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Enhancing Power System Resilience: An Adaptive Under-Frequency Load Shedding Scheme Incorporating PV Generation and Fast Charging Stations

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Abstract : In the rapidly evolving energy landscape, the integration of renewable energy sources and the electrification of transportation are essential steps toward achieving sustainability goals. However, these advancements introduce new challenges, particularly in maintaining frequency stability due to variable photovoltaic (PV) generation and the growing demand for fast charging stations. The variability of photovoltaic (PV) generation due to weather conditions can disrupt the balance between generation and load, resulting in frequency deviations. To ensure the stability of power systems, it is imperative to develop effective under frequency load-shedding schemes. This research proposal presents an adaptive under-frequency load shedding scheme based on the power swing equation, designed explicitly for the IEEE-9 Bus Test System, that includes PV generation and fast charging stations. This research aims to address these challenges by developing an advanced scheme that dynamically disconnects fast charging stations based on power imbalances. The scheme prioritizes the disconnection of stations near affected areas to expedite system frequency stabilization. To achieve these goals, the research project will leverage the power swing equation, a widely recognized model for analyzing system dynamics during under-frequency events. By utilizing this equation, the proposed scheme will adaptively adjust the load-shedding process in real-time to maintain frequency stability and prevent power blackouts. The research findings will support the transition towards sustainable energy systems by ensuring a reliable and uninterrupted electricity supply while enhancing the resilience and stability of power systems during under-frequency events.

Keywords : load shedding, fast charging stations, pv generation, power system resilience
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