BOSTON UNIVERSITY ACADEMY

Title: Optimizing a Microgrid

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Abstract:

As the world increases its dependence on renewable energy so as to combat climate change, the electric power grid must evolve to maintain its reliability and exibility in the face of intermittency caused by non-controllable energy production. In this work, we study one such path towards modernization: microgrids, small sections of the grid that can isolate themselves in case of a large-scale disturbance. We construct a realistic, hierarchical microgrid, optimize its load ow over a 24-hour period, tackle its economic dispatch problem - determining production by individual generating units-, and analyze its efficiency under various weather scenarios. Our formulation includes transmission losses, resulting in a non-convex optimization. We develop two solution approaches: (i) leveraging a new, non-convex optimizer and (ii) develop a linear approximation scheme. We also approach the dispatch problem in two ways (centralized and decentralized), leading to a total of four optimization methods. We test their convergence on a small, simple network. Optimization of a larger network reveals the use of storage units as load shaping tools and reaaffirms the correlation between the net load - load that has to be met by conventional generation - and the overall cost.