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Optimal Design of Green Energy Systems Based on Photovoltaic Source for Rural Electrification in Malaysia

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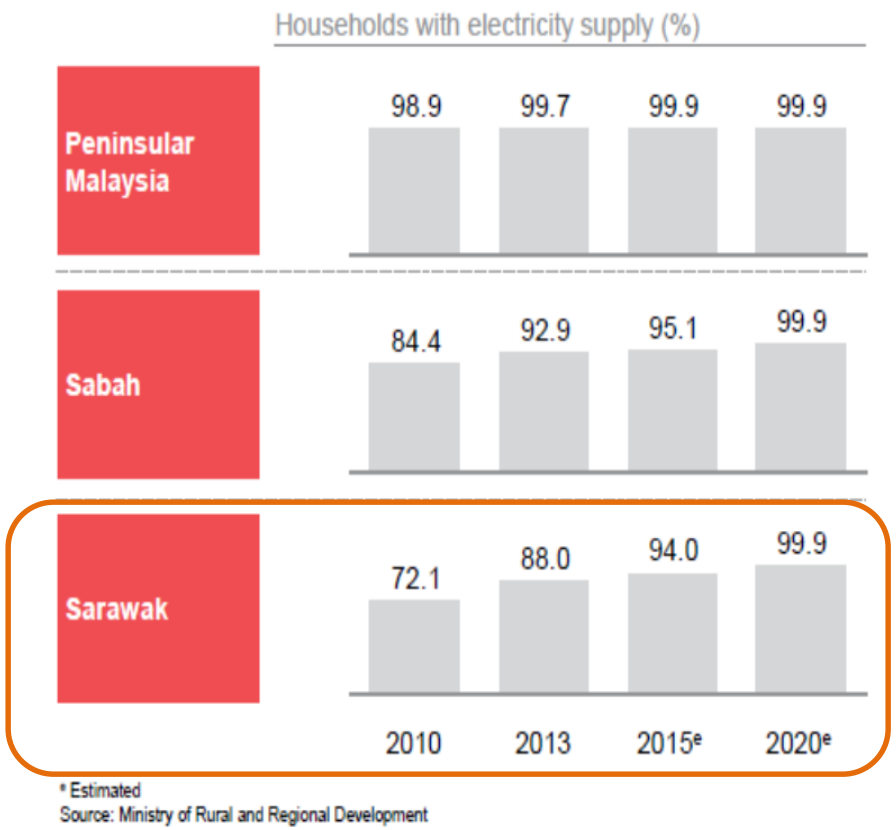
Rural Electrification

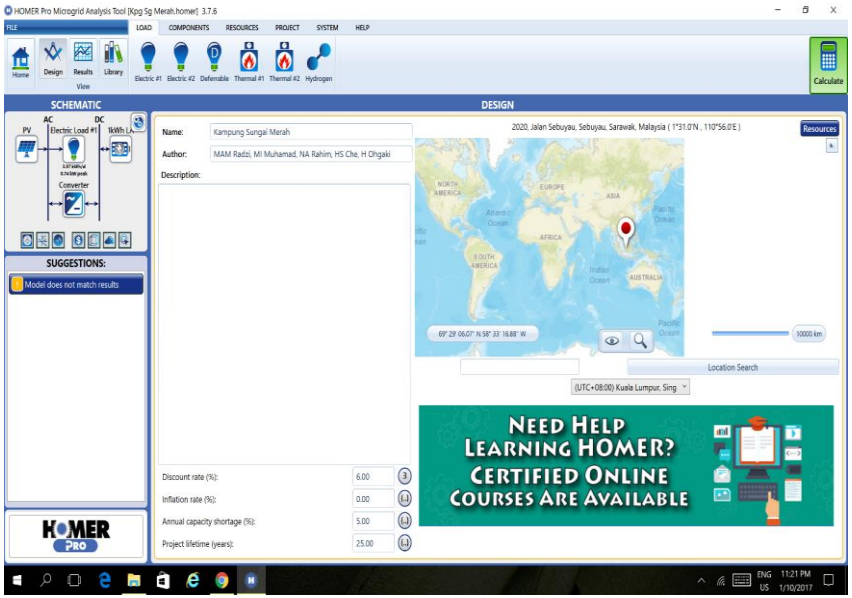


* Estimated
Source: Ministry of Rural and Regional Development

There are various existing works on installing renewable systems, potential of evaluating them for further improvement can be carried out, especially with appropriate design.

