Title: Dataset associated with "Device Characterization on Energy Design and Scoping Tool for DC Distribution Systems and a Study on Harmonics in AC/DC Converters in Low Voltage Distribution" and “Efficiency of AC vs. DC Distribution Systems in Commercial Buildings”

Abstract: DC appliances have resurged with the evolution of power electronics and their massive application in Miscellaneous Electric Loads. The increase of DC distributed generation and battery storage also helped boosting the scientific community's attention to this other alternative. This work collects consumption data from AC appliances and AC and DC converters often found in an in-building’s distribution system. The appliances focused on this study are also called Miscellaneous Electric Loads (MELs), which comprise all electronic loads in a building that are not related to lighting, heating, and air conditioning. Efficiency and harmonics for these devices are analyzed, as this is part of a relevant project funded by the Department of Energy of the United States: The Energy Design and Scoping Tool for DC Distribution Systems.

Contact: Arthur Santos

Email and/or phone number for contact person: arthur.santos@colostate.edu

Recommended data citation:

Santos, Arthur. (2021). Dataset associated with "Device Characterization on Energy Design and Scoping Tool for DC Distribution Systems and a Study on Harmonics in AC/DC Converters in Low Voltage Distribution" and “Efficiency of AC vs. DC Distribution Systems in Commercial Buildings.” Colorado State University. Libraries. http://dx.doi.org/10.25675/10217/207807

Associated publications:

dos Santos, A. F. B. (2020). Device Characterization on Energy Design and Scoping Tool for DC Distribution Systems and a Study on Harmonics in AC/DC Converters in Low Voltage Distribution (Doctoral dissertation, Colorado State University). https://hdl.handle.net/10217/212069

Santos, Arthur, et al. "Comparison of Load Models for Estimating Electrical Efficiency in DC Microgrids." 2019 IEEE International Conference on DC Microgrids (ICDCM), 2019, pp. 1-9, https://doi.org/10.1109/ICDCM45535.2019.9232736

Santos, Arthur, et al. "Efficiency Comparison for AC and DC Power Distribution in Commercial Buildings." *Energies* 14.18 (2021): 5863. https://doi.org/10.3390/en14185863

Santos, Arthur, et al. "Harmonic cancellation within AC low voltage distribution for a realistic office environment." *International Journal of Electrical Power & Energy Systems* 134 (2022): 107325. https://doi.org/10.1016/j.ijepes.2021.107325

Format of data files: .pdf, .csv, .txt, .jpg, .png

Location where data were collected: Powerhouse Energy Campus, Colorado State University, Fort Collins – Colorado, USA

Time period during which data were collected: 2019-01-01 to 2021-11-01

File Information: There are 5 files: README.pdf, AC Appliances.zip, AC Converters.zip, DC Converters.zip, Controllable Load Bank - Code.zip.

README.pdf is the file with the metadata and description of the directory's structures.

AC Appliances.zip contains 33 directories, relative to 33 appliances. In each appliance directory there are .csv files with raw information about its current and voltage waveform at different modes of operation, a picture of the appliance, and one folder called "Processed Data". Inside of this folder is the analysis of the collected data. Therefore, there is one .csv called Harmonics.csv with harmonics generated at each mode; another called "Power_data.csv" with power levels and current total harmonic distortion (THDI); and a folder "Figures" with figures showing the waveforms and harmonic magnitudes and angles.

AC Converters.zip contains 58 directories, relative to AC/DC converters. In each directory there are .csv files with raw information about its current and voltage waveform at different power levels, a picture of the converter, and one folder called "Processed Data". Inside of this folder is the analysis of the collected

data. Therefore, there is one .csv called Harmonics.csv with harmonics generated at each mode; another called “Power_data.csv” with power levels, current total harmonic distortion (THDI) and efficiency; and a folder “Figures” with figures showing the waveforms, efficiency curve, and harmonic magnitudes and angles. The same is true for the DC Converters.zip file with 35 directories relative to DC converters.

Controllable Load Bank - Code.zip contains three python scripts used to run the controllable load bank. scpi_analyzer.py is a library with SCPI commands to allow communication between the load bank and the Power Analyzer PA2203A; Variable_Steps_Code.py is the code that calculate the resistors combinations to execute the tests; and Variable_Steps_GUI.py is the graphic user interface that will show up in the LCD screen and gather information from the user about the converter under test.