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28 May - 1 June 2023 in Orlando, Florida, USA

FIG WORKING WEEK 2023

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Protecting
Our World,
Conquering
New Frontiers

Geospatial Technology for Hydropower Site Selection and Rural Electrification Supply-Demand Analysis –

*A Case Study in the Yabem/Mape Rural of Finschhafen District,
Papua New Guinea*

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Organized By

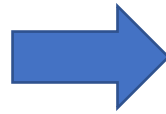


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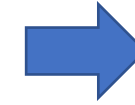


INTRODUCTION

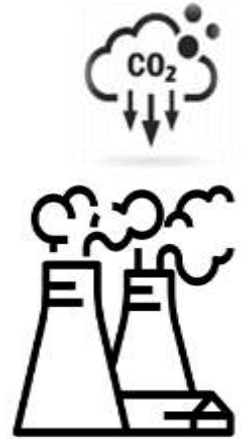
Sustainable means of providing Electricity.



Demand and challenges lie within renewable energy (RE) production.



Emission Reduction



- Most population in developing countries is rural base and lacks electricity.
- PNG is one of the least electrified countries in the world, with only 13% of the population having access to electricity.
- Though it Has high potential of RE, harnessing is a major problem.
- Utilizing geospatial tools to bridge gaps for electrification infrastructure development (EID) in a sustainable way.

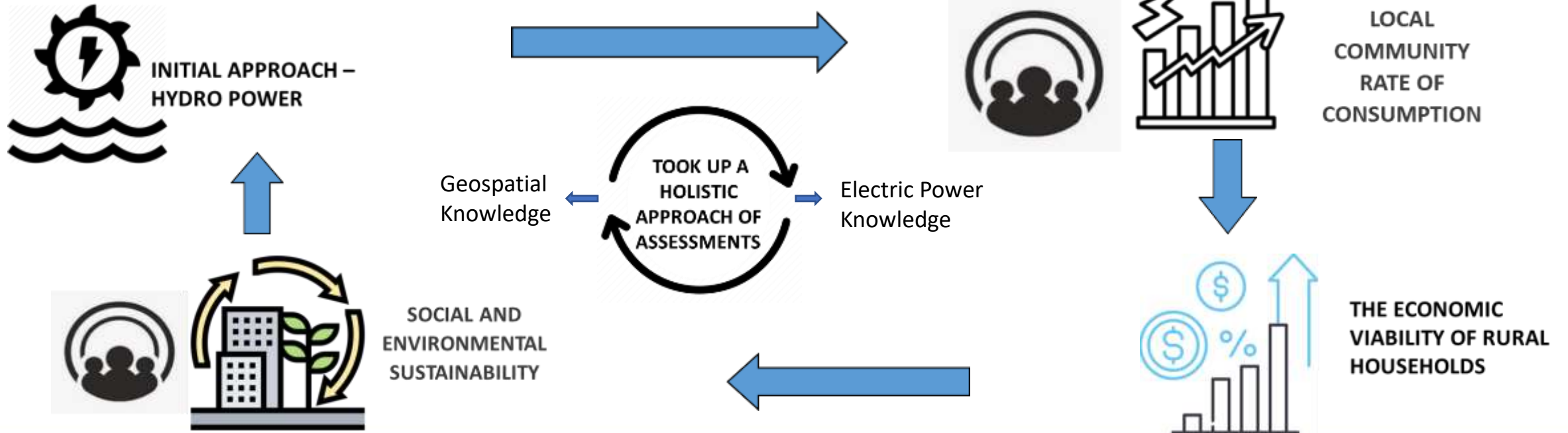
PROBLEM STATEMENT

- Common problems exist that impede and stop the progress and initiation of EID;
 - poorly connected roads
 - Remoteness
 - Complex topography
 - Land issues
 - Low income
 - Lack of data availability
 - Limited knowledge of infrastructure's importance

On this problem, Pathways need to be formulated for effective EID.

