a normal, accepted part of our daily work ethic.

The HSE management system has been prepared in accordance with leading, international principles and practices for the HSE management of power plants, including best industry practices and the requirements specified for an HSE management system under ISO14001 and OHSAS/ISO18001, which are the reference documents from the International Standards Organization for environmental management and health and safety management, respectively.

Therefore, the HSE management system we have in operation is capable of being certified to the requirements of ISO14001/OHSAS/ISO18001 as desired.

IDENTIFICATIONS EVALUATION OF ASPECTS HAZARDS



CORE BUSINESS FIELDS

POWER GENERATION

Thermenergy is in the forefront of the Power Generation supply chain in Ghana. Our services range from Project Conceptual Engineering, Feasibility Studies and Project Development, through EPC Contract Services, Project Management, Operations and Maintenance to Scheduled Maintenance Performance, major overhauls, and decommissioning. Thermenergy also specializes in tailor-made energy solutions for client applications.

Thermenergy's expertise spans a wide range of power generation technologies including but not limited to traditional Thermal Power, Hydro, Utility Scale PV Solar and Wind, Waste-to-Energy as well as Hybrid combinations of these technologies. Due to the wide range of industries that Thermenergy operates in, we make it a priority to develop capability in specialized fields of endeavor.

We also believe that cross skilling our staff will greatly aid in our service offering to clients. As such, we actively encourage and assist our staff to obtain a range of skill sets. This in turn leads to a high level of staff satisfaction and a better quality of service for our clients.



OIL AND GAS

Thermenergy has been involved in the Upstream Oil and Gas sector with exposure to MODEC's FPSO Kwame Nkrumah. Thermenergy has supplied support for some Fibre Optic Installations on the FPSO.

Thermenergy also provided skilled technician for the installation of a Gyrocompass on the same FPSO. TES can deliver the following services:

- Liquid/ Gas Custody Transfer Flowmeter Installation, Maintenance & Calibration.
- Process Instrumentation Diagnosis and Calibration
- Control System Integration.



RENEWABLE AND INNOVATIVE SOLUTIONS

Errigal Energy, in collaboration with reputable partners, is capable to provide innovative solutions and technologies in the following areas.

Photovoltaic Solar.

Wind power solutions.

Smart Hydropower solutions.

Energy management systems.

Hybrid systems for smart and cost-effective energy utilization.

Waste to Energy solutions.

Concentrated Solar Power.



SERVICES

- Engineering, Procurement & Construction (EPC).
- Power Management.
- Power Project Development.
- Supervision and Craft Labor.
- Operations and Maintenance.
- Renewable Energy.
- Advisory Services.
- Plant Assessment.
- Training.
- Thermal Performance Testing.
- Spare parts and Consumables.

ENGINEERING, PROCUREMENT & CONSTRUCTION (EPC)

Engineering Project Management is one of the core competencies of our organization. Thermenergy has in-depth Program and Management capabilities. Thermenergy is proficient in EPCM (Engineering, Procurement, Construction and Management) contract and can deliver fully autonomous EPCM contracts as well as deliver specific EPC functions, in conjunction with other service providers.



PROJECT MANAGEMENT

Thermenergy has EPC experience in the Project Management of Power Generation Projects (Conventional Thermal & Renewable), Process Plant Projects, Power Transmission and Distribution projects as well as structural and Piping projects.



POWER PROJECT DEVELOPMENT

Our depth in the knowledge of the power sector in Ghana puts us in pole position to be your partner of choice in the sector. Thermenergy has a solid background in Power Project Development as well as the customization of Power Supply Solutions for commercial and industrial Clientele. We have extensive experience in the development of Utility Scale Thermal and Renewable Power Plants in Ghana. Thermenergy has been involved in Project Development of multiple Utility scale PV Farms, Conventional Thermal Power Plants as well as Waste-to-Energy and is currently working on the development of some Decentralized Renewable Hybrid Mini grids for Rural Communities.



SUPERVISION AND CRAFT LABOR

A key aspect of Thermenergy's portfolio is the provision of highly skilled Field Service Engineering support for clients within the Power Generation, Oil & Gas and allied industries. Our team has experience in installation, commissioning as well as operation and maintenance of both onshore and offshore equipment including turbines, generators, pumps, compressors, and transformers, metering skids, solar plants as well as other ancillary equipment.

