DC microgrid energy management based on solar radiation forecasting

Gabriel Narvaez [a,b], Corinne Alonso [a], Michael Bressan [b], Luis Felipe Giraldo [c], Bruno Jammes [a].

[a] *Laboratory for Analysis and Architecture of Systems, LAAS-CNRS, Toulouse, France*

[b] *Department of Electrical and Electronic Engineering, Universidad de Los Andes, Bogotá, Colombia*

[c] *Department of Biomedical Engineering, Universidad de Los Andes, Bogotá, Colombia*

The management of DC microgrids is crucial to ensure the power demand, mainly due to the stochastic nature of renewable energy sources (Gaetani-Liseo, Alonso, & Jammes, 2021). Different artificial intelligence techniques have been applied to improve the performance of renewable energies and manage DC microgrids (Narvaez, Giraldo, & Bressan, 2021). These artificial intelligence techniques address different aspects, such as fault detection and diagnosis, protection, energy management, power forecasting, and control converters (Gaviria, Narvaez, Guillen, Giraldo, & Bressan, 2022).

A way to ensure power demand is by anticipating the possible production of renewable energy sources and scheduling the energy storage systems. In the case of photovoltaic (PV) panels, solar radiation can be used to forecast PV power, where authors show that artificial intelligence algorithms are the most suitable technique to forecast solar radiation. With the forecasted solar radiation, the possible PV power can be easily estimated.

The poster presents a DC microgrid energy management methodology based on solar radiation forecasting. Solar radiation forecasting is based on a specialized neural network for time series prediction. The forecasted solar radiation is used to estimate photovoltaic power production. Then, we use the estimated photovoltaic production to manage the energy of the microgrid connected to the power grid and batteries as energy storage systems. The architecture of the microgrid is presented in Figure 1. We show the proposed methodology's benefits through a case with real data. We base our results on data from the ADREAM building in the Laboratory for Analysis and Architecture of Systems (LAAS). Our objective is to minimize the use of the power grid while considering battery degradation.

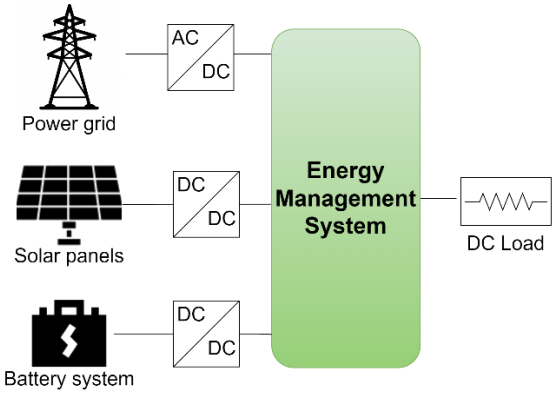

Figure 1. DC Microgrid Management

References

Gaetani-Liseo, M., Alonso, C., & Jammes, B. (2021). Identification of ESS Degradations Related to their Uses in Micro-Grids: application to a building lighting network with VRLA batteries. *European Journal of Electrical Engineering*, 455-466.

Gaviria, J. F., Narvaez, G., Guillen, C., Giraldo, L., & Bressan, M. (2022). Machine learning in photovoltaic systems: A review. *Renewable Energy*, 298-318.

Narvaez, G., Giraldo, L. F., & Bressan, M. (2021). Machine learning for site-adaptation and solar radiation forecasting. *Renewable Energy* , 333-342.