Japan-ASEAN Science, Technology and Innovation Platform (JASTIP)
Report of JASTIP-Net Activity

Date: / /

1. Research partner	Affiliated Organization		
	Name	Dr. Mohd Amran Mohd Radzi	
	Affiliation	Universiti Putra Malaysia	
	Position	Associate Professor	
	Address	Department of Electrical and Electronic Engineering, Faculty of Engineering, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor Darul Ehsan, MALAYSIA	
2. Collaborative research	Collaborative research theme	**Headquarters** ☐ To Develop Operational Linkages and Human Resources among Academic Sector, Government Agencies, and Private Sectors in ASEAN countries and Japan. ☐ To Introduce Various STI Collaborations for Effectively and Efficiently into the Society based on the three joint laboratories' activities. **Energy & Environment Joint Lab** ■ Studies on Rural/Community Renewable Energy. ☐ Development of Renewable Energy Technology adapted to the ASEAN region. ☐ Studies on Energy Policy/Security in the ASEAN region.	

		Bioresources & Biodiversity Lab ☐ Studies on Biodiversity in the ASEAN Region Contributing to the Improvement of Identification, Collection and/or Information. ☐ Sustainable Utilization of Bioresources for Biorefinery, Bioremediation, Wood Construction, Food or Medicine. ☐ Plant Improvement for Agroforestry Systems and Carbon Sequestration Contributing to the Mitigation of and/or Adaptation to Climate Change. **Disaster Prevention Joint Lab** ☐ Innovative Ideas on Disaster Prevention, Mitigation and Recovery Technologies and Policies Peculiar to Each ASEAN Country. ☐ How to Cope with Trans-Boundary Disasters in the ASEAN Region Such as Tsunami, Flood, Drought and Haze. ☐ Understanding and Quantitative Evaluation of Disaster Risks Peculiar to ASEAN Countries.
	Collaborative research title	Optimal Design of Green Energy Systems Based on Multi-Renewable Resources for Rural Electrification
	Host core-researcher	Professor Dr. Hideaki Ohgaki

3. Members

Name	Prof. Dr. Nasrudin Abd. Rahim		
Affiliation	University of Malaya	Position	Professor
Name	Prof. Dr. Hideaki Ohgaki		
Affiliation	Kyoto University	Position	Professor
Name	Dr. Che Hang Seng		
Affiliation	University of Malaya	Position	Senior Lecturer
Name	Mohd Izhwan Muhamad		
Affiliation	Universiti Putra Malaysia	Position	Science Officer

4. Report of activities

Please describe 1) research activities and major findings and 2) their academic and social implications toward achieving the SDGs within 2 pages. You can include tables, figures and photos if necessary.

This study covers optimal design of photovoltaic (PV) system for rural electrification. The study covers Kampung Opar, Bau, and Kampung Sungai Merah, Sebuyau, both in Sarawak. Kampung Opar with latitude of 1.44 and longitude of 110.07 is located 34 km far from Kuching in Sarawak. Meanwhile, Kampung Sungai Merah is located at latitude of 1.51 and longitude of 110.9. The selected software is Hybrid Optimization of Multiple Energy Resources (HOMER). This software navigates the complexities of building cost effective and reliable microgrids that combine traditionally generated and renewable power sources, storage and load management.

1. Configuration of Loads

The loads for Kampung Opar are determined through estimation, and for Kampung Sungai Merah

are by carrying survey. The survey was done by University of Malaya Power Energy Dedicated Advanced Centre (UMPEDAC) through the visit to this village. The detailed electric appliances, power, operating time, average usage, and total usage per day have been included.

2. Meteorological and Climate Data

The collected data in this work for solar radiation on horizontal surface and wind speed at 10 m from ground are conducted based on NASA's Atmospheric Science Data Centre for 22 years. Interestingly in HOMER, this data can be obtained directly by configuring the resources, which are connected directly to the database.

3. Configuration of System's Components

The proposed configuration of the system is shown in Figure 1. It contains PV source, converter, electric load and battery. The system is purely based on renewable source, and therefore, by properly configuring the components according to demands of both areas and simulated by HOMER, the system should be able to provide sustainable supply later.

4. Simulation Work

HOMER contains three main parts, which are simulation, optimization and sensitivity analysis. It simulates the operation of a system by making energy balance calculations in each time step of the year. Optimization algorithm simulates all of the feasible system configurations. In sensitivity analysis, by defining sensitivity variables as inputs, HOMER repeats the optimization process for each sensitivity variable.

