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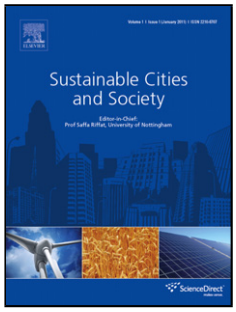

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Optimal Siting and Sizing of Tri-Generation Equipment for Developing an Autonomous Community Microgrid Considering Uncertainties

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Highlights

- Development of sustainable community microgrid has been proposed.
- Total network losses are considered for siting of tri-generation equipment.
- Uncertainties in energy demands are considered for sizing of tri-generation equipment.
- Seasonal energy demand variations are considered in the siting and sizing phases.
- Particle swarm optimization is used for siting and sizing of energy hub.

Abstract- Community microgrids are central pillars of the modern clean and efficient infrastructures, due to their deployment in municipalities. Community energy mangers are responsible for fulfilling the energy demands of inhabitants, especially during outages of the main grid. Determination of optimal sizes of generation sources and optimal site for deployment of these sources is a key issue. Therefore, in this paper, development of an autonomous community microgrid is suggested through optimal sizing and siting of tri-generation equipment. Total network losses (thermal and electrical) for different seasons of the year are considered for determining the optimal site of the energy hub. Thermal losses are computed through modified Dijkstra algorithm and electrical losses are computed by using exact loss formula. Worst-case realization of uncertainties associated with energy demands (cooling, heat, and power) are considered for optimal sizing of tri-generation equipment to fulfil the load demands of community microgrid throughout the year. Final sizes of tri-generation equipment are determined through worst-case realization of uncertainties associated with renewable energy sources. Particle swarm optimization (PSO) is used for both sizing and siting of tri-generation equipment in the community microgrid. Standard IEEE 33-bus distribution system is transformed into a sustainable community microgrid by placing the optimally sized energy hub at the optimal location determined by PSO.

Keywords- Network transformation, particle swarm optimization, resilient microgrid network, siting and sizing, sustainable microgrids, tri-generation

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