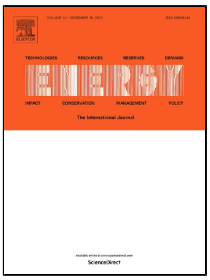
Accepted Manuscript



Optimal capacity of storage systems and photovoltaic systems able to control reactive power using the sensitivity analysis method

Insu Kim

PII:	S0360-5442(17)32175-8
DOI:	10.1016/j.energy.2017.12.132
Reference:	EGY 12081
To appear in:	*Energy*
Received Date:	18 January 2017
Revised Date:	01 December 2017
Accepted Date:	25 December 2017

Please cite this article as: Insu Kim, Optimal capacity of storage systems and photovoltaic systems able to control reactive power using the sensitivity analysis method, *Energy* (2017), doi: 10.1016/j.energy.2017.12.132

Optimal capacity of storage systems and photovoltaic systems able to control reactive power using the sensitivity analysis method

Insu Kim

Alabama A&M University, Normal, AL 35762 USA (insu.kim@aamu.edu)

The paper has not been presented at a conference or submitted elsewhere previously.

Abstract

As weather-dependent distributed renewable energy resources (RERs) such as photovoltaic (PV) systems and wind farms have increasingly been connected to distribution networks, energy storage systems able to compensate intermittency in their power generation may be required. Moreover, such RERs can participate in reactive power control upon voltage regulation. Thus, the problem of optimizing the capacity of storage systems for RERs with the capability of reactive power control is necessary for planning, maintaining, or upgrading a distribution network. The objective of this study is to optimize the capacity of storage systems for RERs, particularly PV inverters with the capability of reactive power control in this study. For this purpose, this study proposes the power-flow algorithm able to optimize reactive power amount to be either consumed or injected by PV systems and a hybrid multi-objective sensitivity analysis algorithm that optimizes the capacity of PV and storage systems. The proposed algorithm includes an objective function that minimizes voltage variations and capital costs of PV and storage as well as maximizes energy savings and peak load reduction. Then, it successfully optimizes the capacity of PV and storage systems in the well-known IEEE test feeders.