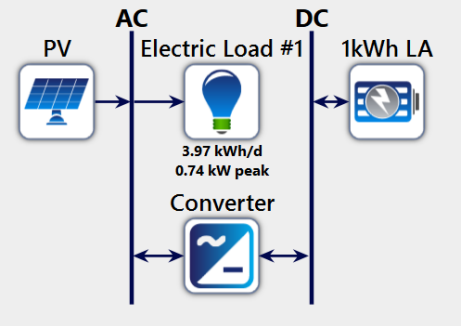

Figure 1 Configuration of the system

5. Major Results and Findings

The main interface for the results is shown in Figure 2. Meanwhile, Table 1 shows the results obtained with optimization case. The results conclude the optimized results with the lowest net present cost (NPC).

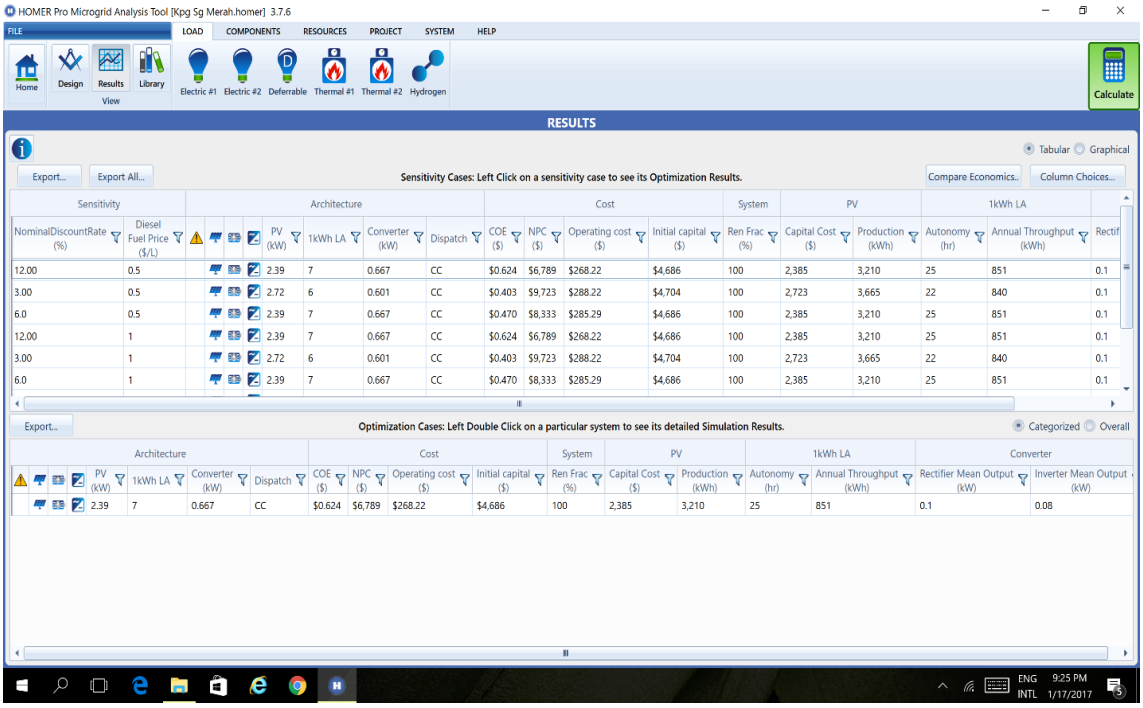

Figure 2 Main interface of results

Table 1 The optimized results from simulation

Component/Parameter	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

5. List of publications

Example of description: Navaporn Kaerkitcha, Surawut Chuangchote and Takashi Sagawa, "Control of physical properties of carbon nanofibers obtained from coaxial electrospinning of PMMA and PAN with adjustable inner/outer nozzle-ends," Nanoscale Research Letters, 11(1), 1-9, 2016

Mohd Amran Mohd Radzi, Nasrudin Abd. Rahim, Hang Seng Che, Hideaki Ohgaki, Hooman Farzaneh, Wallace Shung Hui Wong and Lai Chean Hung, "Optimal Solar Powered System for Long Houses in Sarawak by using HOMER Tool," submitted in 2018.

6. List of oral presentations

Example of description: Worasuwannarak N, Wannapeera J, Jadsadajerm S, and Miura K. Upgrading of rice straw and leucaena by degradative solvent extraction using 1-methylnaphthalene and kerosene at 350 oC. The 21st International Symposium on Analytical and Applied Pyrolysis, Nancy, France, 9-12 May 2016.

Radzi MAM, Rahim NA, Che HS, Ohgaki H, and Muhamad MI. Optimal Design of Green Energy Systems Based on Photovoltaic Source for Rural Electrification in Malaysia. Third JASTIP Symposium - ASEAN-Japan STI Collaboration for SDGs, Bangkok, Thailand, 5 February 2017.