Thermenergy can provide highly qualified and motivated personnel for Scheduled and Unscheduled Maintenance events, LTSA support as well as skilled labour and supervision for startups/performance testing.

Thermenergy has a history of successful completion of Combined Cycle Plant instrument calibrations. Thermenergy has provided and continues to provide craft labour and supervision for Gas Turbine scheduled outages and provides support for Unscheduled Maintenance.



OPERATIONS AND MAINTENANCE

A key aspect of Thermenergy's portfolio is the provision of highly skilled Field Service Engineering experts for clients within the Power Generation, Oil & Gas, and allied industries. Our team has experience in installation & Commissioning and operation and maintenance of both onshore and offshore equipment including turbines, generators, pumps, compressors and transformers, metering skids as well as other ancillaries.

Thermenergy can provide highly qualified and motivated manpower and supervision for Unscheduled Maintenance events, outage management, LTSA support as well as skilled labor and supervision for startups/performance testing.

Thermenergy also provided professional Instrument Calibration Services to Group 5, and later, for CENOPS, for the CENPOWER 330MW Combined Cycle Power Plant in Kpone, Ghana. We have and continue to provide electrical engineering support to MODEC on FPSO Kwame Nkrumah at the Jubilee Oil Field.



RENEWABLE ENERGY

Thermenergy has been involved in renewables for several years. We have installed several Rooftop Solar PV Units for many satisfied homeowners.

We have also provided Solar PV Consultancy services to corporate bodies. One of our satisfied clients is the Centre for Scientific and Industrial Research (CSIR).

Thermenergy provided advisory services for the troubleshooting of catastrophic inverter failures and spurious plant operation of the Solar PV Backup System powering the CSIR's Plant Growth Lab at Fumesua in the Ashanti Region. Thermenergy further recommended corrective action involving the revision of the operating regimen.

We were also at the forefront of the Regulatory Permit application process and PPA negotiations for BXC's 20MW Solar Farm at Gomoa Onyadze in the Central Region of Ghana, currently the biggest Solar PV installation in West Africa. We were also involved in the construction, commissioning, and eventual tie-in to the ECG's Winneba 11kv Grid Network.

In February 2017, Thermenergy was also awarded the contract for the Final Commissioning Report for the BXC 20MW Solar PV Plant that was presented to the Ghana Energy Commissioning, PURC and the Electricity Company of Ghana.

Other capabilities are:

- PV Solar farm Project Development & Implementation.
- Wind Farm Project Development & Implementation.
- Hydro Power Plant Project Development & Implementation.
- Commissioning, Testing & Grid Tie-in.
- Hybrid Power Solution Development & Implementation.



ADVISORY SERVICES

Thermenergy Services Limited provides value-for-money advisory services for a wide range of field of endeavor. These services are delivered in-house or in conjunction with other entities, depending on the scope of the assignment. Thermenergy provides advisory services including, but not limited to:

- Feasibility Studies
- Environmental Due Diligence
- Regulatory Permit Application
- Power Project Development
- Energy Audits/ Efficiency Improvements.
- Process Consulting
- Asset Management
- Project Management Advisory
- Transaction Advisory

Thermenergy has provided advisory services for different stages of construction of Thermal and Renewable Power Projects as well as Operation and Maintenance support for running Power Plants.



PLANT ASSESSMENT

Plant assessment and surveys are carried out to ascertain the health of plant components and to assure that safety and operability are not compromised, resulting in sustained performance and earnings.

These assessments may be part of best-practice benchmarking, contractual or per OEM recommendation.

Thermenergy has conducted plant condition assessments for thermal assets at the point of handover, following a BOOT contract as well as engineering valuation of a wide range of engineering assets. These assets give stakeholders a snapshot of the asset condition as well as feed critical information into operation and maintenance planning, therefore improving operational and commercial performance.



TRAINING

The constantly changing and highly technological nature of the Energy industry makes it necessary for consistent introduction of new technologies and newer methods in the quest to deliver superior customer value and achieve higher efficiency. Our team of expert trainers delivers practical, industry centric courses to assist participants to be abreast with modern industry trends and find their feet once they return tom work.

