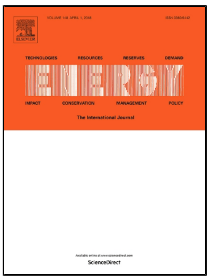
Accepted Manuscript



Methodology for sizing stand-alone hybrid systems: A case study of a traffic control system

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PII:	S0360-5442(18)30712-6
DOI:	10.1016/j.energy.2018.04.099
Reference:	EGY 12738
To appear in:	*Energy*
Received Date:	07 February 2018
Revised Date:	13 April 2018
Accepted Date:	16 April 2018

Please cite this article as: Idoia San Martín, Alberto Berrueta, Pablo Sanchis, Alfredo Ursúa, Methodology for sizing stand-alone hybrid systems: A case study of a traffic control system, *Energy* (2018), doi: 10.1016/j.energy.2018.04.099

Methodology for sizing stand-alone hybrid systems: A case study of a traffic control system

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Abstract

This paper proposes a methodology for sizing stand-alone hybrid photovoltaic-wind power generation systems. This methodology makes it possible to optimise the overall performance of the stand-alone system components, based on the premise of guaranteeing the power supply throughout the useful life of the installation at a minimum cost. The sizing is performed in two stages. Firstly, the components of the wind and photovoltaic power generation subsystem are obtained and, secondly, the size of the storage subsystem is determined. For the storage subsystem sizing, account is taken of the variation in efficiency according to the operating point and also the deterioration of the subsystem due to aging and, therefore, the loss of available energy during the useful life of the installation. This methodology is applied to a stand-alone traffic control system located on a secondary road in the Autonomous Community of Valencia (Spain). This system comprises wind and photovoltaic power generation components, a lithium battery bank and various traffic management components. Finally, an analysis of the proposed sizing is made. Satisfactory results are obtained, showing how the proposed methodology makes it possible to optimise the sizing of stand-alone systems with regard to the size of its components, cost and operation.

Keywords: Stand-alone hybrid systems, Renewable Energy, Sizing, Lithium-ion Battery, modelling