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Design and implementation of an experimental DC microgrid for energy self-sufficient isolated sites

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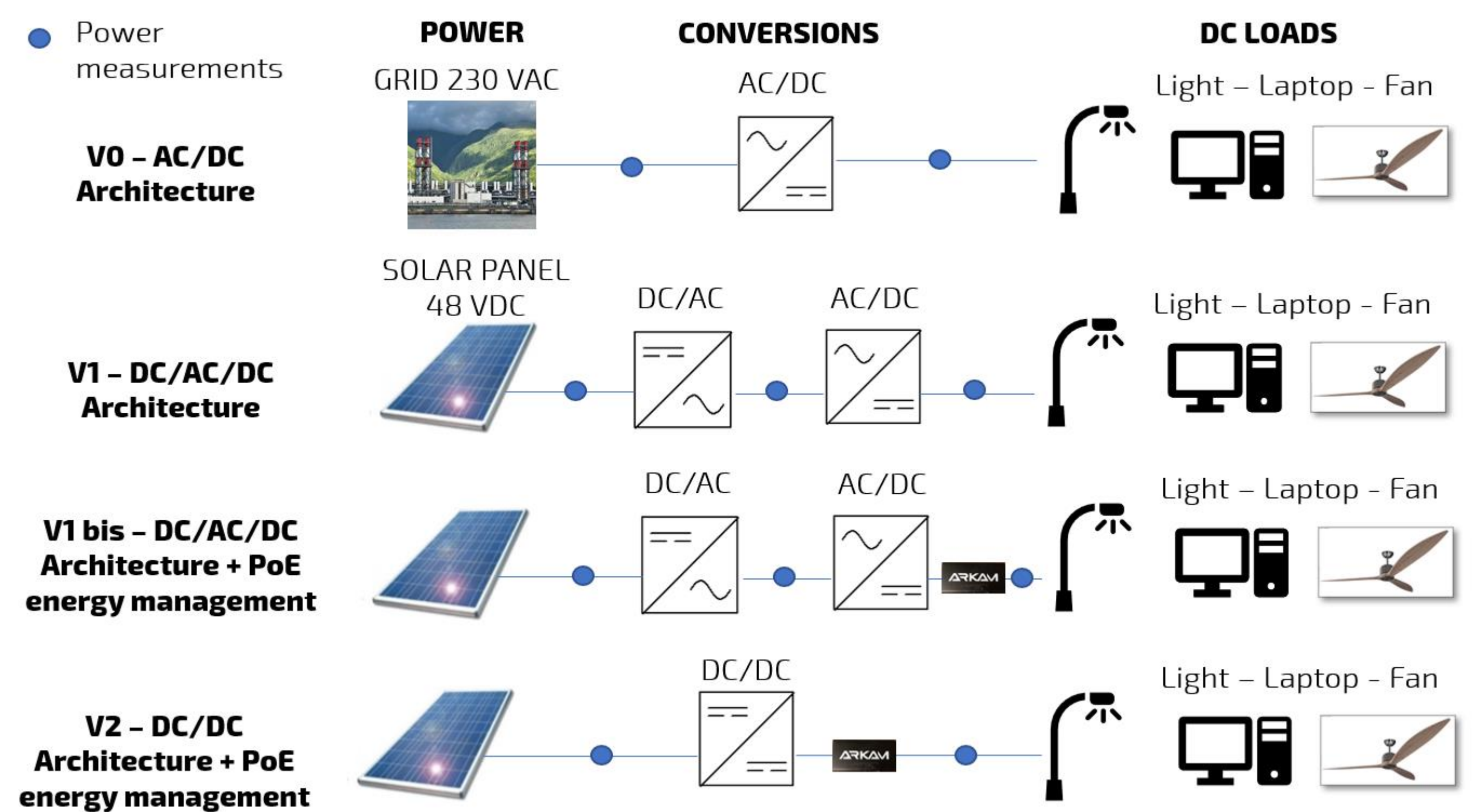
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ABSTRACT