Objective

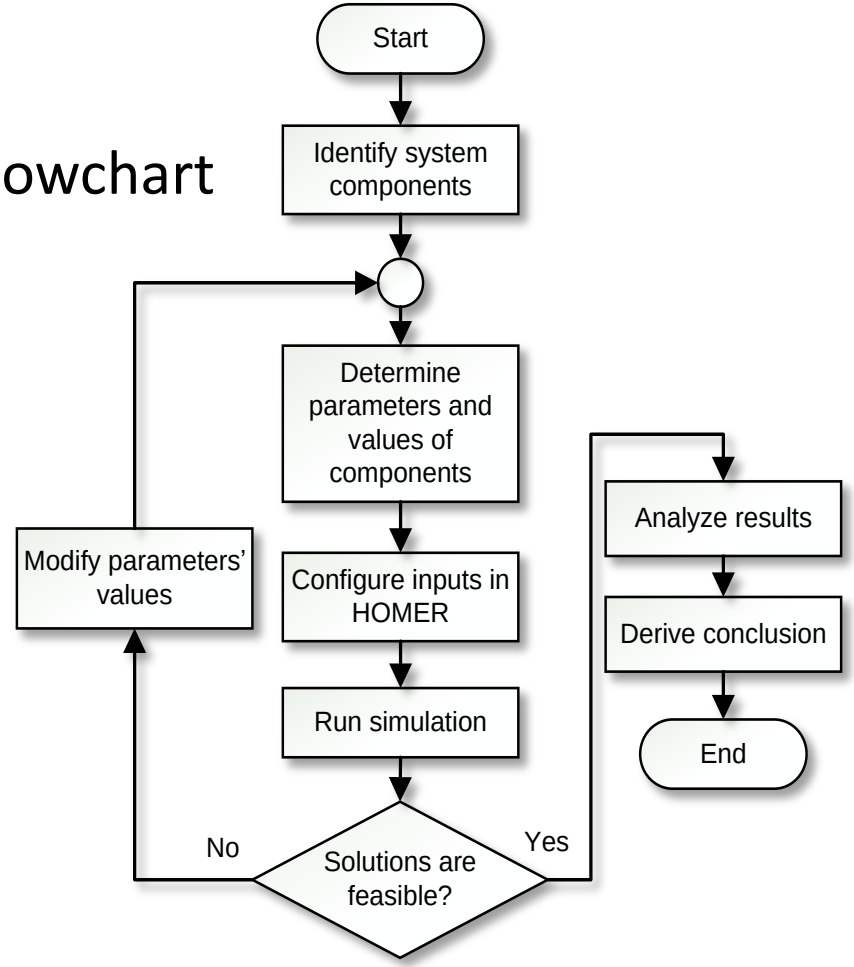
To develop optimal design of fully **green energy systems based on photovoltaic (PV) source** with reasonable cost and appropriate dispatch energy strategy for rural electrification in **two selected areas in Sarawak**