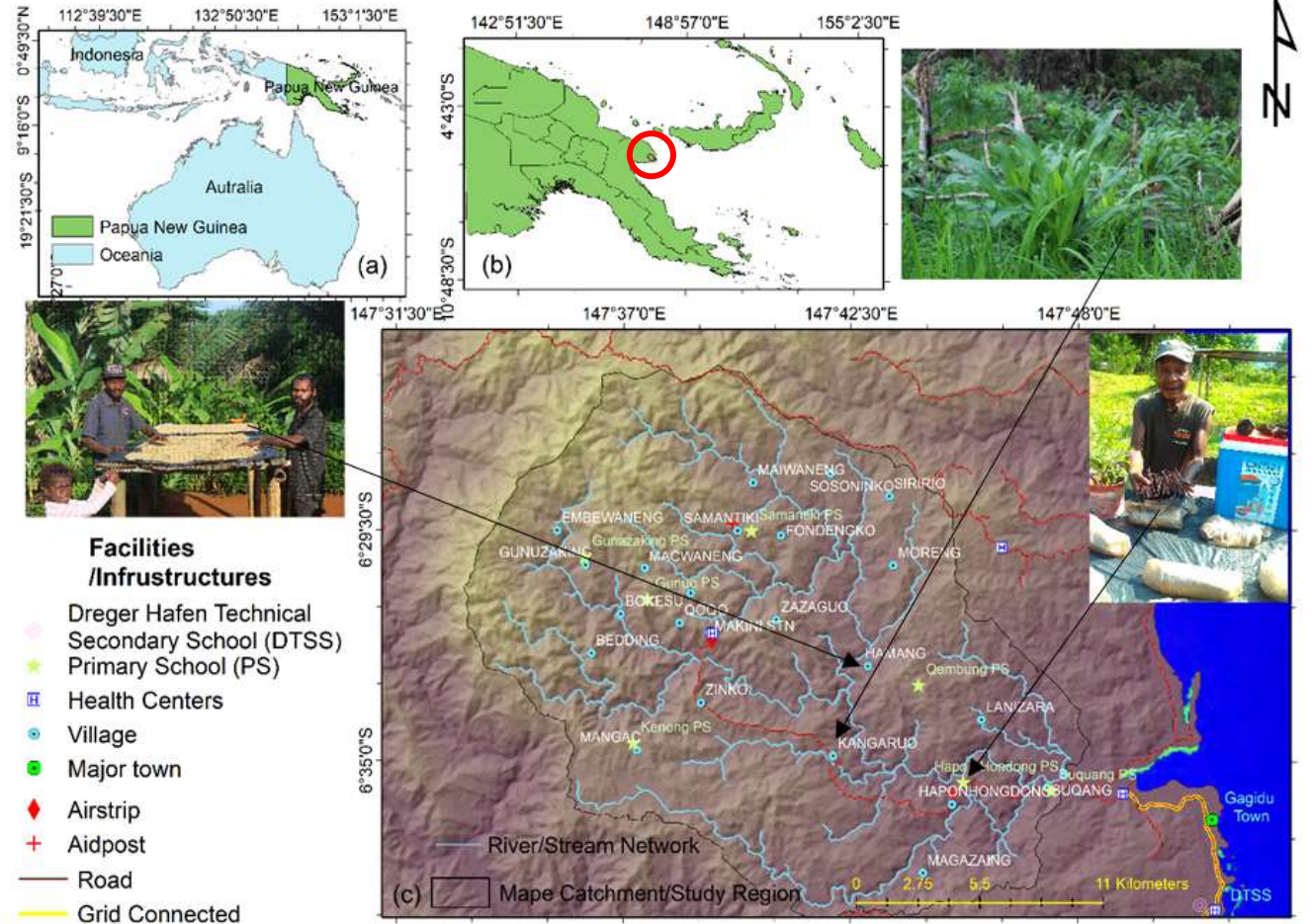
OBJECTIVES

To identify and develop pathways that can bridge and enhance rural electrification development;