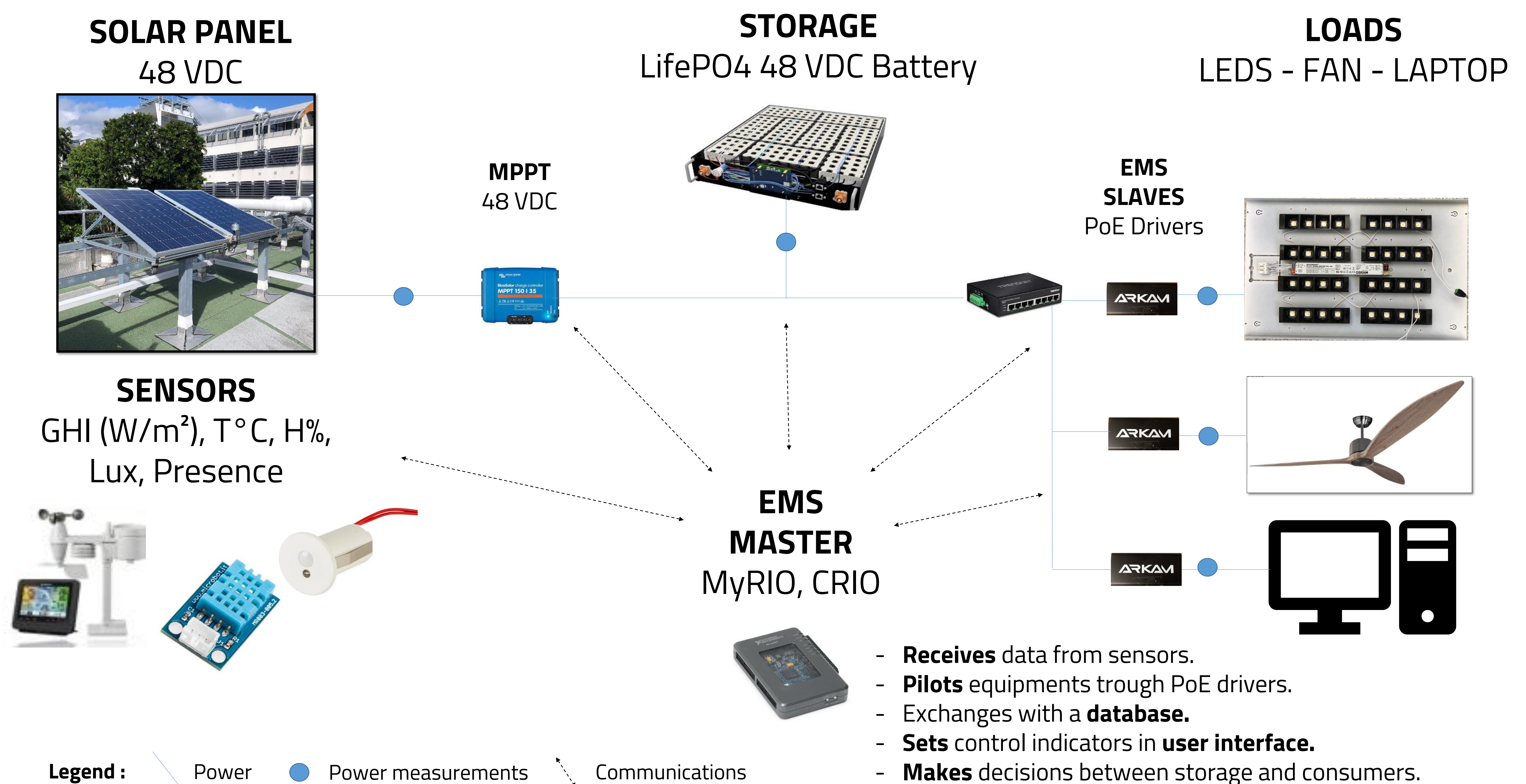
In the context of **climate change**, the French law on energy transition for green growth (LTECV) has set a target of **electrical autonomy** for non-interconnected areas such as Reunion Island by 2030. Despite the significant increasing use of electricity produced by **solar panels**, the energy losses due to transport and the multiple conversions of sources from direct current (DC) to alternating current (AC) and vice versa, considerably reduce the **electrical yield**. If we go back to **Edison's proposal**, a DC electrical architecture has many advantages in the case of local energy production since energy losses in conversions and transport are considerably **reduced**. In order to **quantify** precisely with measures potential energy gains of a DC-DC architecture in comparison to a classical DC-AC-DC architecture, currently deployed for isolated sites, the objectives of this project are to deploy a **DC measurement bench not backed up** by generators and then develop a **predictive EMS (Energy Management System)** including data from environmental indoor and outdoor sensors and PoE (Power Over Ethernet) drivers for each equipments.

