

ABSTRACT

After decades of investment and effort, India has achieved near universal household electrification in recent years. However, there exists numerous issues around availability, reliability, and quality of electricity supply with majority of rural households belong to lower tiers of electricity access. This research aims to investigate the ground reality of electricity access in rural India and scope of Community Energy (CE) in providing clean, reliable, and sustainable electricity access to energy deprived communities. Present status of electricity access and scope of community renewables were evaluated by carrying out a survey of rural households across 13 villages in two states of India. Consumers' preference for community microgrid and willingness to pay more were analyzed by quantitative methods. Survey statistics provides insights about availability and reliability of supply, consumers' dependence on kerosene lanterns, and utilization of community microgrid in productive applications. To evaluate the role of CE in Indian context, case study analysis of CE projects deployed at diversified locations and powered through different sources of renewable energy was performed through Actor-Network Theory (ANT). Interactive framework explaining process barriers, opportunities utilized, and community impact were developed and significant factors determining sustainability of CE projects were extracted. CE barriers and enablers were categorized under six broad dimensions and analyzed through integrated multi criteria decision analysis. Integrated Fuzzy-TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) and IRP (Interpretive Ranking Process) based methodology was adopted to determine critical factors realizing sustainable CE systems. Inter-relationship among critical factors was established by applying Decision Making Trial and Evaluation Laboratory (DEMATEL) method. Influence of significant enablers over inadequately addressed and fairly mitigated barriers was analyzed. Characterization of factors under micro, meso and macro environment and their inter-relationship provides a framework to realize sustainable CE systems. The developed framework provides insights to CE stakeholders and implications to policy makers for realizing sustainable CE projects to ensure clean and reliable last mile electricity access for poorly served communities.

Keywords: Electricity access; Community Energy; Renewables; Barriers; Enablers; Multi criteria decision analysis.