

**TECHNO ECONOMIC FEASIBILITY STUDY ON  
AGRIVOLTAIC ELECTRICITY GENERATION IN  
SRI LANKA**

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Degree of Master of Engineering

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University of Moratuwa

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SRI LANKA**

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Science

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Sri Lanka

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## DECLARATION

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Dr. W D Asanka S Rodrigo

## ABSTRACT

A feasibility analysis for generating Photovoltaic Solar Electricity from agricultural areas as a sustainable solution for the increasing power demand in Sri Lanka. PV solar panels will be installed above the existing cultivated areas while maintaining spaces among rows of PV solar panels to provide the required solar radiation for the crops. Shading level is a critical parameter for the crop yield of a plantation and it was analyzed using DSSAT crop simulation software. DSSAT is a widely used software in agricultural researches for simulating crop growth under various environmental conditions. It takes crop models, soil profile data and annual weather data including solar radiation to simulate and predict the yield per hectare for a selected crop. Required Sri Lankan monthly weather data for DSSAT software simulation was obtained from Solar and Wind Energy Resource Assessment (SWERA) databases while Soil profile data were obtained from high resolution (10km grids) soil data file of International Food Policy Research Institute (IFPRI).

Both Mono-crystalline and Poly-crystalline panels were used for the evaluation and the annual energy generation was obtained using RET Screen software which is a widely used Canadian software. RET Screen has inbuilt databases of climate data for selected locations including Sri Lanka. Fixed angle solar arrays with south inclination of  $8^{\circ}$  and solar tracking with single axis rotation was considered for the evaluation. There were two different mathematical models which were used to obtain the relevant solar shading under the PV array for a given inter row spacing. Shading portions for diffusive solar radiation and direct solar radiation was obtained separately by considering panel tilts and the sun's location with respect to the considered point under shading. Finally, the percentage of the shading was compared with pre obtained crop yield and shading relationship data to predict the feasible yield and to evaluate the technical and financial feasibility of the agrivoltaic system.

An excel based software tool was developed based on the collected databases and simulations to use as a preliminary decision making tool for selecting a crop, PV solar technology and arrangements for an appropriate area.

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## **LIST OF ABBREVIATIONS**

DSSAT	Decision Support System for Agro technology Transfer
PV	Photovoltaic
SWERA	Solar and Wind Energy Resource Assessment
CEB	Ceylon Electricity Board
DNI	Direct Normal Irradiation
DHI	Diffusive Horizontal Irradiance
GHI	Global Horizontal Irradiation
SLSEA	Sri Lanka Sustainable Energy Authority
PUCSL	Public Utilities Commission of Sri Lanka
LECO	Lanka Electricity Company
TMY	Typical Meteorological Year