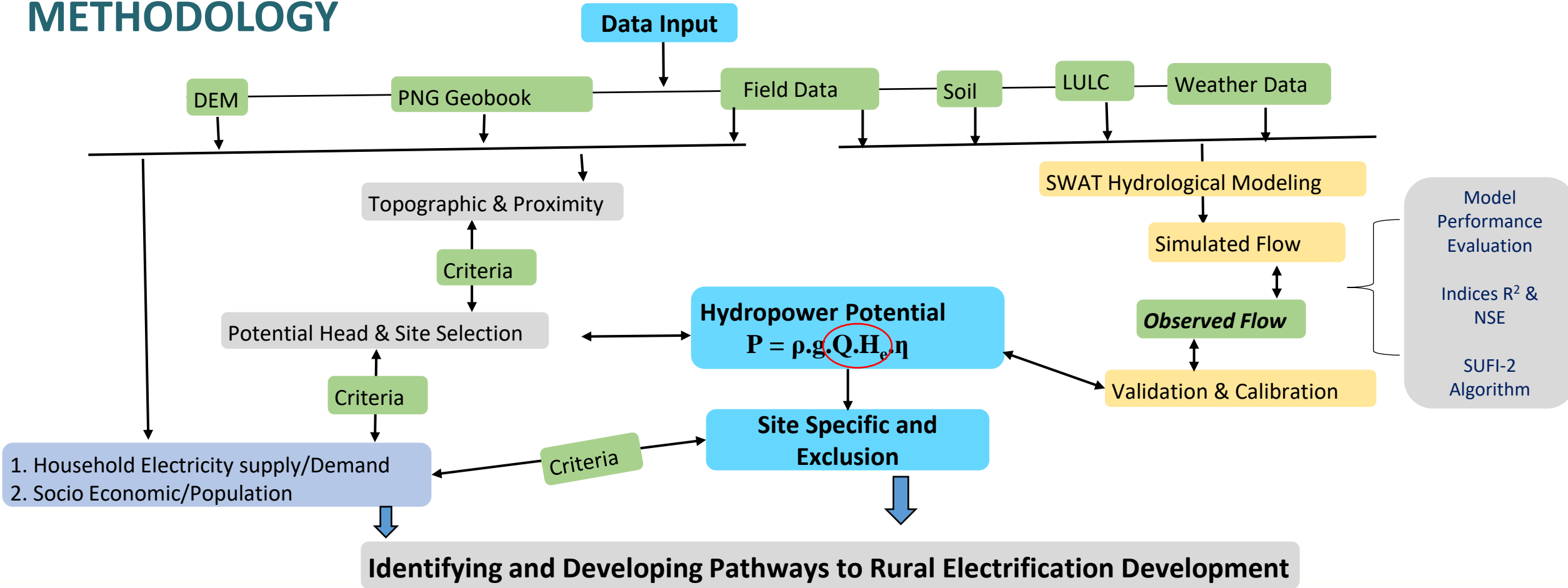


CASE STUDY SITES

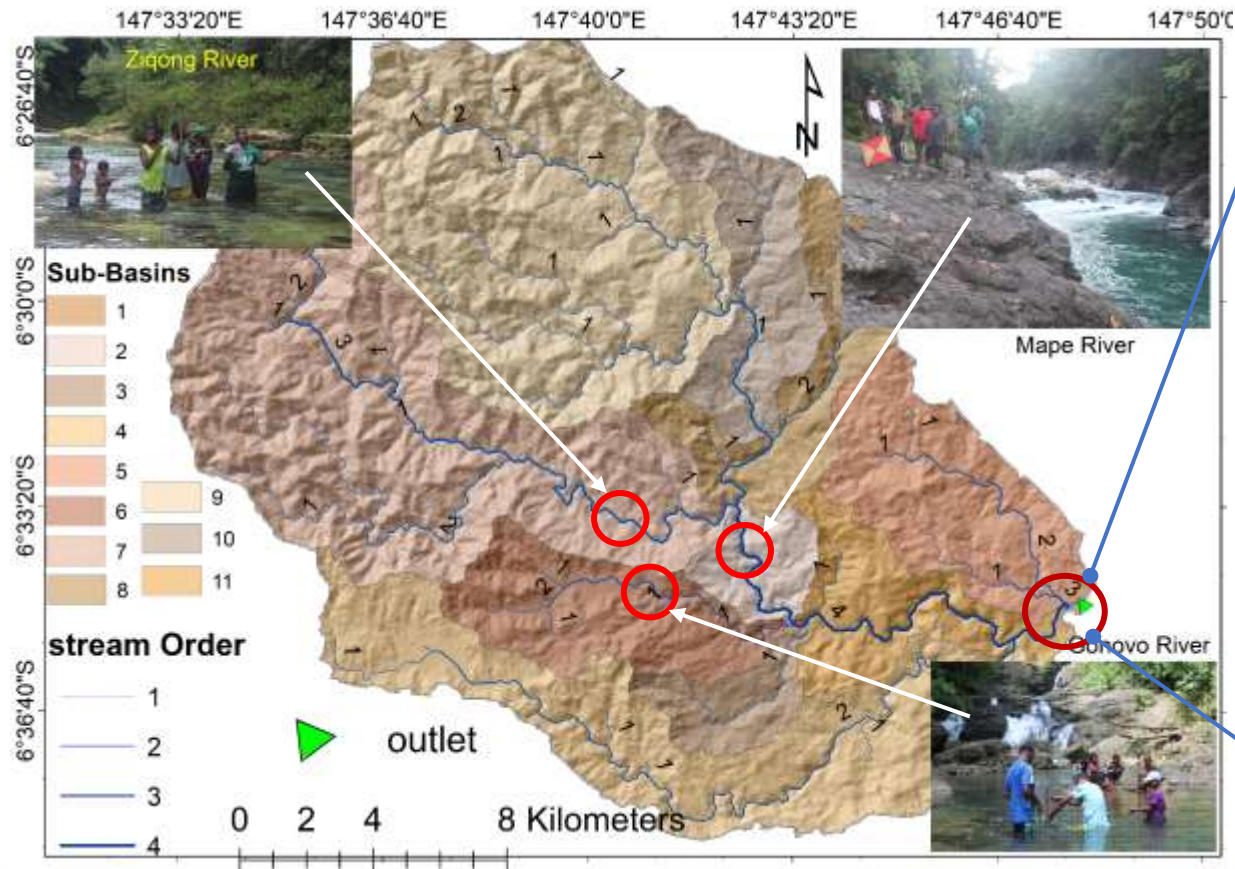
- 432sq.km,
- Population of 7621
- 27 villages/rural places
- Non-availability of any forms of Electricity