OUR TARGET MARKET:

- Onshore and Offshore Oil & Gas firms
- Power Generation
- Process Plants



THERMAL PERFORMANCE TESTING

Thermenergy in conjunction with their partners can carry out thermal performance tests according to international standards such as ASME PTC 22, 45 etc. These tests are to determine heat rates, LHV, Net Power Output as well as Emissions and Acoustics.



ENGINEERING PROCUREMENT

Thermenergy also has extensive experience in the procurement of equipment spares and consumables as well as tools and equipment. These range from Gas Turbine Capital parts and operational spares to specialized tools and equipment.



TELECOMMUNICATION SERVICES

Thermenergy provides a wide range of telecommunications services including RF Optimization Drive Testing, Telecom Equipment Installation and Commissioning, Fibre Optics and Solar Power and what have you.

RF OPTIMISATION DRIVE TESTING AND REPORTING

RF network optimization is a regular end-to-end service offered under the engineering department which takes feedback from various tests conducted on the site during the field trials and during drive testing. It includes.

- Site audit
- Single Site Verification and reporting Pre & Post DT (SSV/SVR)
- Cluster Drive testing and reporting Pre & Post
- Customers complain Drive testing.
- Indoor Test coverage walk test.
- Interference and Pilot pollution detection
- Site acceptance Drive Testing

The drive testing tools, and software are.

- TEMS Investigation 16.3.4 latest Version
- TEMS DISCOVERY 10.3.7 latest Version
- Actix analyser 2.532.84 LTE support
- Galaxy S5 LTE Full Band Supported Tems Pocket version 10.0.
- W 995 Sony Ericsson 3G/2G Tems Pocket version 7.2
- Scanner for frequency band Scanning and Interference Detection.
- GPS
- Laptop



LTE SMART Phone test

S5 G900F with TEMS pocket SUPPORT

- **GSM 850 / 900 / 1800 / 1900**
- **HSDPA 850/ 900/ 1900/ 2100**
- **LTE2100/1900/1800/850/2600/900/800**
- **LTE B1/B2/B3/B5/B7/B8/B20**

- **CAT 4 150 / 50 MBPS**
- **HSPA+ 42 MBPS**
- **RAT / BAND LOCK**
- **pci / psc lock**

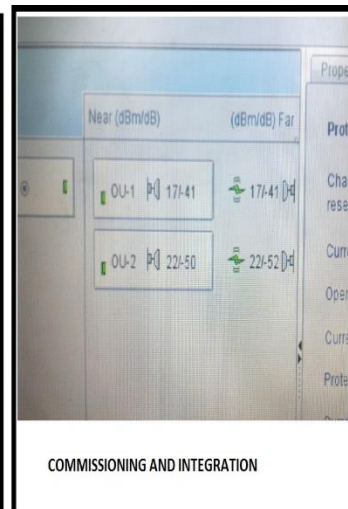
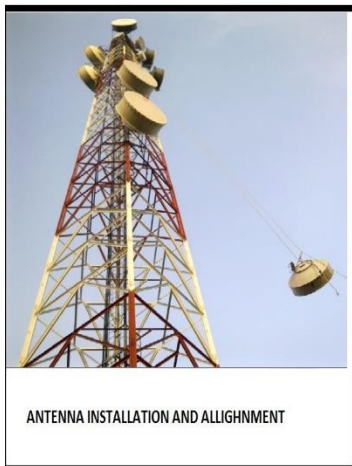
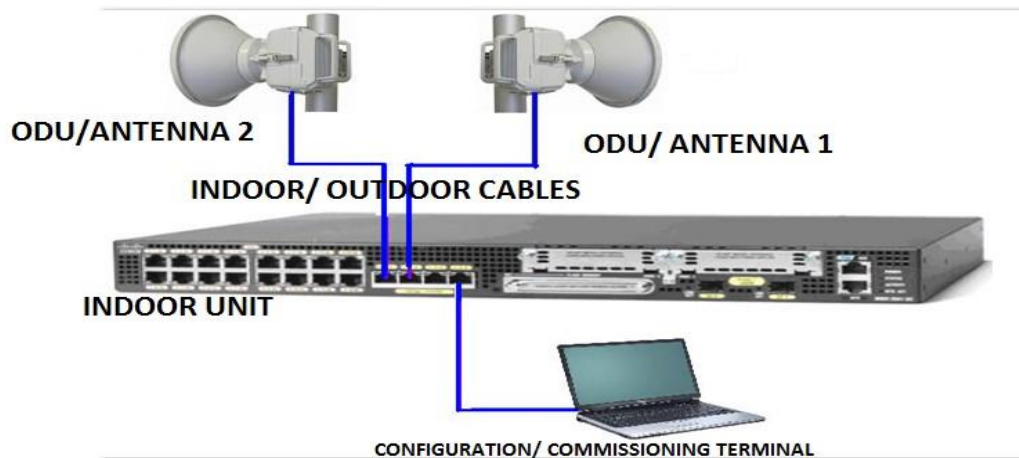
TEMS Investigation Data Collection Software

