

6th International Conference on

GREEN ENERGY AND EXPO

August 29-31, 2018 | Toronto, Canada

Techno-economic analysis and optimum sizing of diesel-based off-grid power systems in Northern Canada

Athula D. Rajapakse and K R D Peiris
University of Manitoba, Canada

The Northern off-grid power systems in Canada mostly rely on diesel as their primary energy resource. Many of these communities do not have overland roads and therefore rely on winter roads for transportation of diesel. Transportation of diesel over winter roads is costly and hazardous to both people and the environment. On the other hand, growing fuel prices and the adverse effects of increased carbon footprint have shifted the energy policies to favor more environmentally healthy approaches. In this context, Hybrid Renewable Energy Systems (HRES) deploying locally available renewable energy sources and energy storage methods have emerged as perfect candidates to compete with the existing diesel-based facilities. High penetration of renewable sources is expected to reduce, optimize or replace diesel-based energy production while increasing the carbon-free generation capacity. To maximize the envisioned benefits, technology selection, optimum sizing and performance evaluation have become decisive steps in the designing process of HRES. This study aims to find the optimum HRES retrofit for an existing diesel-based off-grid power system. The decision variables employed in the optimization process ensure the technical feasibility and economic viability of the selected configurations while indirectly addressing their environmental friendliness. Four HRES configurations with increasing renewable penetration were optimized using NREL's HOMER software platform. The performance of each optimized system was assessed in terms of economic, technological and environmental criteria. Results reveal the competence of HRES in delivering high environmental performance, energy security and enhanced reliability while achieving fuel savings up to 20-23%.

athula.rajapakse@umanitoba.ca