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### **Abstract**

#### **Title: Design, Control Strategies, and Economic Viability of Inverter-Based Resources in a Microgrid**

This tutorial explores inverter-based resources of microgrids, a promising technology for achieving resilient and sustainable energy systems. We will study the design considerations, control strategies, and economic feasibility of microgrids. The presented design features a battery energy storage system (BESS), a photovoltaic (PV) system, and a combined heat and power (CHP) unit. We explain grid-connected and islanded operation control strategies using droop control for efficient power sharing and voltage/frequency regulation. Protective measures like over/under voltage tripping, under-frequency load shedding, and islanding detection are also addressed. A detailed economic analysis is provided, demonstrating the project's financial viability through a positive net present value (NPV) and a low levelized cost of energy (LCOE). This tutorial serves as a valuable resource for researchers, engineers, and policymakers seeking to understand and implement microgrids as a path toward a sustainable energy future..