The screenshot displays the TEMS Investigation 16.3.4 software interface. The main window is titled "WCDMA/GSM Line Chart [EQ1, EQ1, EQ1]". It features a central plot area with multiple data series and a vertical axis ranging from -50 to 30. The plot area is divided into sections for "MSL" (Mobile Station Location) and "UE" (User Equipment). The "MSL" section shows a signal level around -110, and the "UE" section shows a signal level around -120. The "GSM Current Channel [MS1]" panel on the right lists various parameters such as Time, Cell Name, CGI (MCC, MNC, LAC, CI), Cell GPRS Support, Band, BCCH ARFCN, TCH ARFCN, BSIC, Mode, Time Slot, Channel Type, Channel Mode, Speech Codec, Ciphering Algorithm, Sub Channel Number, Hopping Channel, Hopping Frequencies, Mobile Allocation Index Offset(MAIO), and Hopping Sequence Number (HSN). The "GSM Radio Parameters [MS1]" panel shows parameters like Mode (System), RxLev, RxQual, FER, Cell Name, BER Actual, FER Actual, and SNI MOS. The "Event Counter" panel shows a table with columns for Voice, LTE Cell Handling, and GSM/WCDMA Cell Handling, and rows for various events like Blocked Call, Call Attempt, Call Setup, Call Established, Call End, Call Attempt Retry, AQM Synched, and AQM Out of Synch. The "WCDMA Serving Cell" panel shows parameters like Serving Cell DL UARFCN, Serving Cell SC, Serving Cell Identity, and Serving Cell Identity (RNC). The "WCDMA Radio Pa..." panel shows parameters like IE, Value, Mode (System), Tx Power, and SNI MOS.

TELECOM EQUIPMENT INSTALLATION AND COMMISSIONING

In an efficient and professional system, we execute below type of work in Telecom Equipment (TE) category.

- BTS/GMS/WiMAX antenna Installation
- BTS Installation; Integration and Commissioning
- MW Installation and Commissioning (SDH; PDH; CARRIER ETHERNET)
- INSTALLATION OF SDH EQUIPMENTS
- INSTALLATION OF CORE ROUTERS AND OPTICAL DWDM EQUIPMENTS
- INSTALLATION AND COMMISSIONING OF SDH MULTIPLEXERS
- IP ACCESS INSTALLATION AND COMMISSIONING