METHODOLOGY

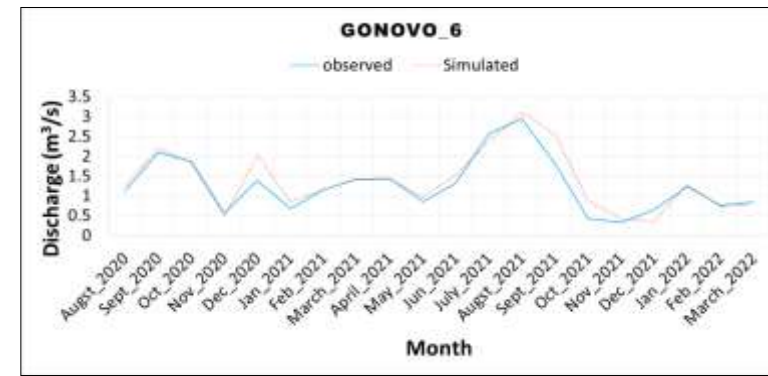
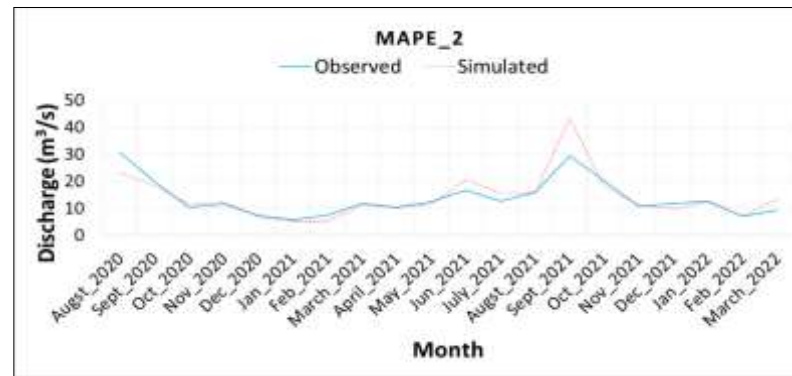
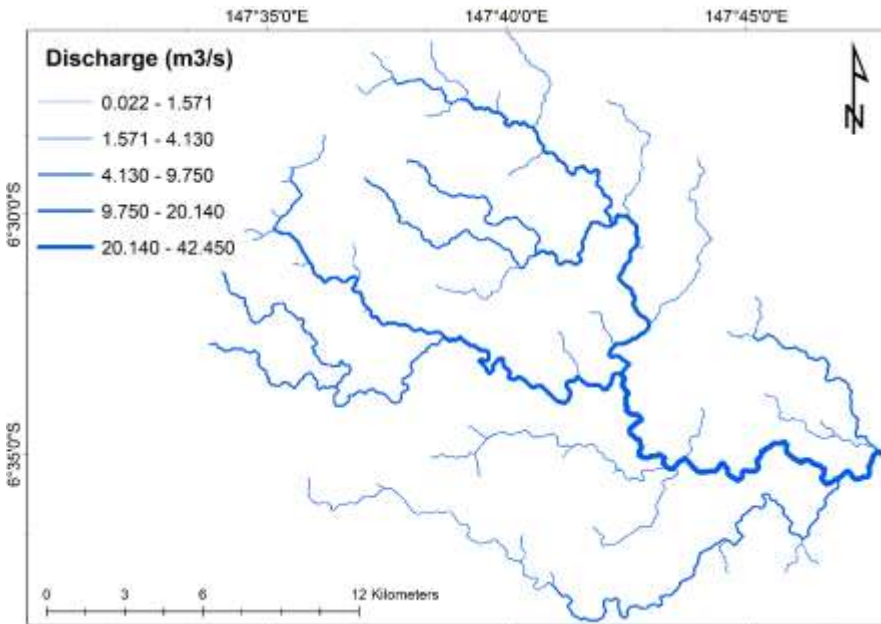