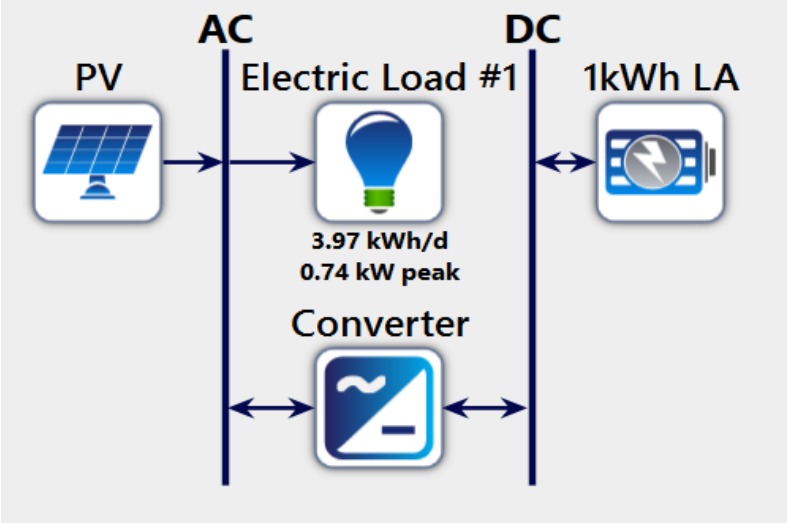


Studied Areas

Assessment

Flowchart



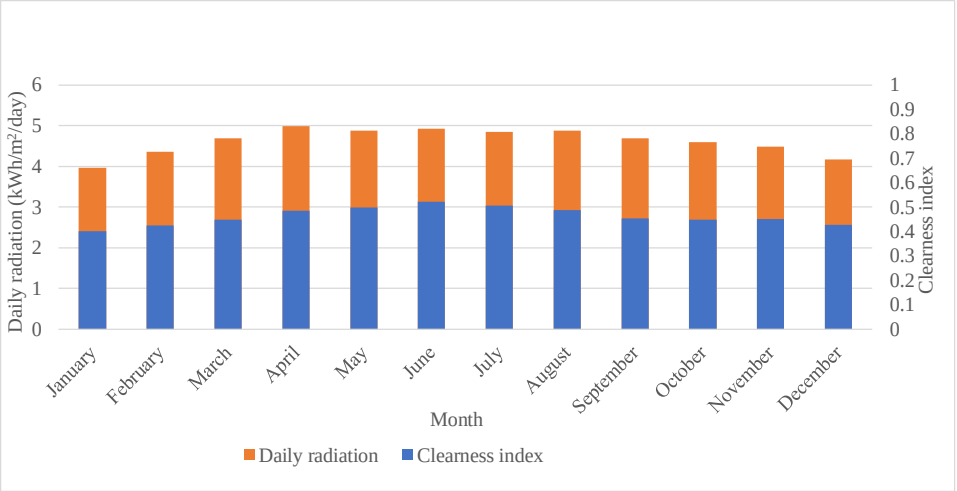


Configuration of the system

Loads and Solar Data

House	Electrical appliance	Power (W) per hour	Average usage (Hour/ day)	Usage for 1 unit per day (Wh)	Unit	Total usage for 1 house per day (W/h)
1	Compact fluorescent light bulb 1	26	5	130	1	130
	Compact fluorescent light bulb 2	20	5	100	1	100
	Compact fluorescent light bulb 3	18	5	90	7	630
	CRT television	72	5	360	1	360
	Table fan	48	6	288	2	576
	Ceiling fan	60	6	360	1	360
2	Compact fluorescent light bulb	18	5	90	8	720
	LCD television	50	5	250	1	250
	Table fan	48	6	288	1	288
3	Compact fluorescent light bulb	18	5	90	3	270
	Table fan	48	6	288	1	288
					TOTAL	3972

For Kampung Sungai Merah, surveyed by UMPEDAC



Annual average irradiance is 4.62 kWh/m²/day

Outcomes of Optimal Design

Component/Parameter	Value	
	Kampung Opar	Kampung Sungai Merah
Architecture/PV (kW)	13.3	2.39
Architecture/1kWh LA	36	7
Architecture/Converter (kW)	3.22	0.67
Architecture/Dispatch	Cycle charging	Cycle charging
Cost/Cost of energy (COE) (USD)	0.652	0.624
Cost/Net present cost (NPC) (USD)	**38,052**	**6,789**
Cost/Operating cost (USD)	1,660	268.22
Cost/Initial capital (USD)	25,029	4,686
System/Renewable fraction (%)	100	100
PV/Capital Cost (USD)	13,264	2,385
PV/Production (kWh)	17,858	3,210
1kWh LA/Autonomy (hour)	24	25
1kWh LA/Annual Throughput (kWh)	4,526	851
Converter/Rectifier Mean Output (kW)	0.6	0.1
Converter/Inverter Mean Output (kW)	0.4	0.08

Conclusion & Future Prospect

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The work has successfully been carried out to design and simulate the renewable energy systems. The results conclude the optimized results with the lowest NPC.

Appropriate design with comprehensive analysis through powerful software tool like HOMER should provide better future prospect in ensuring **sustainable renewable systems**. The supplied electricity later will provide better life for rural people.

The future work is to consider multi sources for more sustainable renewable systems.

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