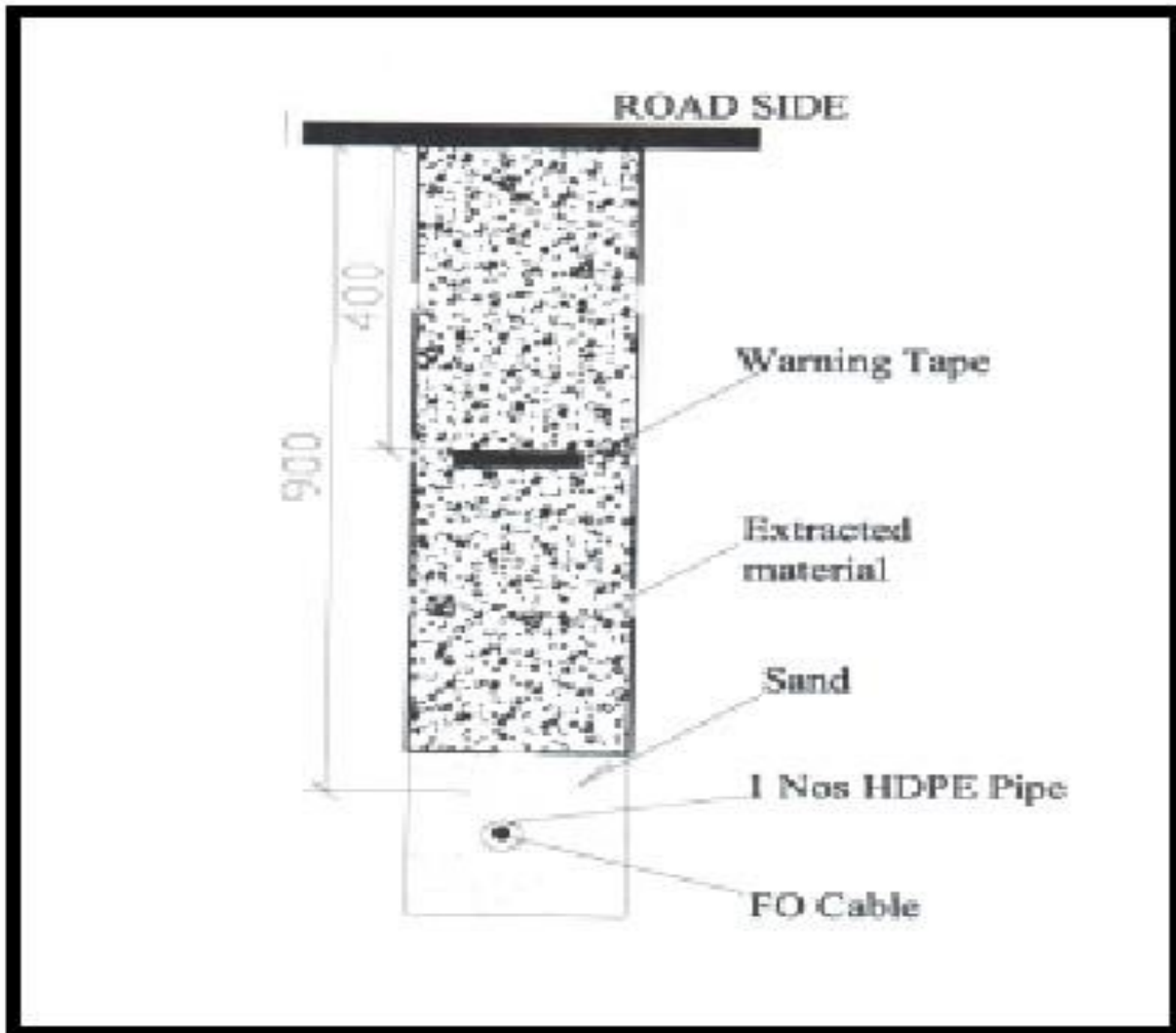


FIBRE OPTICS AND SOLAR POWER

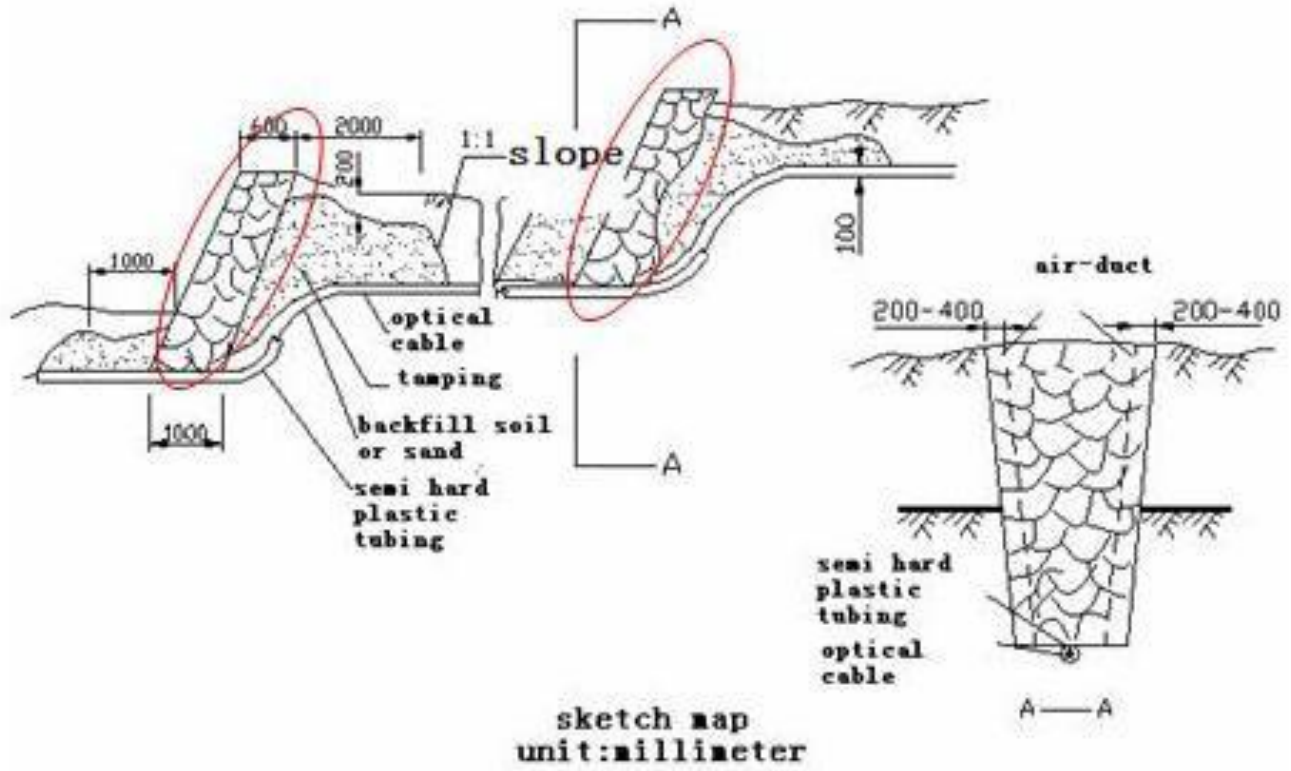
We support our customer from conception to actualization advising on best route plan, fiber specification, equipment specification, fiber laying, testing, and commissioning.

