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Conventional and Hybrid Network Energy Systems Optimization for Canadian Community

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Abstract : Local generated and distributed system for thermal and electrical energy is sighted in the near future to reduce transmission losses instead of the centralized system. Distributed Energy Resources (DER) is designed at different sizes (small and medium) and it is incorporated in energy distribution between the hubs. The energy generated from each technology at each hub should meet the local energy demands. Economic and environmental enhancement can be achieved when there are interaction and energy exchange between the hubs. Network energy system and CO₂ optimization between different six hubs presented Canadian community level are investigated in this study. Three different scenarios of technology systems are studied to meet both thermal and electrical demand loads for the six hubs. The conventional system is used as the first technology system and a reference case study. The conventional system includes boiler to provide the thermal energy, but the electrical energy is imported from the utility grid. The second technology system includes combined heat and power (CHP) system to meet the thermal demand loads and part of the electrical demand load. The third scenario has integration systems of CHP and Organic Rankine Cycle (ORC) where the thermal waste energy from the CHP system is used by ORC to generate electricity. General Algebraic Modeling System (GAMS) is used to model DER system optimization based on energy economics and CO₂emission analyses. The results are compared with the conventional energy system. The results show that scenarios 2 and 3 provide an annual total cost saving of 21.3% and 32.3 %, respectively compared to the conventional system (scenario 1). Additionally, Scenario 3 (CHP & ORC systems) provides 32.5% saving in CO₂ emission compared to conventional system subsequent case 2 (CHP system) with a value of 9.3%.

Keywords : distributed energy resources, network energy system, optimization, microgeneration system
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