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## Voltage regulation with energy storage application in distribution feeders with high penetration of PV

J O Petinrin<sup>1</sup>, Mohamed Shaaban<sup>2</sup>, J O Agbolade<sup>1</sup> and D A Olatunji<sup>1</sup><sup>1</sup>Federal Polytechnic Ede, Nigeria<sup>2</sup>Port Said University, Egypt

Photovoltaics (PVs) integration to the distribution feeder is on the increase. The variability and uncertainty of the renewable energy (RE), however, can potentially cause a voltage deviation from the permissible limits and disruption of normal operation of voltage/VAR (VVAR) control devices. This paper proposes a platform, in the operation timescale, to maintain voltage regulation and facilitates the smoother integration of renewable energy into the distribution feeder with PV energy sources. With the objective of improving system-wide voltage profile and minimal losses, the operation of VAR control devices and energy storage, is coordinated in the operational timescale. A Genetic Algorithm (GA) based-optimization method is used to consider the optimum settings of the VAR control devices and the dispatch of energy storage. The effectiveness of the proposed method is validated through a time sequence analysis over a 24-hourly simulation period, applied to the IEEE 123 test feeder. Test results depict clearly that the coordinated operation among the control devices, along with the energy storage, causes reduction in system losses and enhances system capability to maintain voltages within the statutory bounds under various penetration levels of PV energy sources.

jopetinrin2@gmail.com