Keywords : DC microgrid, solar energy, storage, isolated sites, PoE (Power Over Ethernet), EMS (Energy Management System).

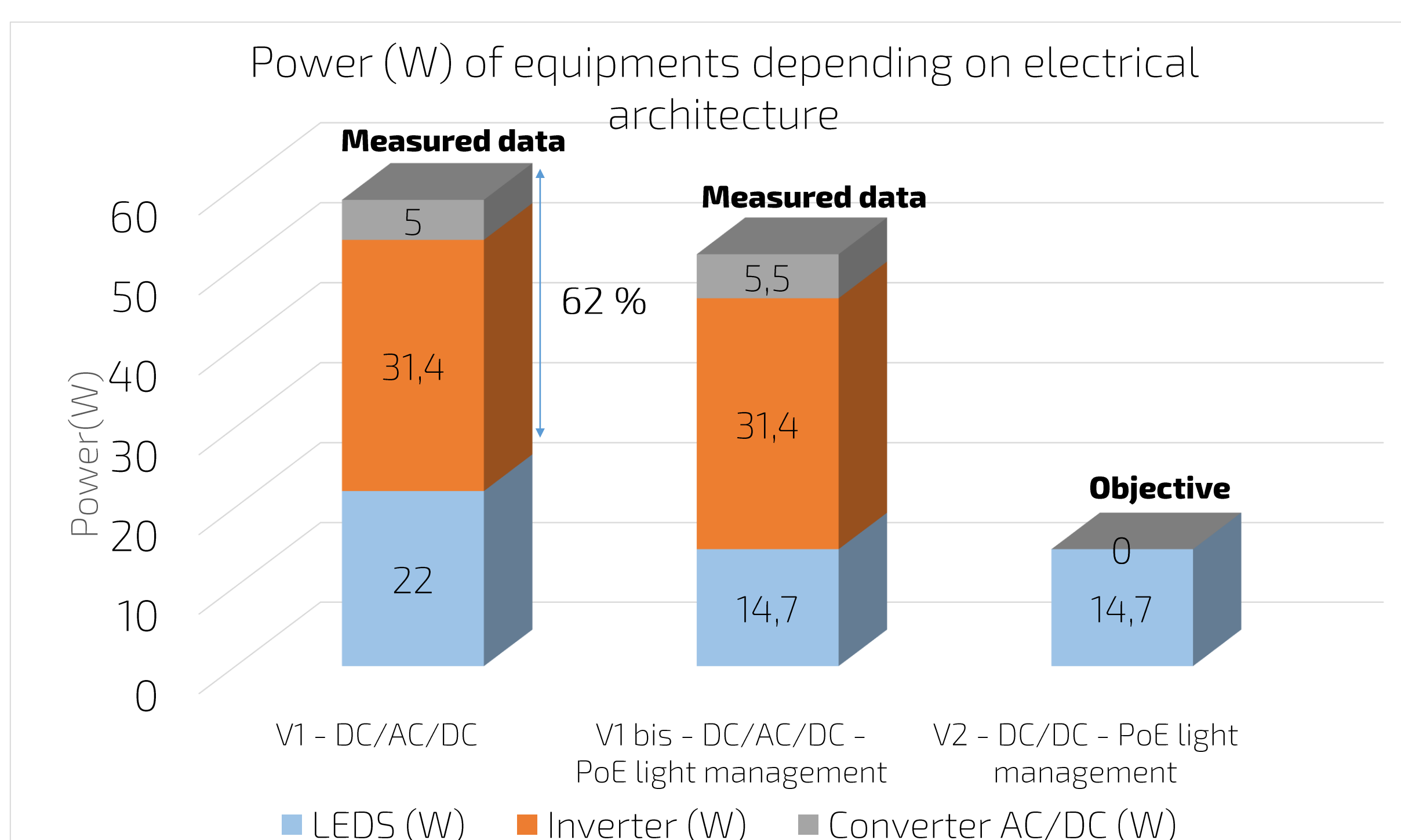
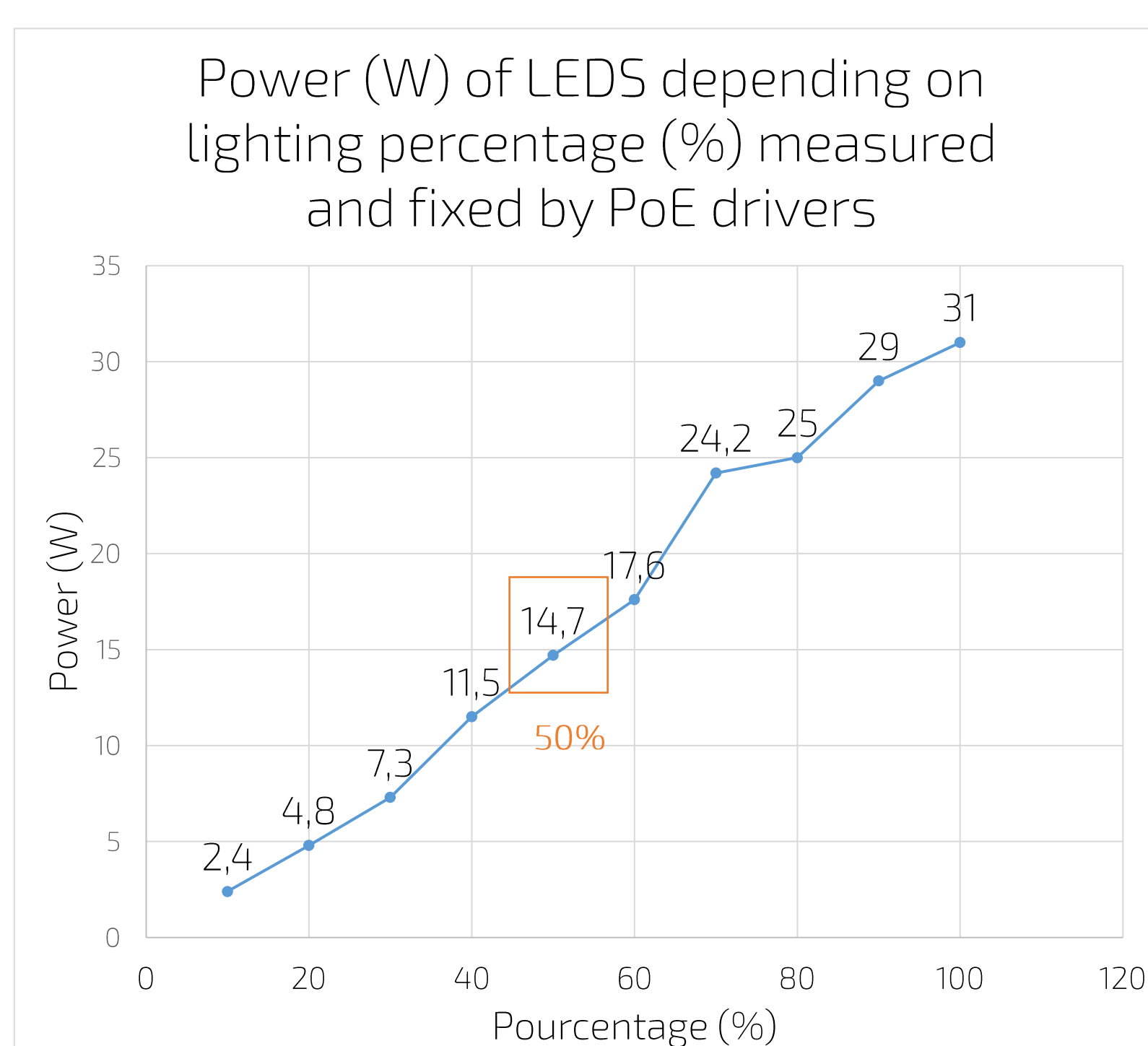
COMPARATIVE TESTS PLANNED



DC EXPERIMENTAL TEST BENCH



RESULTS AND PERSPECTIVES



First measurements carried out made it possible to highlight a percentage of **62%** of the energy consumption linked to conversions for lighting, within a **DC-AC-DC** electrical architecture. The perspectives of the project consist in including in the EMS other types of electrical loads and propose a **predictive control model** based on the available **solar resource**. This model will also have to integrate **hybrid storage** (battery, hot water, hydrogen reserve) in order to optimize the battery drain.

Note : 50% is the average value fixed by drivers to reach a light comfort between 300 and 500 lux, depending of dimming light and presence during the day.