

**Aggregation-Based Colocation Datacenter Energy Management in Wholesale Markets**

**Abstract:**

In this paper, we study how colocation datacenter energy cost can be effectively reduced in the wholesale electricity market via cooperative power procurement. Intuitively, by aggregating workloads and renewables across a group of tenants in a colocation datacenter, the overall power demand uncertainty of the colocation datacenter can be reduced, resulting in less chance of being penalized when participating in the wholesale electricity market. We use cooperative game theory to model the cooperative electricity procurement process of tenants as a cooperative game, and show the cost saving benefits of aggregation. Then, a cost allocation scheme based on the marginal contribution of each tenant to the total expected cost is proposed to distribute the aggregation benefits among the participating tenants. Besides, we propose proportional cost allocation scheme to distribute the aggregation benefits among the participating tenants after realizations of power demand and market prices. Finally, numerical experiments based on real-world traces are conducted to illustrate the benefits of aggregation compared to noncooperative power procurement.