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Modeling of Virtual Power Plant

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Abstract : Keeping the right balance of electricity between the supply and demand sides of the grid is one of the most important objectives of electrical grid operation. Power generation and demand forecasting are the core of power management and generation scheduling. Large, centralized producing units were used in the construction of conventional power systems in the past. A certain level of balance was possible since the generation kept up with the power demand. However, integrating renewable energy sources into power networks has proven to be a difficult challenge due to its intermittent nature. The power imbalance caused by rising demands and peak loads is negatively affecting power quality and dependability. Demand side management and demand response were one of the solutions, keeping generation the same but altering or rescheduling or shedding completely the load or demand. However, shedding the load or rescheduling is not an efficient way. There comes the significance of virtual power plants. The virtual power plant integrates distributed generation, dispatchable load, and distributed energy storage organically by using complementing control approaches and communication technologies. This would eventually increase the utilization rate and financial advantages of distributed energy resources. Most of the writing on virtual power plant models ignored technical limitations, and modeling was done in favor of a financial or commercial viewpoint. Therefore, this paper aims to address the modeling intricacies of VPPs and their technical limitations, shedding light on a holistic understanding of this innovative power management approach.

Keywords : cost optimization, distributed energy resources, dynamic modeling, model quality tests, power system modeling
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