RESULTS OF STREAMS AND SUB-BASINS



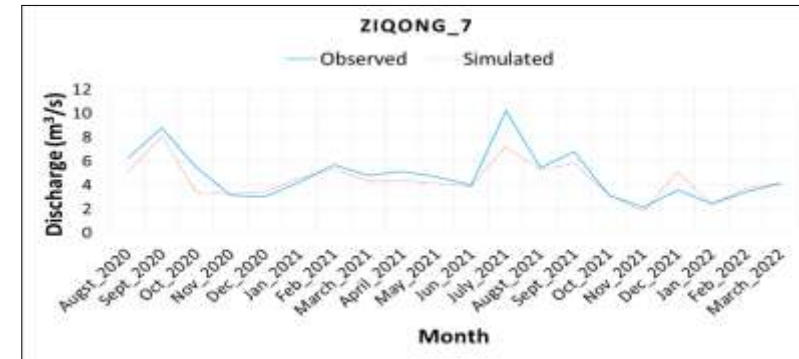
RESULTS OF STREAMS AND SUB-BASINS

Results of Calibration and Validation of SWAT Model

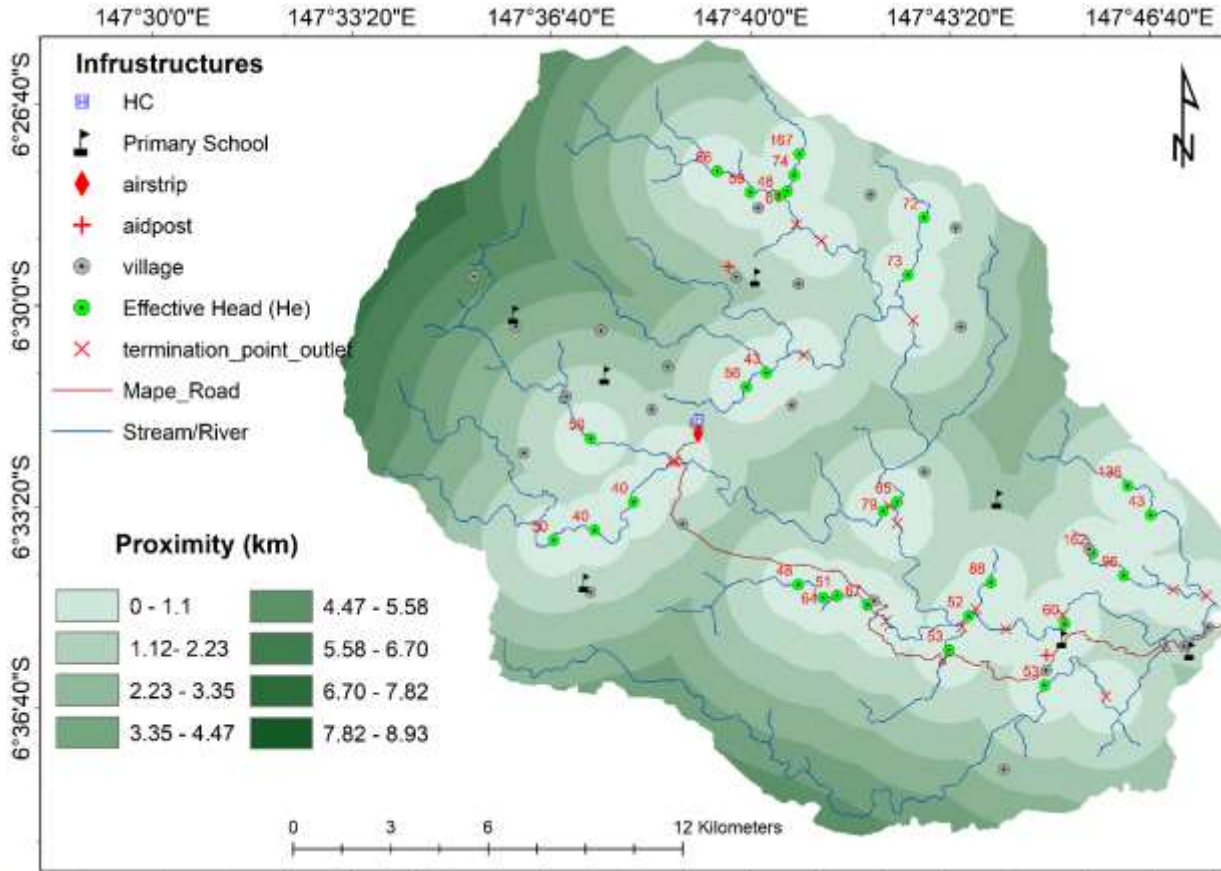


Statistical results of calibration and validation of simulated and observed flow

	August 2020 - May 2021		May 2021 - March 2022			
	Calibration		Validation			
Parameters	Mape_2	Ziqong_7	Gonovo_6	Mape_2	Ziqong_7	Gonovo_6
NSE	0.75	0.87	0.77	0.89	0.78	0.87
R2	0.94	0.79	0.85	0.88	0.83	0.89



