Grouping-based optimal operation of multi-microgrid under uncertainty

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Microgrid (MG) is a localized energy supply network with distributed renewable energy sources. However, renewable sources are uncertain in nature and can induce frequent supply-demand mismatches. Hence, this study develops a data-driven stochastic model to predict the renewable sources. In addition, multi-microgrid (MMG) can be designed so that MGs can trade energy with each other to better absorb the local supply and demand variabilities. This study investigates the operation of MMG with varying scales based on a developed decision-making platform. First, we test three levels of cooperation: fully cooperative (F), partially cooperative (P), and independent (I). The cases F and P lead to a much lower operating cost than the case I, but they require high computational costs, which can limit the addressable size of MMG to apply. To resolve the numerical issue, we incorporate a novel cooperation scheme based on k-means clustering, which groups MGs located within a close distance and allows them to trade energy in the same group. As a result, the grouping-based operation gives an operating cost close to that of the cases F and P while keeping the computational cost highly tractable.