Prior to cable plant construction, TSL will carry out a detailed survey, to get the relevant information and parameters regarding the civil work to be performed, such as:

- Optimizing final route
- Soil type analysis
- Trenching
- Cable laying methods and protection
- Required construction materials.
- Information for the Right of Way



FIBRE OPTICS- ENVIRONMENTAL PROTECTION



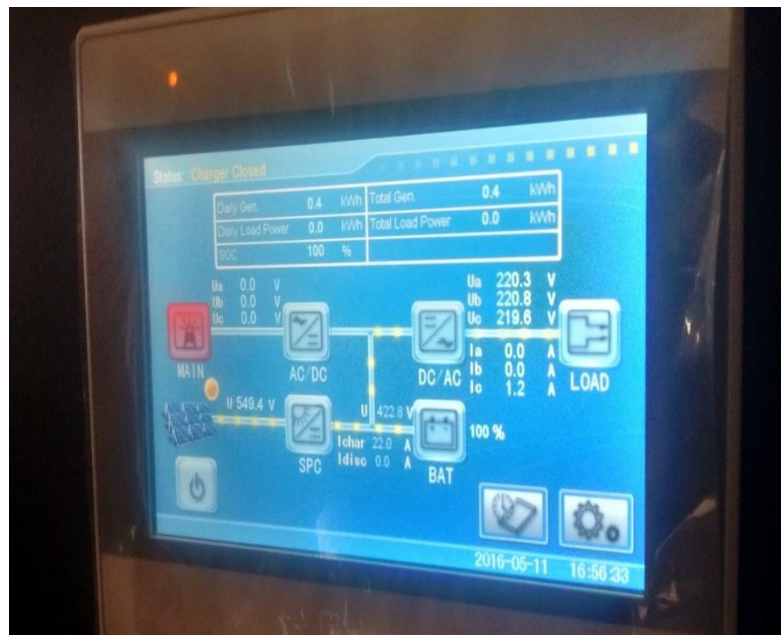
sketch map
unit:millimeter

Protection slope wall are put in place where needed for the side or part of the micro-cable routes where the elements might cause collapse, the protection slope wall shall be used to reinforce the routes.

