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A statistical approach for hybrid energy storage system sizing based on capacity distributions in an autonomous PV/Wind power generation system

Abdelkader Abbassi, Mohamed Ali Dami, Mohamed Jemli

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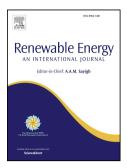
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## ACCEPTED MANUSCRIPT

- 1 A statistical approach for hybrid energy storage system sizing based
- 2 on capacity distributions in an autonomous PV/Wind power
- 3 generation system
- 4 Abdelkader ABBASSIa,\*, Mohamed Ali DAMIa, Mohamed JEMLIa
- 5 "University of Tunis, Higher National Engineering School Of Tunis (ENSIT), Engineering Laboratory of
- 6 Industrial Systems and Renewable Energies (LISIER), 5 avenue Taha Hussein, PO Box 56, 1008 Tunis,
- 7 Tunisia.
- 8
- 9 \* Corresponding author. Tel.: +21697011405
- 10 E-mail addresses: abd abbassi@yahoo.com, medali.dami@esstt.rnu.tn,
- 11 mohamed.jemli@isetr.rnu.tn
- 12 ABSTRACT:
- 13 Hybrid Energy Storage System (HESS) integration with autonomous PV/Wind hybrid power
- 14 system becomes, currently, an interesting option for the improvement of the storage units'
- 15 reliability and the life cycle assessment. In this paper, a new method for optimally sizing of HESS
- based on a statistical approach is proposed. This approach aims to exploit the capacity distribution
- 17 of hybrid supercapacitor-battery system in an autonomous PV/Wind power generation system. This
- 18 hybridization, of both slow and fast dynamics, aims to eliminate the power peaks caused by the
- 19 load consumption. For the power distribution for all coordinated components of the storage system,
- 20 a frequency management control and a hysteresis strategy are used in order to accomplish two
- 21 goals: firstly, to delimit this exchanged power for not exceeding the maximum value and, secondly,
- 22 to keep the States Of Charge (SOC) of the batteries-supercapacitors in a suitable range. Moreover,
- 23 statistical analysis of several cumulative levels was performed to examine their contribution on the
- 24 HESS optimal sizing. The obtained results prove that the integration of supercapacitor takes
- 25 advantage of the complementary characteristics of the batteries, improves the exchanged power
- 26 flow, extends the battery life cycle and affects on storage system sizing through accommodate the
- 27 fast power fluctuations.
- 28 Keywords: Optimal sizing; Hybrid Energy Storage System (HESS); probability distributions; frequency
- 29 management; capacity distributions
- 30 1. Introduction
- Recently, renewable energy sources are increasingly operated in electrical energy production such
- 32 as wind turbines and photovoltaic panels. To satisfy the need of energy in isolated sites, it is
- 33 necessary to integrate energy storage batteries. Due to fluctuations of meteorological data (wind

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