Accepted Manuscript

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PII: S2210-6707(17)31066-1
DOI: https://doi.org/10.1016/j.scs.2018.01.010
Reference: SCS 923

To appear in:

Received date: 14-8-2017
Revised date: 11-12-2017
Accepted date: 8-1-2018

Please cite this article as: Castillo C., Tony., Macarulla, Ana M., Kamara-Esteban, Oihane., & Borges, Cruz E., ANALYSIS AND ASSESSMENT OF AN OFF-GRID SERVICES BUILDING THROUGH THE USAGE OF A DC PHOTOVOLTAIC MICROGRID. Sustainable Cities and Society https://doi.org/10.1016/j.scs.2018.01.010

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ANALYSIS AND ASSESSMENT OF AN OFF-GRID SERVICES BUILDING THROUGH THE USAGE OF A DC PHOTOVOLTAIC MICROGRID

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Highlights:
• A methodology to size an off-grid DC photovoltaic microgrid to feed a service building with high Power Demand (PD) located in an urban environment.
• An evaluation of the behaviour of a DC off-grid service building with large energy demand.
• A measurement of the efficiencies in all critical points of the installation.
• An analysis of the power losses in the internal energy distribution.
• An evaluation of the performance of the storage subsystem under five real scenarios.

ABSTRACT
The main motivation for carrying out this research is to collaborate in developing new less aggressive energy consumption mechanisms to take care of the environment and reduce greenhouse emissions. This paper is focused on the development of a DC photovoltaic building in off-grid operation mode. The modelized PV system satisfies the energy demand of a large residential building using only DC electricity to keep it powered on without any shortage or cut-off. A comprehensive study has been carried out using real consumption data, local solar irradiance, and local temperature measures, all gathered in the last 30 years, to create five different scenarios. These scenarios test the installation under typical weather and usage pattern conditions as well as under the lowest irradiance levels, all the while maintaining: the comfort in all areas without any energy cut-offs and keeping the output rated voltage inside the tolerance values (the voltage fluctuation average represented a 9.70 %). Finally, the mean performance of the system is higher than 75 % while the losses due to the low voltage used are three times lower than the transmission losses of the AC network.

Keywords: Off-grid building, DC-facility, PV energy, Battery performance, Non regulable consumption

Nomenclature
AC Alternating current

Peer review under responsibility of xxxxx.
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