

Why distributed? A critical review of the tradeoffs between centralized and decentralized resources

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Abstract— The recent proliferation of distributed energy resources (DERs) is creating new options for the delivery of key electricity services, including energy, firm capacity, operating reserves, and even alternatives to transmission or distribution network investments. Rooftop solar photovoltaics (PVs) have the highest profile of these resources, but DERs include any generator or energy-storage device connected at distribution voltage levels and characterized by relatively small capacities (e.g., a few kilowatts to a few megawatts). In addition, improved power electronics and communication and control technologies enable more efficient and dynamic electricity consumption as well as the ability for flexible demand (demand response) to serve as a DER in many contexts.

Index Terms— Investment, Propagation losses, Distributed power generation, Power system reliability, Load flow, Generators, Power distribution planning

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