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Affordable High-Performance Green Redox Flow Batteries

GRANT AGREEMENT No. 875613

HIGREEW – Deliverable Report

<< D4.3 – Description of the battery prototype model and algorithms optimization>>

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Publishable summary

The HIGREEW project sets out to design, build, and demonstrate a prototype of a new high energy density generation of Aqueous Organic Redox Flow Battery (AORFB) based on a water-soluble low-cost organic electrolyte and featuring low-cost components and long service life.

A fully functional AORFB prototype would be one of the major outcomes of the project. After initial specifications of the system (WP1), development and testing of the components at cell (WP2) and stack level (WP3), the design and construction of the prototype is the aim of WP4.

A functional and autonomous prototype that can operate in a safe and efficient way relies on the battery management system (BMS) which is ultimately ruled by the control algorithms. Algorithms of the battery are essential for the adequate operation of the battery and the auxiliaries of the balance of plant (BoP), that means to avoid malfunctioning or any damage of the components or system. Currently, the goal on the algorithm development goes beyond operation and safety requirements and entails efficiency and cost&durability aspects. Thus, algorithms are responsible for running the battery in the best possible conditions, including mentioned variables, in a variety of scenarios dictated by the needs of energy storage or supply of the hybrid wind-solar power plant of La Plana (Spain).

This report describes in detail the work performed in the system modelling and algorithm development. A zero-dimensional dynamic model developed and implemented in MATLAB/Simulink is presented, including a preliminary validation. This model was developed to support the definition and optimization of the prototype control algorithms. The latter are explained in detail in three subsections: a) System Monitoring & Fault Detection; b) Prototype Operation State Control; c) Control of Auxiliaries. The following parameters have been identified as relevant and measures for their monitoring and/or control are described in this document: voltage, current, pressure, electrolyte flow rate and levels, atmosphere, temperature, SOC and SOP.

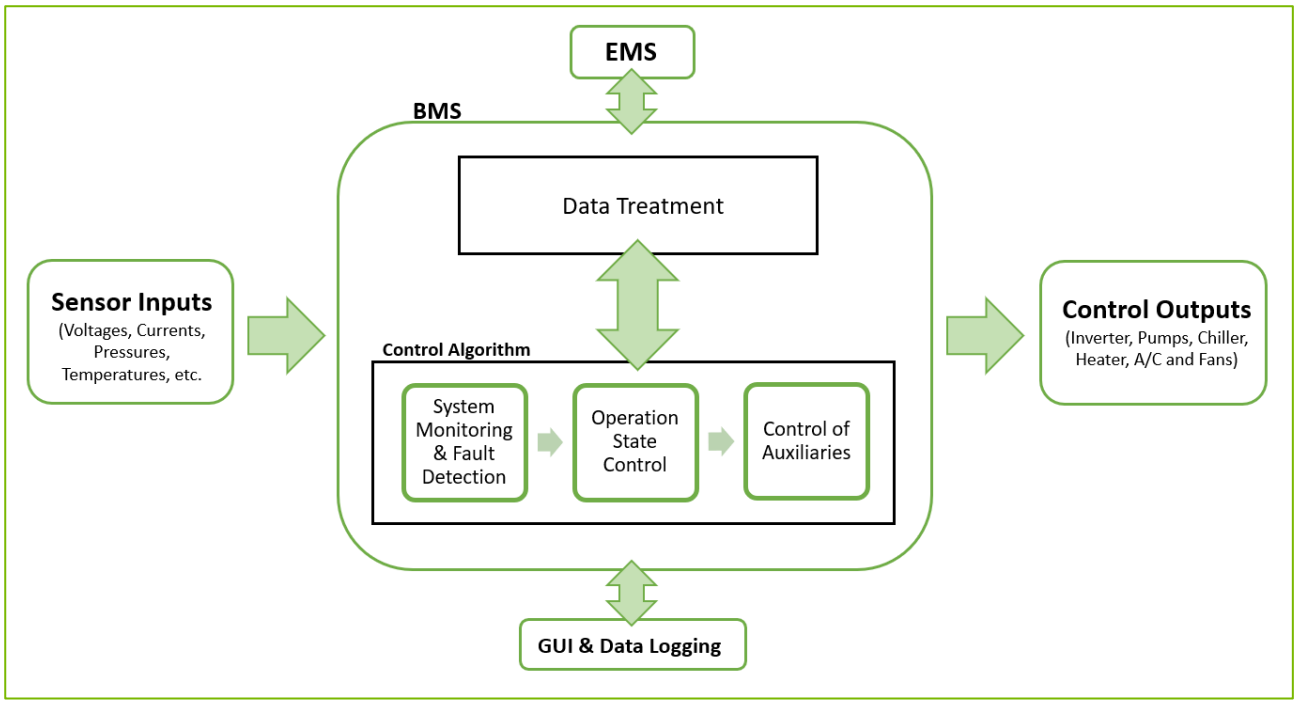

Figure Block diagram of the BMS and the interaction with other system blocks