

DEVELOPMENT OF A SOLAR SYSTEM DESIGN CALCULATOR

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DEVELOPMENT OF A SOLAR SYSTEM DESIGN CALCULATOR

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**A MASTER'S DISSERTATION SUBMITTED TO THE DEPARTMENT OF
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UNIVERSITY, OTA IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF M.Eng DEGREE IN
ELECTRICAL AND ELECTRONICS ENGINEERING**

MAY, 2017

ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfillment of the requirement for the award of the degree of Master of Engineering in Electrical and Electronics Engineering in the Department of Electrical and Information Engineering, College of Engineering, Covenant University, Ota.

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DECLARATION

I, JOHN, Temitope Mercy (09CK09712), declare that this research was carried out by me under the supervision of Professor Samuel Tita Wara of the Department of Electrical and Information Engineering, Covenant University, Ota, Ogun State. I attest that the dissertation has not been presented either wholly or partly for the award of any degree elsewhere. All sources of data and scholarly information used in this dissertation are duly acknowledged.

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Signature & Date

CERTIFICATION

We certify that the dissertation titled “Development of a Solar System Design Calculator” is an original work carried out by **JOHN, Temitope Mercy** (09CK09712), of Electrical and Electronics Engineering program in the Department of Electrical and Information Engineering, College of Engineering, Covenant University, Cannanland, Ota, Ogun State, Nigeria. We have examined the work and found it acceptable for the award of a degree of Master of Engineering in Electrical and Electronics Engineering.

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DEDICATION

To ROHI

My Shepherd

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It is very exciting writing this page; mainly because it is becoming more real that my master's graduation is looming on the horizon. On this day, I cannot but think of all who had been there through the last 20 months; words cannot encapsulate the helps and joys you have given me through this season. However, I would do my best to appreciate you:

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John, Temitope Mercy

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ABSTRACT

In this dissertation, the development of a Solar System Design Calculator has been explored. One of the challenges faced in the Solar Power industry in Nigeria is the challenge of proper sizing of solar equipment to be installed. The installed solar systems in many homes in Nigeria are undersized; this leads to the underperformance of such systems. This and many other reasons have led to consumer skepticism and reluctance in installing solar power systems for their energy requirement. The purpose of this developed Smart Calculator is to help ascertain; to a large extent, the minimum solar requirement to be installed for any home or business in Nigeria. The calculator estimates the number and wattage of solar panels required, the quantity and rating of the batteries needed, the rating of the inverter and charge controllers to meet any energy requirement. The calculator results are displayed on a MATLAB GUI. The user can also print out the results of the calculator on an excel spreadsheet. The results from the calculator were also compared with Solar Installation catalogs from two Nigerian companies, to check for similarities and deviations. The results show that 52.2% of the measurements comparing company 1 result and SSDC were out of range, while 43.5% of the measurements were within range for panel size measurement, battery size and inverter size calculations and 62.5% and 25% for panel size measurement and battery size measurement respectively for company 2. The calculator was also used to estimate the solar requirement for a rural community for the current energy demand and a futuristic growth rate of 0.8, 1.2 and 1.5% was considered. The developed calculator shall assist solar system engineers and installers, home and business owners and other enthusiasts make better estimates.

Keywords: *Solar calculator, Rural Electrification, Solar Power, MATLAB GUI*

ABREVIATIONS

Ah	Amps hour
AWG	American Wire Guage
BToe	Billion tonnes of oil equivalent
CSP	Concentrated Solar Power
GUI	Graphical User Interface
GW	Gigawatts
GWh	Gigawatts hour
IEA	International Energy Agency
Kcmil	Kilo Circular Mils
KWh	Kilowatts hour
LHP	Large Hydropower
MPPT	Maximum Power Point Tracking
MW	Megawatts
MWh	Megawatts hour
PV	Photovoltaic
PWM	Pulse Width Modulation
SCF	Standard Cubic Feet
SDG	Sustainable Development Goals
SHP	Small Hydropower
SSA	Sub-Saharan Africa
SSDC	Solar System Design Calculator
TWh	Terawatts hour
UNDP	United Nations Development Program