Title of dissertation				
Planning and Operation of Microgrid Power Supply based Renewable Energy Sources in West Africa: Case Study Sierra Leone				
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West Africa, to which Sierra Leone belongs, has one of the largest populations on the continent. In 2017, only 51.3% of the region's population had access to electricity. Sierra Leone is suffering from a persistent electricity gap that has crippled its economic growth and prevented it from attaining several health and education development goals. Despite various interventions by the government, a balance between electricity demand and supply has yet to be achieved. As part of this study, we analyze alternatives to conventional electricity generation systems aimed at providing electricity in a sustainable, reliable, and affordable manner. The thesis carried out A review of the power sector of Sierra Leone for the expansion of electricity access through the integration of renewable energy sources (RES) into the power grid. RES is clean, efficient, and reliable and it is expected to address global challenges such as climate change, energy security, and greenhouse gas emissions. The country possesses vast potential in renewable energy which remains virtually untapped. However, the country has yet to harness its renewable potential due to inadequate planning. This work proposes integrated resource planning (IRP) that assesses the country’s current and future electricity supply and demand. The Long-range Energy Alternatives Planning System (LEAP), model was used to assess Sierra Leone’s energy supply and demand for 2019–2040, based on forecasted demand, resource potential, techno-economic parameters, and CO2 emissions. Overall, 60% of the Sierra Leone population lives in rural areas with little or no access to electricity. This situation is seen as a significant factor hampering the social and economic development of the country. The application of micro-grid for the electrification of rural towns with no access to the central electricity grid can eliminate power shortages, thereby bringing electricity and development opportunities to those towns and villages that have never enjoyed those benefits, spurring industrial growth, creating entrepreneurs, and support increased prosperity across the country. They can also facilitate a cost-effective transformation to a cleaner and more secure power sector. The thesis also aims to analyze the techno-economic feasibility of a hybrid renewable energy system (HRES) for sustainable rural electrification in Sierra Leone. Optimization, economic, reliability, and sustainability analyses were carried out using a genetic algorithm (GA), with the main objectives of minimizing the loss of power supply probability (LPSP) and cost of energy (COE).

PhD certificate.

Research activity in Lab.