- D7.3 – Data Management Plan -

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- PROJECT INFORMATION -

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- DELIVERABLE INFORMATION -

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- TABLE OF CONTENTS - (if relevant)

1. Summary

The Data Management Plan (DMP) describes the collection, generation, management and preservation of data during INSTABAT project. During INSTABAT project, several types of data are going to be acquired, processed and stored. Guidelines on FAIR data management in Horizon 2020 and Battery2030+ are followed, and accessibility, interoperability and reusability of data will be ensured within the framework of the INSTABAT project. The DMP describes the data management life cycle for the data to be collected, processed and/or generated by INSTABAT.
The decision to share or exploit/protect the results generated during the project will follow the regulations stated in the Consortium Agreement (CA) and in the complementary grant to be signed with LC-BAT-12, 14 and 15 consortia.
The DMP is a living document, produced as deliverable D7.3.
The DMP aims at making research data findable, accessible, interoperable and reusable (FAIR) and includes:

- The handling of research data during and after the project;
- The type of data collected, processed and generated by the project;
- The methodology and standards applied;
- Whether data will be shared/made open and how;
- How data will be curated and preserved.

The application of this document is the responsibility of all INSTABAT project partners. This document will be updated through the life cycle of the project to enrich and update the current information as well as to include new issues or changes in the project procedures.

Any update of the document will follow the internal approval procedures.

2. Introduction

The present document constitutes the Data Management Plan (DMP) of the INSTABAT project. The main objective of the DMP is to provide an analysis of the main elements of the data management policy that is going to be adopted by the consortium.
The DMP is being developed by CEA, yet its application involves all project partners who will publish INSTABAT's results. The DMP follows the below structure in line with the EC template: Data summary, including the purpose of the data collection/generation, the data description, the origin of the data and the data utility. The present document includes also the FAIR data description and compliance, and the allocation of resources.
The Data Management Plan will also be compiled considering the new GDPR legislation applied to research projects, always acting according to the principles of lawfulness, fairness, transparency, propose limitation, minimisation, accuracy, storage limitation, integrity, confidentiality and accountability.
This plan will gather the strategy to manage the following data sources identified during the implementation phase:

- Processing of the data at testing stage: This data will reflect the impacts that the innovations have had under the real operation (confirming defined KPIs), as well as the performance of the prototype developed. Key results will be disseminated among all the involved stakeholders. A particular effort of dissemination will be made towards industry and research community to highlight the benefits of adopting the strategies proposed and developed in INSTABAT.

- Scientific publications: Data relative to scientific achievements will be disseminated to the scientific community in specific events or journals. The publications will always include acknowledgements to the project. Prior to publishing any scientific publication, the partner involved shall contact the Project Coordinator (PC), following the regulations stated in the CA for protection of project results and IPR. The partners will have to provide open access to all peer-reviewed scientific publications relating to their results according to Article 29.2. of the Grant Agreement and H2020 Guidelines on Open Access to Scientific Publications (EC, 2013). In addition, the project website will provide access to a repository containing the publications.

INSTABAT PROJECT & OBJECTIVES

INSTABAT will develop a proof of concept of smart sensing technologies and functionalities (called "lab-on-a-cell"), integrated into a battery cell and capable of:

- Performing reliable in operando monitoring (time- and space-resolved) of key parameters (temperature and heat flow; pressure; strain; Li^+ concentration and distribution; CO_2 concentration; "absolute" impedance, potential and polarization), by means of:
    - four embedded physical sensors (optical fibers with Fiber Bragg Grating and luminescence probes, reference electrode and photo-acoustic gas sensor),
    - two virtual sensors (based on electro-chemical and thermal reduced models),

- Correlating the evolution of these parameters with the physico-chemical degradation phenomena occurring at the heart of the battery cell,
- Improving the battery functional performance and safety, thanks to enhanced Battery Management System (BMS) algorithms providing in real-time higher accuracy States of Charge, Health, Power, Energy and Safety cell indicators (taking the measured and estimated parameters into consideration). INSTABAT will in particular focus on the following two key use cases: cycling at extreme conditions and high-power charging for Electric Vehicles (EV) applications.

In a nutshell, with INSTABAT the battery will no longer be a black box. It is expected that such a disruptive approach of monitoring/estimating physical parameters and correlating them with battery degradation phenomena will open new horizons to: (1) bring battery performances to their theoretical limits; (2) reduce battery safety margins; (3) improve the optimisation of the cell use through a better BMS using data from the sensors; (4) enable battery self-healing and facilitate battery second life usage and autonomous material findings.