EFFECTIVE HEAD SPECIFICATIONS



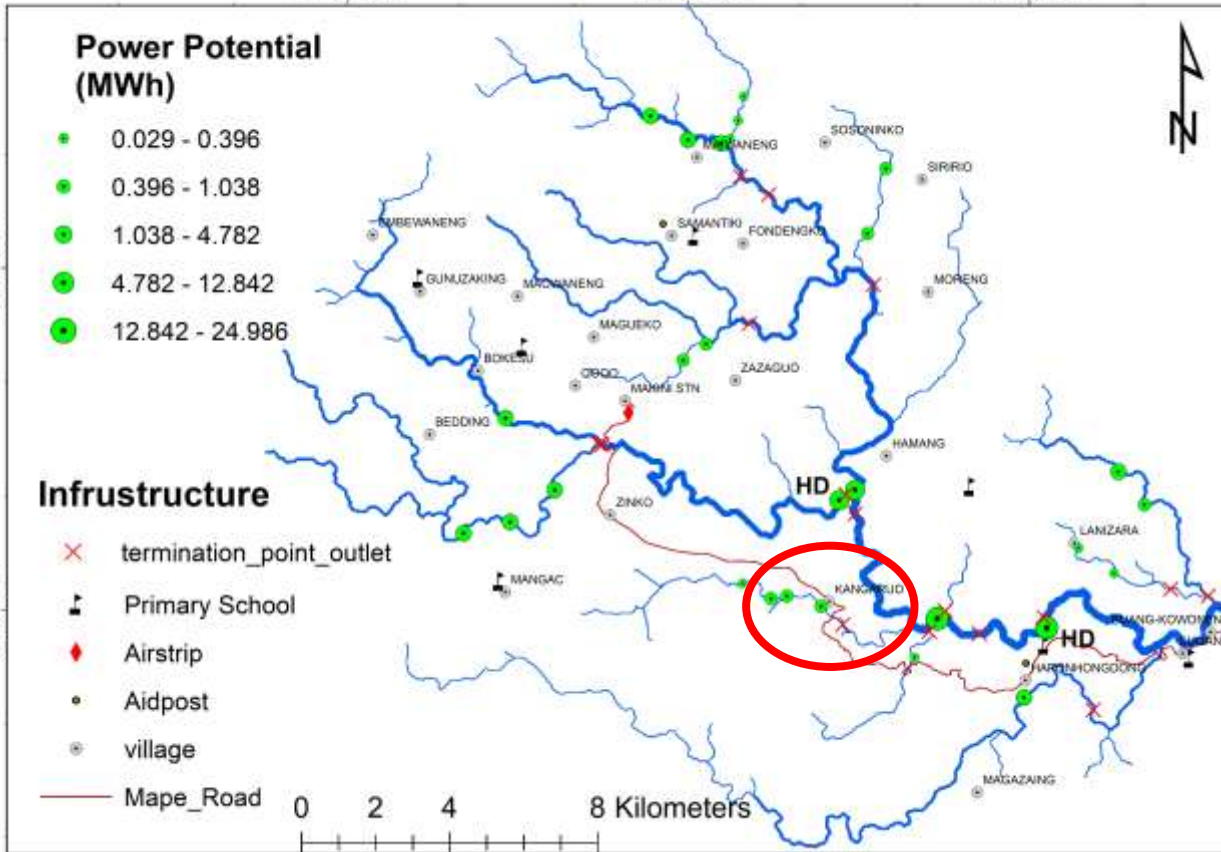
Criteria used for Head Specifications;

- Flow Accumulation/flow discharge
- Vertical and Horizontal head Distance
- Slope/Topography
- Infrastructure/proximity



