= iSTORMY =

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Interoperable, modular and Smart hybrid energy STORage systeM for stationarY applications

GRANT AGREEMENT No. 963527

Deliverable Report

D2.2 – Programmed BMS for extended lifetime

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Publishable summary

The iSTORMY project aims at developing an interoperable and modular Hybrid Energy Storage System (HESS) by demonstrating various use cases and seamlessly interfacing the grid to provide multiple services. Within WP2 of the project a hybrid battery is developed and manufactured with the goal in mind to optimize the performance of a stationary energy storage system by making use of different types of batteries, each with their own benefits. In collaboration with other WPs, potential battery cell candidates have been selected and underwent significant testing in WP2 to characterise their performance. The system level optimization in WP3 selected the optimal configuration of such a battery system, including both a high-energy and high-power part.

In order to operate this Hybrid Battery Energy Storage System (HBESS) in an optimal manner, an overarching Energy Management System is developed in WP4 to control the individual power flows to/from the battery modules. For the EMS to control this system properly, it needs to be fed with information from the Battery Management System (BMS) with more information than is currently present in a typical BMS. For this reason, WP2 also develops a set of functionalities and algorithms to be implemented in the BMS and provide the required information for the EMS to function properly.

Targeting the project objective of TCO reduction due to enhanced SoX estimation, a new SoX (SoC and SoH) estimation algorithm is developed and embedded in the BMS of the demonstrator HBESS. With the more accurate SoX estimation, the EMS will also be able to improve the system lifetime with optimal operation.

Alongside the SoX estimation, WP2 developed an Active Diagnostics System that will operate in direct collaboration with the SoX estimation to provide more accurate SoH estimations. This is realized by a combination of passive and active diagnostics that when needed interfere with the operation of a specific battery module in order to obtain the best possible data for estimation. This all without impacting the overall operation of the HBESS.

With inputs from both the SoX estimation as well as the Active Diagnostics System the Remaining-Useful-Life estimation algorithm will predict the future evolution of the SoH of the batteries. This is currently trained with data from the ageing testing and will be trained later on with data from the actual demonstration in WP5.

Data gathered and estimated by the three algorithms (SoX, ADP and RUL) will be stored in a central battery passport that is also embedded in the BMS of the HBESS. This passport will allow for tracking the battery performance over its lifetime and aid the development of the RUL estimation.

Slightly out of scope of the actual BMS, an Ageing Cost Function was also developed in WP2, based on the ageing testing performed earlier. This Ageing Cost Function will aid the optimization of WP3 to decide upon a proper power split between the high-energy and high-power part of the HBESS. Since this optimization is part of the EMS it was most suitable to embed the algorithm in the EMS rather than the BMS.

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Project partners:

#	Partner short name	Partner Full Name
1	VUB	VRIJE UNIVERSITEIT BRUSSEL
2	PWD	POWERDALE
3	CEG	CEGASA ENERGIA S.L.U.
4	CEA	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
5	MGEP	MONDRAGON GOI ESKOLA POLITEKNIKOA JOSE MARIA ARIZMENDIARRIETA S COOP
6	ZIG	ZIGOR RESEARCH & DEVELOPMENT AIE
7	EDF	ELECTRICITE DE FRANCE
8	TNO	NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO
9	PT	PRODRIVE TECHNOLOGIES BV
10	GW	GREENWAY INFRASTRUCTURE SRO
11	AIT	AIT AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH
12	UNR	UNIRESEARCH BV

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