The INSTABAT "lab-on-a-cell"), will be capable of monitoring simultaneously multiple battery key parameters and of correlating them with battery cell physico-chemical degradation processes. The Battery Management System (BMS) will receive in real-time the output data from the physical/virtual sensors of the platform, enabling the delivery of very accurate SoX cell indicators (States of Charge, Health, Power, Energy and Safety). The benefits of the improved accuracy of the SoX will be demonstrated via two critical uses cases: cycling at extreme conditions and high-power charging for EV applications.
To reach this goal, the complementary skilled consortium has defined eight main objectives, which are described below :

- Perform time- and space-resolved measurements of battery cell critical parameters by means of embedded physical sensors
- Perform time- and space-resolved estimations of battery cell critical parameters by means of virtual sensors
- Establish correlation between (1) cell physico-chemical degradation phenomena and (2) in operando measurements/estimations
- Provide in real-time, via INSTABAT multi-sensor platform, (1) simultaneous monitoring of multiple battery key parameters and (2) accurate SoX cell indicators
- Demonstrate improved performance of BMS algorithms (1) integrating measured/estimated parameters (2) based on fine electro-chemical and thermal modelling of the battery cell
- Demonstrate improvement of cell functional performance and safety through two use cases for EV applications

3. Data summary

INSTABAT will generate data both from experimental campaigns and various modelling sources. This also includes several datasets which be further processed and analyzed with a range of software tools to facilitate interactions and tasks being carried across the different work packages. As such, potential re-utilization will be enabled, and quality of the data will be ensured by careful documentation of data collection methods as well as the contents of the datasets.

3.1 Purpose of data collection/generation

The data generated within the project will all aim to fulfill the objectives defined here above, targeting the required Key Performance Indicators.

4.1 Data description

TYPES OF DATA

The main data generated by the project are presented below :

- Documents compiling requirements for smart batteries

- Data from environmental assessment and recyclability analysis, from techno-economic feasibility for multi-sensor platform

- Data gathered on protocols of battery sensors fabrication and integration

- Measurements data of the sensor response during fabrication, calibration and stability/adaptation to battery cell environment: Fiber-Bragg-Grating sensor data (OF FBG), Photo Acoustic (PA) CO_2 sensor data, Reference Electrode (RE) sensor data, Luminescence sensor (OF Lum)

- Measurement data resulting of experimental protocol defined cycling test based on EV standard use : OF FBG sensor, PA CO_2 sensor, RE sensor, OF Lum sensor.

- Data coming from abusive tests

- Simulation data from cell modelling activities : cell models, scripts, and simulation results data

- Data from the demonstrator : cycling data, abusive data, performance analysis results data

DATA FORMATS

The formats of the data will include :

- Data and metadata
- Reports : MS Word (.doc, .docx) and Excel (.xls, .xlsx) compatible files, PDF (.pdf)
- Illustrations : .jpg, .avi, mov, mp4, wmv
- Software development : .m scripts files, .lvproj files
- Results and databases : .mat files, .txt files, .csv files, hdf5 databases

DATA SIZE

To be evaluated during the project and will depend on the extent and the nature of the data that are made available. The size of different data formats could differ greatly across various experimental, processing results, description reports and modelling formats. It is expected to have data ranges between KBs and TBs.

5.1 Existing data being reused

The re-use of existing data available from research projects and other European projects will be encouraged. Data will be sourced from several already existing datasets and/or reports and will be updated, making use of the knowledge of project partners. Data generated during previously realized European project will be reused such as : EVERLASTING, SIRBATT, MAT4BAT, TEESMAT, NENUFAR and OBELICS projects.

6.1 Data usefulness

The audience of DMP is mainly the INSTABAT project consortium and the European Commission. The data utility also includes additional stakeholders :

- INSTABAT Consortium.
- Battery 2030+ initiative and associated partners
- Stakeholders Involved In the field.
- Scientific community.
- European Commission services and European Agencies.
- EU national bodies.
- General audience.

4. FAIR data

The FAIR data management (Findable, Accessible, Interoperable and Reusable data) principles will be ensured by INSTABAT project. While some data will not be publicly available, the project will try to maximize access and re-use of research data generated by the project.