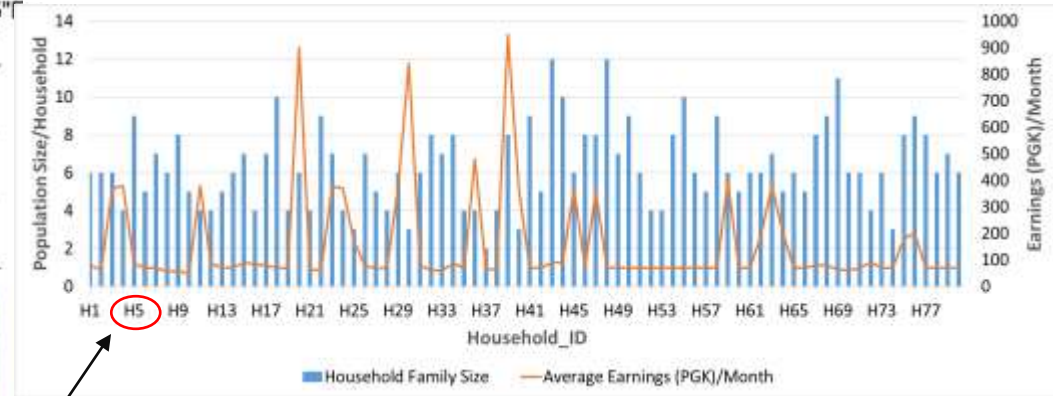
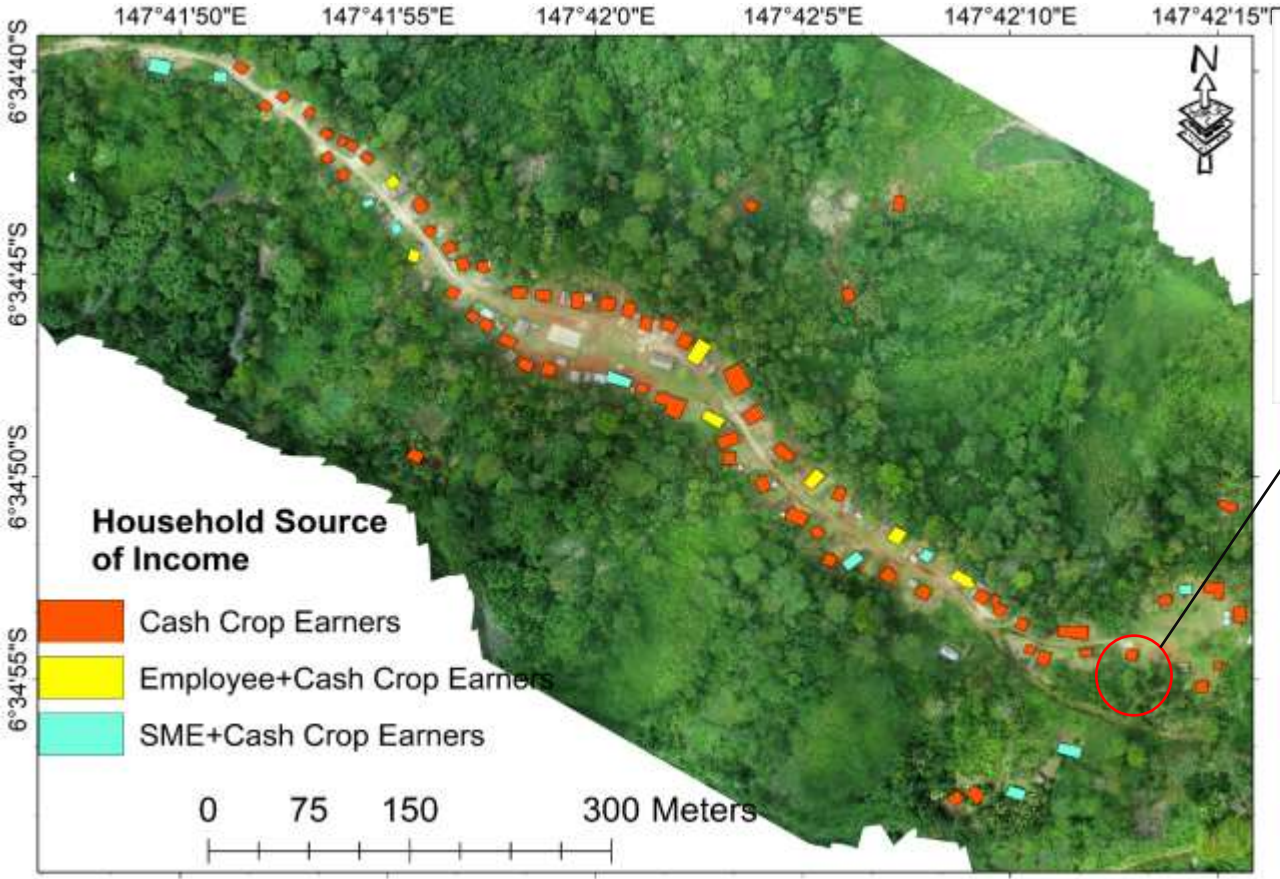
HYDROPOWER POTENTIAL (MWh)

