FORMULATING AN INSTALLATION GUIDELINE FOR PHOTO VOL TIC DC SOLAR HOME SYSTEMS IN SRI LANKA

A dissertation submitted to the
Department of Electrical Engineering,
University of Moratuwa
in partial fulfillment of the requirements for the
Degree of Master of Science

by
RAJESHKUMAR.V.S.W.THOMAS RANASINGHE

Supervised by: Professor J.R.Lucas

Department of Electrical Engineering
University of Moratuwa, Sri Lanka

2009

Abstract

Although grid electrification drastically increased during the past two decades up to about almost 75% of the total households in Sri Lanka, it is noted that attempting to electrify the rest of the approximately 25% of the households is very expensive. This is due to the fact that these households are situated in very remote areas which do not permit the normal low voltage (230V Phase to Neutral / 415V Phase to Phase) transmission since the losses would make it unusable to the end user point.

Thus, in order to avoid this losses medium voltage line should be drawn at a very expensive cost which is not justified by the measly amount of end users. The cost benefit analysis would not be feasible. Thus, the rest of these 25% of un-electrified households stands the risk of not having accessibility to grid power even in another 20 to 30 years. Therefore, for such rural house holds the solution for the moment is alternative energy sources. Up to about decade or so back the solution that they had was kerosene fuel to light up their lamps, thereafter they obtained the accessibility to solar photovoltaic (PV) electricity through private sector vendors and government intervention. This solution was widely accepted by this community since the end result was the next best thing to grid power. Further it was safe in usage than kerosene fuel and even grid power. The government and world bank also subsidized the purchase of such systems from vendors. However, the supply of solar PV home systems (SHS) became very competitive, amongst the vendors who supplied them. As a result quality of these systems as well as their installation was compromised by the vendors. As result the poor rural folks who purchased these systems went through severe hardships due to malfunctioning systems. Considering that the investment for these systems would be the largest or the second largest investment in their lives it was unacceptable for them,

Therefore, author of this dissertation had set out to develop a solar PV installation guideline and has managed to develop same in order to be utilized and to be educated

by , the end users or their financing institutions. So that vendors has to deliver proper system with proper after sales procedure in order to be paid for their product or service. Thereby develop some ethical standard of professionalism to this area of engineering! Electrical installations.

DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

UOM Verified Signature

R.V.S.W.T.Ranasinghe
27-02-2009

I endorse the declaration by the candidate.

UOM Verified Signature

Professor. J.R.Lucas

Acknowledgement

Many thanks are due to my supervisor, Professor. Rohan Lucas, for his great insights, perspectives and specially the patients he exercised with my short comings and the guidance he gave thereafter. My sincere thanks go to present Head of Electrical Engineering department Dr.J.P.Karunadasa who helped me to achieve my goal in engineering studies thought my life time and the former Head of Electrical Engineering department Professor. H.Y.R.Perera. Wish to thank all faculty members at Electrical Engineering Department along with the excellent panel of visiting lectures, especially Dr. Lanka Udawattha, Dr.Thilak Siyabalapitiya, Dr.Narendra de Silva, for their guidance and support throughout the study course.

Further , I am greatly appreciative to my batch mates who were great inspiration to me and who encouraged me and who worked as a team to get through this tough task of reading for a MSc. May be I could not have made it without your support.

Last not but the least I would like to thank my loving family, wife Samanali and lovely little daughter Sahanya who was patient with my commitment to my studies reading for MSc, a lot of good family times were missed for the future of a dear husband and a loving father.

Contents

List of Figures

List of Tables

List of Abbreviations

A	Ampere
AC	Alternating Current
Ah	Battery Ampere-Hour
AL	Aluminium
BS/EN	British Standards / European Norm
C_n	Nominal Capacity
C_u	Useful Capacity
CFL	Compact Fluorescent Light
DC	Direct Current
DOD	Depth of Discharge
GI	Galvanized Iron
g/cl	
INGO	International Non Government Organizations
IP 32	Protection against Solid Objects Greater Than 2.5mm Diameter and Protected Against Dripping Water When Tilted Up To 15°
LED	Light Emitting Diodes
LLP	Loss of Load Probability
MS	Mild Steel
NGO	Non Government Organizations
PDD	Depth of Discharge in the Daily Cycle
PD_{max}	Depth of Discharge
PR	Performance Ratio
PV	Photovoltaic
PV GAP	Global Approval Program for Photovoltaic
PVRS 5A	Lead-acid batteries for solar photovoltaic energy systems (modified automotive batteries).

RMS	Root Mean Squire
SHS	Solar PV Home System
SLI	Starting, Lighting & Ignition
SOC	State of Charge
V	Voltage
VRLA	Valve Regulated Lead Acid
Wp	Peak Watts- The Measurement of Electricity Produced By A Solar Generator at Noon on a Sunny Day, Under Predetermined Standard Conditions.