IET Generation Transmission & Distribution. Volume:10. Number: 3. Pages: 815-821. February 2016

Cost-benefit analysis of battery storage in medium voltage distribution networks

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Abstract— The increasing deployment of non-dispatchable generation in electric systems where generation and demand must be balanced at all times has led to a renewed interest in technologies for energy storage. This paper presents a cost-benefit analysis of energy storage for peak demand reduction in medium voltage distribution networks. In particular, the installation of batteries in secondary substations is studied for three realistic large-scale networks representing urban, semi-urban and rural distribution areas. On the one hand, savings in energy costs derived from storing energy at low-priced hours and selling it at peak hours are considered. On the other hand, savings in network reinforcement due to the peak shaving are evaluated. Network reinforcement requirements are assessed using reference network models (RNMs), large-scale network-planning tools often used by distribution regulators to establish the allowed distribution costs. Additionally, sensitivity to different demand growth ratios and battery capacities is analysed. The final objective is to determine the target cost for batteries to be profitable from the point of view of distribution. Results show that significant savings can be obtained, especially in urban and semi-urban areas.

Index Terms— battery storage plants; power distribution planning; cost-benefit analysis; power distribution economics

Citation:
Mateo, C.; Rodriguez, A.; Reneses, J.; Frías, P.; Sánchez, A.; "Cost-benefit analysis of battery storage in medium voltage distribution networks", IET Generation Transmission & Distribution, vol.10, no.3, pp.815-821. February, 2016.