147°35'0"E 147°40'0"E 147°45'0"E



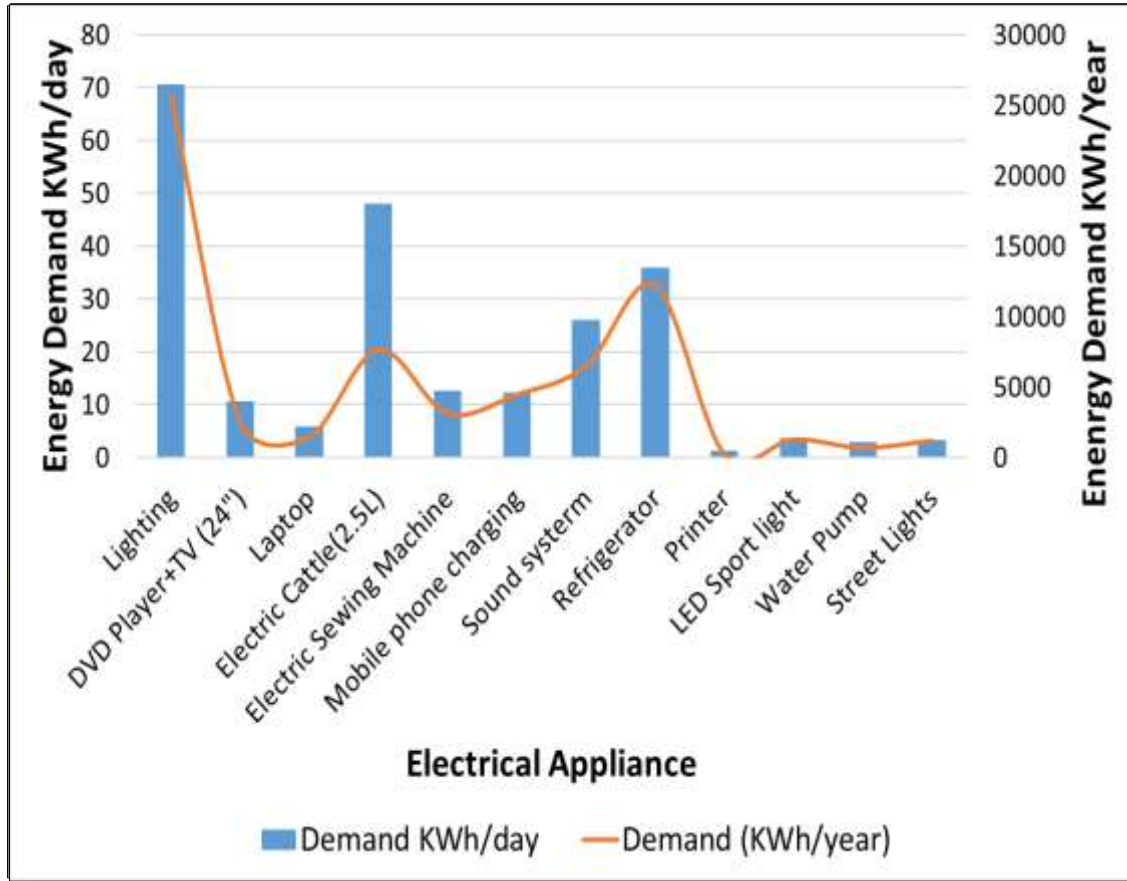
- 29 Hydropower potential sites Identified.
- Hydropower Potential ranges from 0.029 – 24.99 MWh
- Two sites considered as Hydro Dam (HD)
- Sample village considered for economic and consumption rate analysis.

SOCIO-ECONOMIC CONDITION



- 80 household; 78% cash crop earners, 13% SME + Cash Crop Earners, 9% Employee + Cash Crop Earners.
- Average earnings per month for each household; USD 20.30 – USD 85.23
- 90% of the population found to be economically viable to sustain electricity at the Tariff rate between US 0.150 – USD 0.200 per kWh.

ELECTRIFICATION DEMAND RATE



- Number of household and Electrical appliances for load categorizing and profiling.
- The load profile for 24 hours' time.
- System sizing for Kangaroo village = 40KW (Peak Load)
- Peak demand for kangaroo village in a day = 163 kWh in a day)
- Total energy demand for the village = 233 kwh/day and 67,486 kwh/year

CONCLUSION

- We Identify and develop pathways that can bridge and enhance rural electrification development.
- Baseline data established to enable sustainable infrastructure development.
- Geospatial Tools were found to be helpful for renewable energy sustainable planning.
- Hydropower sites have the potential to provide sufficient electricity capacity to the nearest communities.
- Continuous flow data is to be recorded.
- Stakeholders Collaboration – to ensure rural communities’ demands are met in a sustainable way.

THANK YOU

