Rapid Assessments from GIS to Mini-Grids

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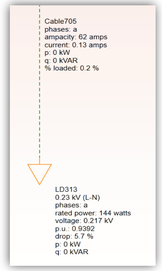
Research Question: How can Mini-Grid Designers Optimally and Rapidly access the economic, geographic, and technical factors needed in developing a Mini-Grid

Abstract

Off-grid electrification strategies, including mini-grids, are needed to achieve the UN Sustainable Development Goal 7 of affordable, clean, and modern energy for all. The design of these mini-grids usually takes several months and typically focuses on the sizing of generation assets only. This research is aimed at creating a comprehensive approach to rapidly access and design mini-grids including making decisions for generation assets and placement, as well as distribution technology. The result is a methodology that is more accurate, reduces design time, and more cost-effective.

Fig 1.1: GIS Domain

Fig. 1.2: Electrical Domain



Methods

1. QGIS and ARCGIS used to analyze and build projects in the spatial domain
2. Excel and Python are used to process and optimize geographic data
3. Xendee and OpenDSS are used to analyze powerflow and finance metrics

Fig. 2: Workflow of Methodology

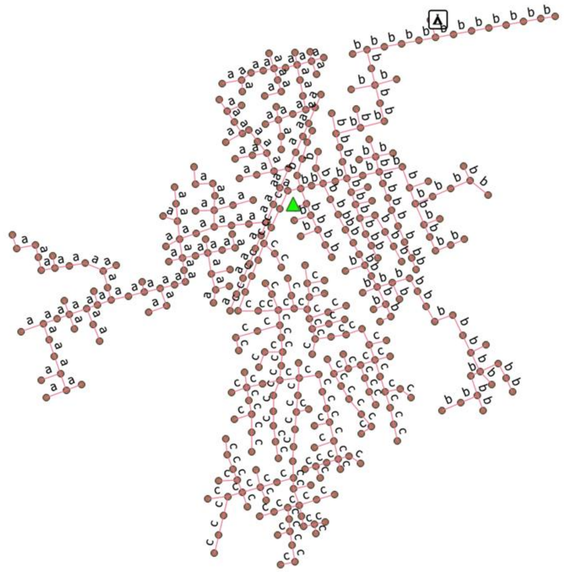


Fig. 3: GIS Representation of Village

Results

Assets	Generator	Solar	Battery Storage
Size	20kW	174kWdc	308kWh

Fig. 4: Economic Optimization Results

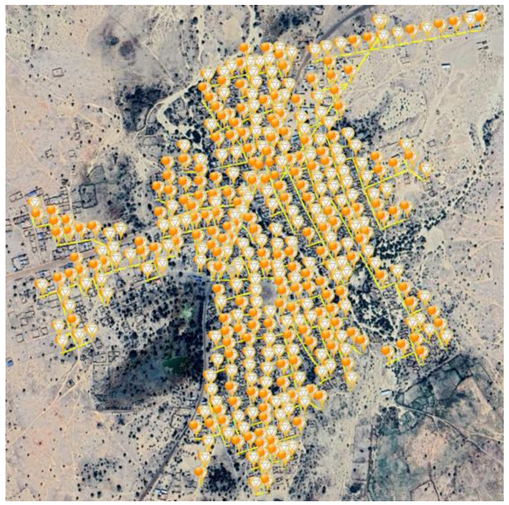


Fig. 5: Electrical Network of Village

The results from economic optimization stage is used to run a power flow on the village and check for voltage violations.

Conclusion

The Rapid assessment methodology showed great potential to reduce EPC(by up to 80%) whilst providing more comprehensive analysis (through introduction of power engineering). Future works will include an automated method for optimizing position of generation assets within the network

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