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Resilience-oriented placement of multi-carrier microgrids in power systems with switchable transmission lines

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Abstract-

Extreme events such as floods, hurricanes, earthquakes, and wildfires pose significant threats to the uninterrupted supply of electricity to consumers, as they can cause the failure of numerous power system is defined by its ability to withstand extreme events and continue meeting demand. While the placement of multi-carrier combined heat and power (CHP), thermal storage. The developed model employs a stochastic mixed-integer linear programming (MILP) approach, ensuring the attainment of the global optimum. Resilience is evaluated using the metric of expected load not supplied (ELNS). The results demonstrate that when the bus connected to the MG is isolated, the MG generates electricity through its CHP unit to meet local demand, reducing the total demand shed in the power system and improving system resilience. Specifically, the MG reduces ELNS from 4955.48 MWh to 2356.64 MWh, indicating a remarkable 52% improvement in ELNS. Furthermore, the study shows that transmission line switching further decreases ELNS from 2356.64 MWh to 848.68 MWh. Several experiments are conducted to analyze the sensitivity of power system resilience to the number of MGs, the MG-power system exchange limit, and the limit on gas import from the gas network.

Index Terms- Power system resilience; Microgrids; Transmission switching; Heat-power-hydrogen microgrids

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