SOLAR PV STRUCTURE SYSTEM



Equipment Room installation



ENGINEERING SURVEY ACTIVITY

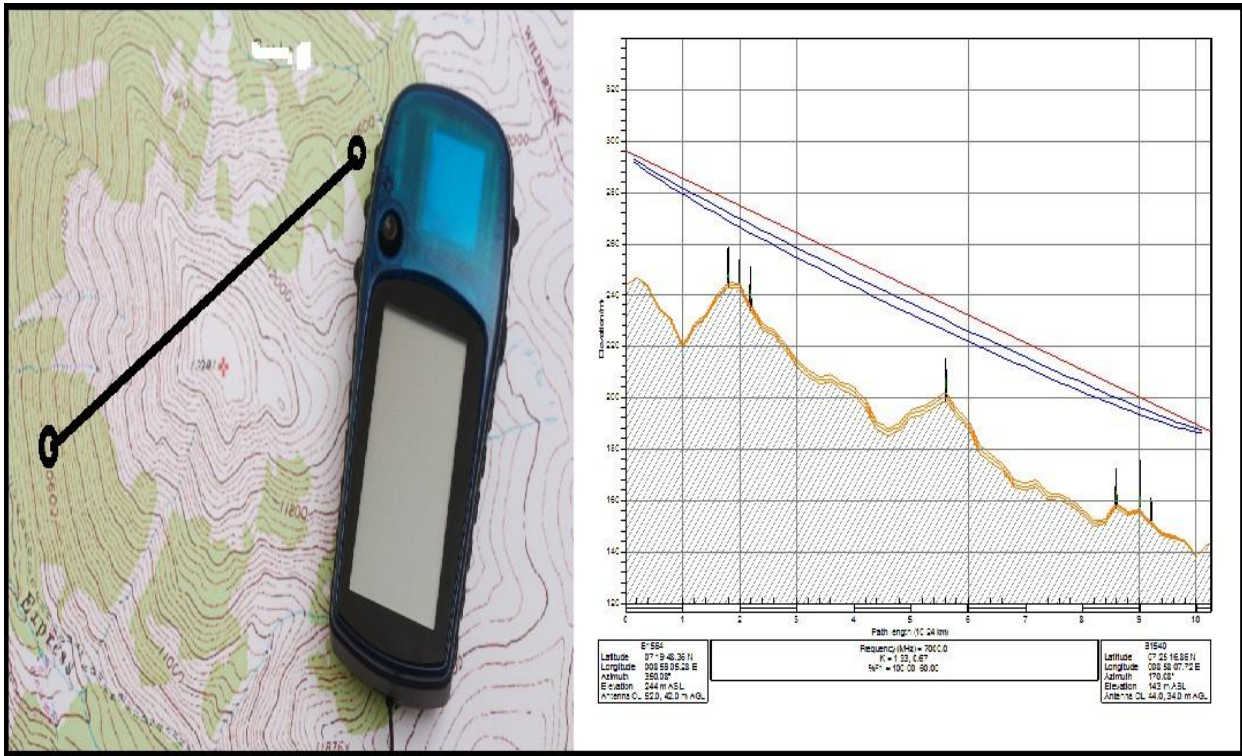
This involves the use of specialized tools and equipment backed by good engineering judgment to collect field data for the purpose of fool proof engineering design. Our in-house experienced engineering surveyors have a proven record of providing accurate **engineering surveys** for use in design and construction of BTS and Transmission infrastructure.

With Accurate and reliable dimension data given, the client has enough information to be used throughout the construction process. Digital Information from the base Map study and those from **topographical survey, Digital maps, Cluster information** of cross-sections and ground modeling information are used to back up field surveys. Information for the Setting-out on-site and finished as-built drawings are also provided to customers.

The range of projects undertaken also include more specialized **engineering surveying** for the laying of fiber optic cables along railway, high tension cable, coastal areas, highway and even some restricted access site.

