Agri-Solar Water Pumping Design, Energy & Environmental Analysis: A Comprehensive Study in Tropical Humid Climate

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INTRODUCTION

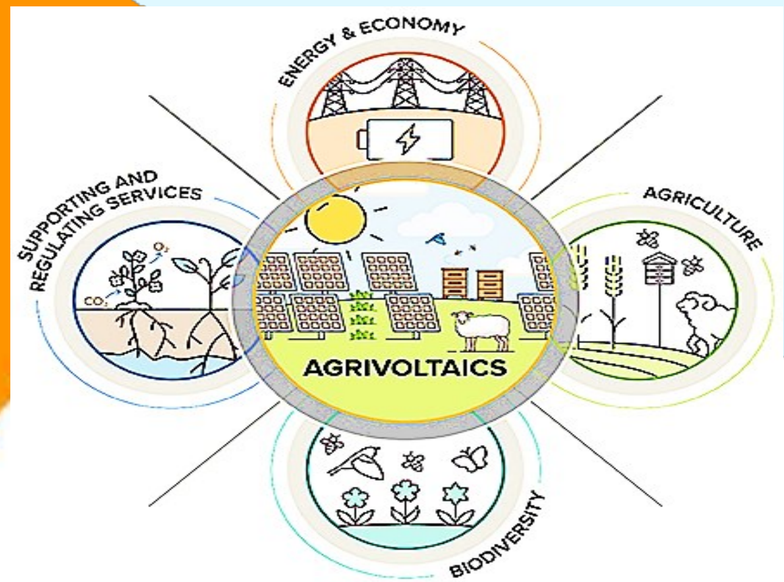


Fig. 1. Conceptual framework of Agri-Solar Farming **(Leroy J. Walston, 2022)**

OBJECTIVE

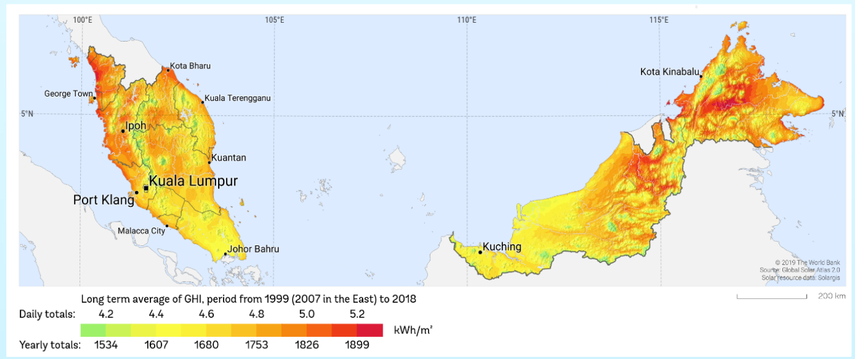
To design an agri-solar water pumping system for farming lettuce

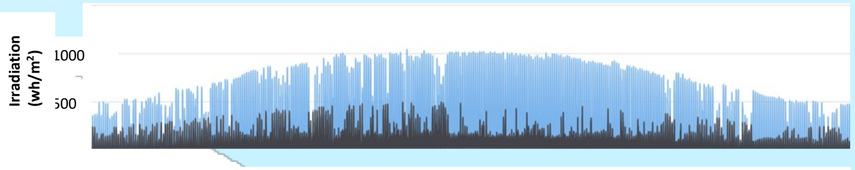
Assess the Energy Yield, System Efficiency, Pumping Capacity

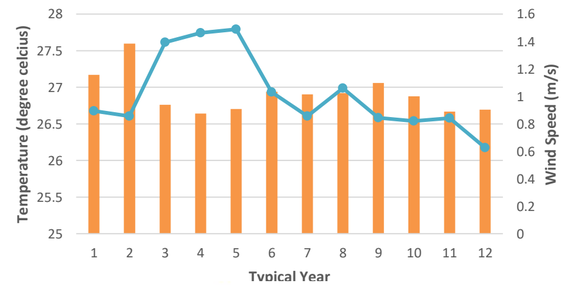
Analyse the carbon mitigation and carbon credit potential

