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Summary:

One of the main concerns globally is the phenomenon of climate change - which is mainly caused by human activities. The total energy demand is rising as a result of an increasing number of residential and commercial buildings, while, at the same time, an increase in global population is expected. The only solution to deal with, is to move to a cleaner, greener and more sustainable development in various sectors such as electricity, transports, industry, etc. An important step in this direction, especially in the electricity sector, is the penetration of more and more renewable energy sources in the electricity grid. Therefore, with the increasing penetration of direct current (DC) Distributed Energy Resources (DERs) such as photovoltaics (PV) and Energy Storage Systems (ESS), the concept of DC and hybrid AC-DC distribution systems attract more and more attention nowadays. The present study proposes a novel concept in the development of an innovative compact hybrid electrical-thermal storage system for buildings, in combination with the installation of a hybrid AC-DC distribution system for the interconnection of the photovoltaic system, the electric storage and electrical loads of the building. Photovoltaic system, battery energy storage system and all the DC devices (such as DC Heat Pump) are directly connected to the DC part of the system, avoiding losses from unnecessary conversion stages, while AC loads and the AC utility grid are connected to the AC part of the system (Figure 1).

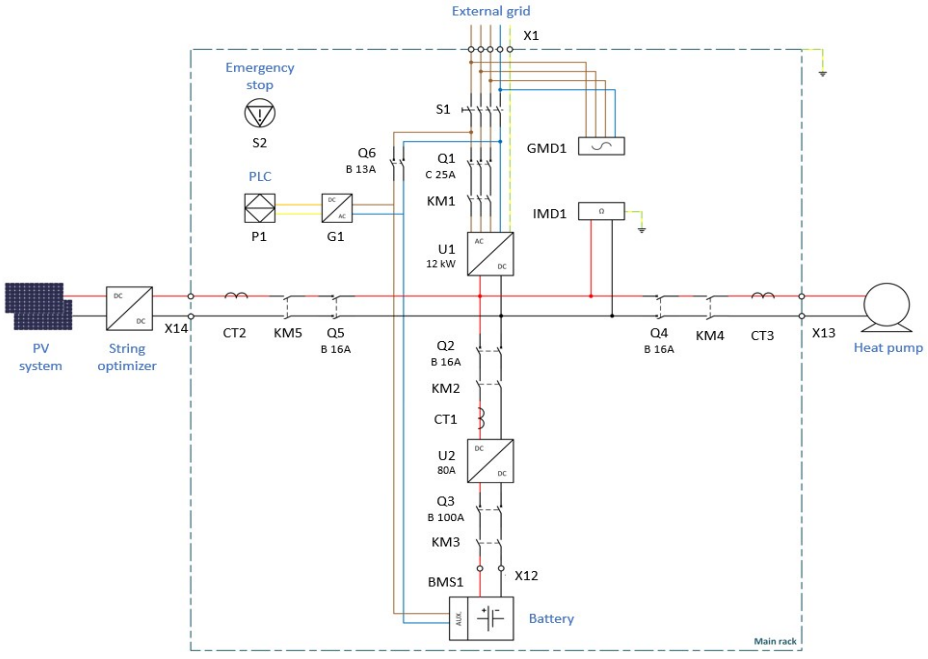

Figure 1: Single line diagram of the proposed solution.

The proposed configuration is expected to increase the overall energy efficiency of the system and will allow for energy savings ranging from 20 to 40% on an annual basis. In addition, the overall system is controlled through a programmable logic controller (PLC), which decides and implements the optimal operation of the system. This is achieved taking into consideration the requirements and needs of the user, as well as the indoor conditions at that time. After checking the status of the various components of the system (such as the state of charge of the battery, PV generation etc.) then the PLC puts into operation the optimal scenario in order to meet the needs of the user in the most efficient way. This poster aims to describe the innovative system and assess its performance in real conditions through field measurements with regards to energy consumption, the energy production, indoor comfort conditions, and battery status and behavior. The proposed hybrid solution aims to upgrade existing building configurations and will be monitored in near-life operation in a demo site in Cyprus. The concept presented herein is part of the research project HYBUILD, which was funded by the European Union through HORIZON 2020.