ALL SURVEYS ARE DONE BASED ON PLANS AND WORK AUTHORISATION SUBMITTED BY THE CUSTOMER

FIELD SURVEY TOOLS



MAP WORK AND PATH PROFILING

EXPIEREINCE LIST

	Job Description	Client	Year
1.	GE Frame 5 Maintenance work prior to Commercial operation	GENSER Power Ghana Limited	June 2009
2.	Turn key Plant-wide Distributed Control System	Atholl Energy	March 2010
3.	Sub-contractor responsible for commissioning of CENIT Tema 110MW Protection Panels	GTG Ghana Ltd	May 2012
4.	Provision of Engineering Services and Drawings for Generator Panel Interconnections on 125MW Generator for CENIT	GTG Ghana Ltd	June 2012
5.	Provided Field Services for GENERATOR Cold Commissioning on 125MW Gas Turbine Generator for CENIT Energy	GTG Ghana Ltd	October 2012
6.	GENERATOR Hot Commissioning and Full Speed No Load Testing of 125MW Gas Turbine Generator for CENIT Energy	GTG Ghana Ltd	December 2012
7.	Annual Maintenance and testing of Protection Panels at Heidelberg Cement's GHACEM Tema and Takoradi Plants	GHACEM	2012 to date
8.	Commissioning of Generator Protection Panels for Genser Unilever's 5MW CHP Panel at Unilever Plant, Tema.	GENSER Ghana Limited	2012
9.	Installation and Testing of Chemical analyzers on FPSO KNK.	MODEC	June 2013
10.	Provision of Field Services for Installation of Fibre-Optic System on FPSO Kwame Nkrumah	MO D E C	June 2013
11.	Provision of Field Services for Installation of Honeywell Oxygen Analyzer	MO D E C	December 2013
12.	Brokering of Gas Sale and Purchase Agreement between VRA and NNPC, Nigeria	VRA	2014
13.	Involved in the application for Regulatory Permits, PPA Negotiations and EPC for BXC's 20MW Utility Scale Solar PV Power Plant at Gomoa Onyadze.	B X C	2014-2015
14.	Full Erection of 33MW Distributed Generation Power Plant for Goldfields Tarkwa consisting of 3 x Solar Mars Gas Turbines as well as Balance of Plant	Goldfields Ghana Limited	2016
15.	Full Erection of 25MW Distributed Generation Power Plant for Goldfields Damang consisting of 5 x Centrax (KB5) Gas Turbines as well as Balance of Plant	Goldfields Ghana Limited	2016
16.	Provided Project Management for the expansion of WAGPCO'S Tema R&M Station, increasing capacity from 70MMscf to 140MMscf	WAGPCo	2017-2018
17.	Project Management for EPC contract for Natural Gas Metering skid for KIPP 350MW Power Plant	Top General Construction Limited	2017
18.	Instrument Calibration for 2 Frame 9E Gas Turbines on KIPP 350MW Combined Cycle Power Plant Project. Provided Manpower for Loop checks as well as Functional Checks	Group Five	2017
19.	Fabrication and GTAW Welding of Food Grade Stainless Steel lines for Ideal Milk 170g/410g packaging.	Nestle Ghana Limited	July 2017
20.	Feasibility and Grid Impact Studies for a 378 MW Combined-Cycle Thermal Power Plant at Aboadze.	BXC Ghana Limited	October 2017

21.	Feasibility and Grid Impact Studies for a 2 x 20 MW Solar PV Plant at Sege.	Sun Investments Ghana Ltd	August 2017
22.	Feasibility and Grid Impact Studies for a 150 MW Solar PV Plant at Ada.	Ada Solar Ghana Ltd	March 2017
23.	Feasibility and Grid Impact Studies for a 20MW Utility Scale Solar PV Power Plant at Gomoa Onyadze.	MENERGY Technology Limited	June 2017
24.	Instrument Calibration for 2 Heat Recovery Steam Generators and one Steam Turbine Generator on KIPP 350MW Combined Cycle Power Plant Project	Group Five	2018
25.	Provision of Office Caravans for client	SAIPEM	2018
26.	Fabrication and GTAW Welding of Food Grade SMAW Welding for Unilever Ghana's Oral (Toothpaste) Factory	UNILEVER	March 2019
27.	Fabrication and GTAW Welding of Food Grade SMAW Welding for Unilever Ghana's Tea Factory	UNILEVER	July 2019
28.	Instrument Calibration of 2 GE Frame 9E Gas Turbines, 2 Heat Recovery Steam Generators and one Steam Turbine Generator on KIPP 350MW	CENOPS	2019
29.	3.5MW Biomass Power Plant Condition Assessment	Unilever Ghana (TOPP)	2019
30.	Engineering, Fabrication and Welding A105 Carbon Steel and PN20 HDPE line for Protection System	CHAVERN LIMITED	2019
31.	Power Transformer Maintenance for Gold Mine Client	Westrafo	2020
32.	250MW TM2500 Power Plant Condition Assessment	AMERI/VRA	2021
33.	CENPOWER Combustion Inspection	Ethos Energy	2021
34.	AMERI EPC Contract Review	VRA	2021