Fig.2. a. The crop is lettuce used for cultivation **(Esther Sung, 2020)** 2. b. Integration of solar panels **(https://en.wikipedia.org/wiki/Solar_panel)** 2. c. carbon mitigation of agrivoltaics system **(pexels.com/photo/carbon-capture-alberta-323527/)**

METHODOLOGY







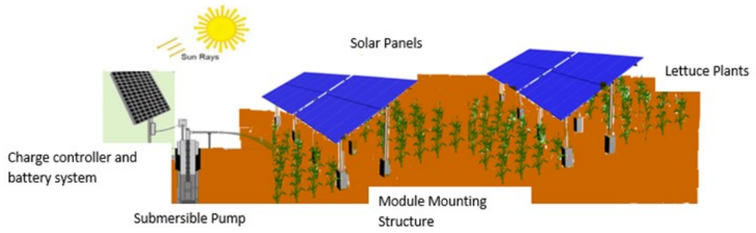
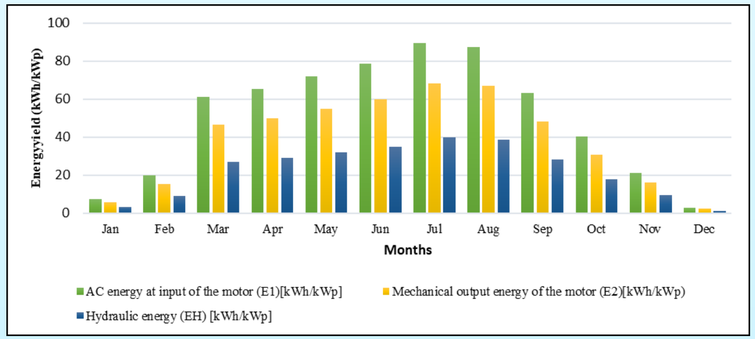
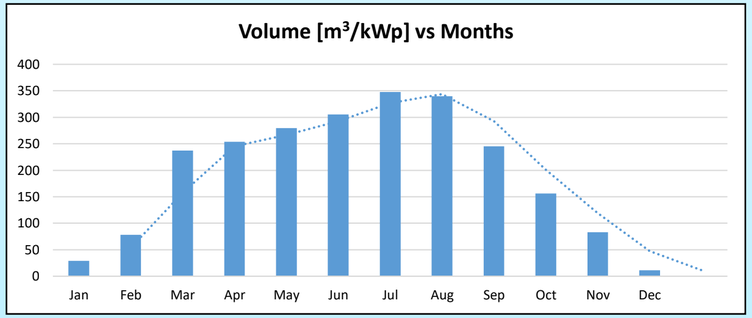


Fig.3.a Global Horizontal Irradiance of Peninsular and Eastern Malaysia **(Solar GIS)** 3. b. Solar irradiation of Malaysia for a Typical Metereological Year **(SISIFO)** 3. c. Variation of Temperature over Windspeed **(NSRDB)** 3.d. Agri Solar water Pumping and Pumping System

RESULT





Categories	Kuala Lumpur
Annual Energy Generation (kWh)	11913.6
CO_2 emissions from Conventional Plant ($tonCO_2e$)	9.29
CO_2 emissions from Solar Plant ($tonCO_2e$)	0.48
Annual net CO_2 mitigation in (tCO_2e)	8.82
Carbon Credit($)	255.40

Fig.4.a Solar water pumping energy yield 4. b. Agri Solar Water Pumping Yield per month 4. c. Environmental Analysis for APVWPS in Kuala Lumpur

CONCLUSION

The required pumping power for the study region ranges between 6400 kWh and 8400 kWh. Further, the observed system efficiency of the solar water pumping system ranges between 58.9% and 89%. This research contributes to the evolving field of agri-solar water pumping design and simulation, offering valuable insights while highlighting the need for ongoing research and development to further validate these findings in diverse climatic conditions and agri-solar design settings.

(The following research have been submitted to Heliyon Cell Press for Peer Review)