7.1 Making data findable and interoperable

Rigorous quality management will be applied during the battery cell test campaigns, in order to converge toward consistent and harmonized databases. Metadata elements will be used describing the data to aid data discovery and potential reuse. Metadata of datasets will be made available via FAIR compliant repository for research and re-use after the end of the project. Persistent identifiers provided by the repository will be used in linking to datasets.

An internal sharepoint directory is set and will be used as the main tool to collect, gather, process, share and make available/findable open research data produced within the project.
In addition, an action to select and use a freely accessible public repository (for example Zenodo) will be carried out.

1.1.1 Standard and metadata

Metadata parameters/properties will be associated with all published data, including :

- Name and entity name of the partner who produced the data
- Chemistry of battery cell tested
- Type of cell format
- Mechanical dimension of the cell
- Capacity of the cell
- Description of test
- Detailed description of integrated sensors used
- Single sensor test or multi-sensors test

- Versions of the sensors used
- Type of lab equipment used to produce the data
- Temperature of the cell under test
- Type of cycling profile
- Discharge/charge rate
- Maximum and minimum SOC values during experiment
- Associated publications and reports

- Bibliographic information
- Keywords

2.1.1 Search keyword

Specific keywords will be assigned to public datasets.

3.1.1 Versioning and naming convention

The different dataset produced within the duration of the project will be grouped following relevance indicators, and proper versioning method will be applied. Project harmonized and shared naming convention will be adopted.

8.1 Making data accessible

As outlined by the H2020 Open Access guidelines, research data generated by H2020 projects will be made accessible with minimal restrictions related to protection of personal data or sensitive information that is governed by privacy concerns and/or commercial or security reasons.

The decision to open up access to data or groups of data will be taken collectively by the different partners involved in generating the data. The task managers associated with the battery cell test campaigns will take appropriate measures to ensure that the data generated respects the FAIR principles, and to ensure that this public data are findable and reusable for third parties.

SHARING DATA AND STORING DATA

Three main platform will be used for storing data in the INSTABAT project:

- INSTABAT website public area : https://www.instabat.eu/

  All publications (public deliverables, reports, scientific articles and newsletters, etc.) will be available to third parties during the whole project's duration.

- CEA SHAREPOINT repository for the project: It will be running/online during the entire project's duration. All project partners will have access to this area to upload and download all restricted data to consortium.

- Public open access data platform to be defined : after selection of the most suitable platform, and the definition of the adapted storing methodology, all research open data will be stored onto a specific data platform

9.1 Data reusability

Ownership of datasets will belong to project consortium after the project completion. EULA agreement license could be adopted, this type of license being very often used for example in machine learning community.
This EULA (end user license agreement) is designed to govern the relationship between a licensor of software and end users. The EULA can act as a stand-alone license; but it can also act as one element in a more sophisticated licensing arrangement. The licensing provisions are flexible, and can easily be adapted for a wide range of different situations. In addition to the core licensing provisions, the EULA includes optional short-form clauses covering support and maintenance. But the EULA type licensing for data reuse needs to be confirmed.

No period or time limit is already defined for access or reuse of the data. However, open data will be deposited in a repository that guarantees data integrity. Some more actions need to be done to select the correct data platform for open access data, a platform that guarantees integrity and security.
In terms of reusability, specific efforts will be done to make data accessible and reusable by any partners contributing to the BATTERY2030+ initiative.

10.1 Interoperability

As already mentioned, all the data produced within the INSTABAT project will not be public and freely accessible, but data will be made public as much as possible. A specific data steering group among the partners consortium will decide which datasets are public and those datasets which are not. For the datasets made public, efforts will be made to render these data as interoperable as possible.
It is although very probable that all source code, as well as all simulation models code will not be public and will remain only compliant with the IP definitions and contract requirements of the Grant Agreement.
Guidelines and recommendations, obtained from the outcomes of the BATTERY 2030+ working groups developments on data management, will be adopted as much as possible. And the standards provided by BATTERY 2030+ will be used as much as possible.

5. Allocation of resources

Costs related to research data management and data opening are eligible as part of the project grant.

During the project consortium partners will be responsible for managing and curating datasets at their possession. A specific working group will define and promote guidelines for a FAIR data

management during the project and after the end of the project. The costs of data management are allocated in the project budget, so no further costs are envisaged for such activity.

6. Annex : project data table

Data_table_INSTABAT_v3.xlsx