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NOTICE

Dated- 20/11/2019

This is for the information of the concerned learners of CODL of the following programmes- MA Mass Communication, PGD EDM, PGD REEM and PGD CRG; who have submitted their final project proposals and are same was subsequently accepted by the CODL Office, for Autumn Semester 2019, the last date for submission of their final project reports (4 copies; hard binding) is 20th December 2019 (office closing hours).

The reports must reach the Office of the CODL within the said last date (in person/by post). Further the reports must invariably contain the following headings in sequential order:

1) COVER PAGE (http://www.tezu.ernet.in/tu_codl/download/Project%20Cover%20Page.pdf)
2) FORWARDING CERTIFICATE
3) CERTIFICATE OF APPROVAL
4) DECLARATION
5) ACKNOWLEDGEMENT
6) ABSTRACT
7) CONTENTS
8) LIST OF TABLES (if any)
9) LIST OF FIGURES (if any)
10) LIST OF ABBREVATIONS (if any)
11) MAIN BODY/CONTENTS
12) BIBLIOGRAPHY

For reference of the learners a sample project report containing the following headings is enclosed with this notification.

Sd/-
Director
Centre For Open and Distance Learning

DESIGN OF A 310 kWp PHOTO VOLTAIC POWER PLANT AT IOCL

PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF

POST GRADUATE DIPLOMA
IN
RENEWABLE ENERGY AND ENERGY MANAGEMENT

IN THE
CENTRE FOR DISTANCE AND OPEN LEARNING
TEZPUR UNIVERSITY

By

PULIN KUMAR PATHAK, B.E. (ELECTRICAL)

TEZPUR UNIVERSITY
CENTRE FOR OPEN AND DISTANCE LEARNING

Forwarding Certificate

I hereby recommend that the project report prepared under my supervision entitled "***Design of a 310 kW$_P$ Photo Voltaic Power Plant at IOCL***" be accepted in partial fulfillment of the requirements for the degree of Post Graduate Diploma in Renewable Energy and Energy Management.

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Certificate of Approval

The foregoing thesis by Pulin Kumar Pathak **(Registration Number: CODL12 DRE1007)** is hereby approved as a creditable study carried out and presented in a manner satisfactory to warrant its acceptance as a pre-requisite to the degree for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve only for the purpose for which it is submitted.

Committee On
Final Examination for Evaluation of Thesis

Dr. Soumik Roy

DECLARATION

I, Pulin Kumar Pathak hereby declare that this thesis entitled "***Design of a 310 kW_P Photo Voltaic Power Plant at IOCL***" is submitted to the Centre for Open and Distance Learning, Tezpur University, Tezpur, Assam, India for acceptance to award the degree of the Post Graduate Diploma in Renewable Energy and Energy Management is prepared by me and the same has not been/is not being submitted to any other institution.

Pulin Kumar Pathak

Date: 31.12.2014.
Place: Tezpur

(PULIN KUMAR PATHAK)
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ABSTRACT

The global need to reduce green gas emission, rapid increase in the cost of energy and fossil fuels and inevitable energy shortages give rise to worldwide trend to utilize renewable energy sources. Solar energy is one of the most potential renewable energy sources among the other renewable sources of energy. Solar Photovoltaic (PV) attracts tremendous attention, due to its direct conversion of solar energy to electricity. In the study, PV system is used to feed non critical electrical load system in the plants like LPG Bottling Plant and POL Depots. The system operation in standalone mode has been addressed since only non critical loads like street lights, Admin Building lights, High Mast Tower lights, Shop Floor area lights and some small motor loads are connected to the system. The design of a standalone PV system in terms of sizing the PV units and battery storage are calculated. The sizings of the system are determined based on expected loads, characteristics of the used PV module and meteorological data of the place. The systems consists of PV panels, *DC-DC converter interfacing PV panels*, a bi-directional DC-DC battery charger and a 3-phase inverter interfacing the DC Bus to the loads. The power conditioning unit needed to regulate the output voltage of the system across the terminals of the load and track the maximum power point (MPP) is selected according to load demand and battery voltage. In the project, the criteria for designing the PV system are based on available insolation data of Guwahati. i.e 5 $kWh/m^2/day$. The study is about designing a 310 kWP (10 kWp + 100 kWp + 200 kWp) PV system in 3 phases as follows.

- Initial erection of 10 kWp PV systems and supplying the power to lighting loads e.g. street lights.
- In the second stage, addition of 100 kWp PV systems and supply the power to Admin Building, FLT ,Electrical Control Room (PMCC), Canteen, Security Cabins and shop floor lighting.
- And in the third stage, further addition of 200 kWp PV system and supply the power to non critical motor loads where motor ratings are below 10 kW.

While designing the PV system, Load Curve is analyzed carefully and the PV system is sized and combined with the battery system in such a way to cover all the points of load curve. A trade off is done between over-sizing the system to guarantee to power continuity and system costs. At the end economic evaluation has been carried out to validate the applicability of the designed system.

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LIST OF ABBREVIATIONS

kW_P	Kilo Watt peak
SPV	Solar Photovoltaic
kWh	Kilowatt hour
kW	Kilowatt
MU	Million Unit
I_{SC}	Short Circuit Current
V_{OC}	Open Circuit Voltage
Imp	Current at Max Power Point
Vmp	Voltage at Max Power Point
KVA	Kilo Volt Ampere
PSH	Peak Sun Hours
MW	Mega Watt

CHAPTER 1

Introduction

1.1 PV POWER SYSTEM:

Photovoltaic (PV) technology converts one form of energy (sunlight) into another form of energy(electricity) using no moving parts, creating no pollution and lasting for decades with very little maintenance. The use of widely available and reasonably reliable fuel source - the sun-with no associated storage or transportation difficulties and no emissions makes this technology eminently practicable for powering remote areas as well as urban areas. Indeed, numerous examples of successfully deployed systems are already available. The completely scale able nature of the technology also lends itself well to varying power requirements –from the smallest autonomous research platforms to infrastructure –based systems. This technology can be limited by annual fluctuations in solar insolation, especially at extreme latitudes.

Based on semiconductor technology, solar cell operate on the principle that electricity will flow between two semiconductors when they are put into contact with each other and exposed to sunlight (photons)

A Stand-alone photovoltaic power systems are electricity generating photovoltaic systems that are not connected to the electrical grid. This type of PV system may exclusively use solar panels or use them in conjunction with other electricity supplying devices, such as diesel generators and wind turbines.

Direct-coupled system

The basic model of a direct coupled system consists of a solar panel connected directly to a dc load. As there are no battery banks in this setup, energy is not stored and it is capable of powering common appliances like bulbs, fans and pumps etc. only during the day. MPPTs are generally used to efficiently utilize the Sun's energy. Impedance matching is also considered as a design criteria in direct-coupled systems

Stand alone system with batteries

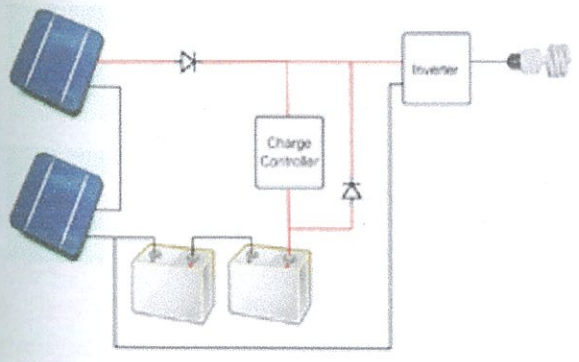

Fig: 1.1
A typical stand-alone photovoltaic power system with battery and battery charger arrangement[3]