Electric Vehicle Enhanced Range, Lifetime And Safety Through INGenious battery management

D8.2 – Data Management Plan

April 2017

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 713771

Public

PROJECT SHEET	
Project Acronym	**EVERLASTING**
Project Full Title	Electric Vehicle Enhanced Range, Lifetime And Safety Through INGenious battery management
Grant Agreement	**713771**
Call Identifier	H2020-GV8-2015
Topic	GV-8-2015: Electric vehicles' enhanced performance and integration into the transport system and the grid
Type of Action	Research and Innovation action
Project Duration	48 months (01/09/2016 – 31/08/2020)
Coordinator	VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK NV (BE) - *VITO*
Consortium Partners	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (FR) - *CEA* SIEMENS INDUSTRY SOFTWARE SAS (FR) - *Siemens PLM* TECHNISCHE UNIVERSITAET MUENCHEN (DE) - *TUM* TUV SUD BATTERY TESTING GMBH (DE) - *TUV SUD* ALGOLION LTD (IL) - *ALGOLION LTD* RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN (DE) - *RWTH AACHEN* LION SMART GMBH (DE) - *LION SMART* TECHNISCHE UNIVERSITEIT EINDHOVEN (NL) - *TU/E* VOLTIA AS (SK) - *VOLTIA* VDL ENABLING TRANSPORT SOLUTIONS (NL) – *VDL ETS*
Website	www.everlasting-project.eu

DELIVERABLE SHEET	
Title	**D8.2 – Data Management Plan**
Related WP	WP8 (Dissemination)
Lead Beneficiary	VITO
Author(s)	Carlo Mol (VITO)
Reviewer(s)	Tijs Donckers (TU/e) Leon Osinski (TU/e) Niles Fleischer (ALGOLiON) Didier Buzon (CEA) Javier Munoz Alvarez (LION Smart) Florian Ringbeck (RWTH Aachen) Pacome Magnin (Siemens) Ilya Zilberman (TUM) Alexander Stadler (TUV SUD) Anouk Hol (VDL ETS) Trad Khiem (VITO) Mario Paroha (VOLTIA)
Type	Report
Dissemination level	Public
Due Date	M6
Submission date	28 April, 2017
Status and Version	Final, version 1.0

REVISION HISTORY

Version	Date	Author/Reviewer	Notes
V0.1	06/02/2017	Carlo Mol (VITO) Lead Beneficiary	First draft
V0.2	02/03/2017	Will Hendrix (TU/e)	Input TU/e RDM Team
V0.3	13/04/2017	Carlo Mol (VITO)	Input from DMP workshop 31/3/2017
V0.4	26/04/2017	Carlo Mol (VITO)	Input from all EVERLASTING partners, mainly on data inventory
	27/04/2017		Final review
V0.4	28/04/2017	Carlo Mol (VITO)	Quality check
V1.0	28/04/2017	Carlo Mol (VITO) Coordinator	Submission to the EC: First version of DMP

DISCLAIMER

The opinion stated in this report reflects the opinion of the authors and not the opinion of the European Commission.

The commercial use of any information contained in this document may require a license from the owner of that information.

All EVERLASTING consortium members are committed to publish accurate information and take the greatest care to do so. However, the EVERLASTING consortium members cannot accept liability for any inaccuracies or omissions nor do they accept liability for any direct, indirect, special, consequential or other losses or damages of any kind arising out of the use of this information.

ACKNOWLEDGEMENT

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 713771

TABLE OF CONTENTS

List of Abbreviations and Acronyms

ACRONYM	DEFINITION
WP	Work package
WPL	Work package leader
DOW	Description of Work
DMP	Data Management Plan
BMS	Battery Management System
MB	Management Board
GA	General Assembly
OA	Open Access
CA	Consortium Agreement
GA	Grant Agreement
DPO	Data Protection Officer
RDM	Research Data Management
CSV	Comma separated value
SOC	State Of Charge
SOH	State Of Health

1 PROJECT OBJECTIVES

EVERLASTING is focussing on model based battery management systems (BMS) for Li-ion batteries. New or improved BMS features will be developed by performing intensive research activities in the field of physical testing, simulations, modelling and validation on battery cell and pack level to improve the reliability, lifetime, performance and safety of Li-ion batteries when being used in electric vehicles.

Today, batteries are not yet the ideal energy container they were promised to be. They are expensive, fragile and potentially dangerous. Moreover the current electric vehicle cannot compete yet with traditional vehicles when it comes to driving range and flexibility. EVERLASTING intends to bring Li-ion batteries closer to this ideal by focusing on the following technology areas:

- Predicting the behaviour of battery systems in all circumstances and over their full lifetime. This enables accurate dimensioning and choice of the correct battery type, leading to lower cost. It also facilitates the development of a powerful battery management system during all stages of its evolution from idea to fully tested product.
- Sensing signals beyond the standard parameters of current, voltage and temperature. This multi-sensing approach, over early, mid and late stage time domains, provides more varied and in-depth data on the status of the battery facilitating a pro-active and effective management of the batteries, preventing issues rather than mitigating them.
- Monitoring the status of the battery by interpreting the rich sensor data. By intelligently combining this information with road, vehicle and driver data we intend to offer accurate higher-level driver feedback. This induces a bigger trust and hence a lower range anxiety.
- Managing the battery in a proactive way, based on a correct assessment of its status. Efficient thermal management and load management results in increased reliability and safety and leads to lower overall cost through an increased lifetime.
- Defining a standard BMS architecture and interfaces and gathering the necessary support in the market. This allows an industry of standard BMS components to flourish which will result in lower cost.

2 DATA MANAGEMENT PLAN

2.1 INTRODUCTION

A new element in Horizon 2020 is the use of Data Management Plans. A **Data Management Plan** (DMP) describes the data management life cycle for all datasets to be collected, processed or generated by a research project. The purpose of the Data Management Plan (DMP) is to provide an analysis of the main elements of the data management policy that will be used by the applicants with regard to all the datasets that will be generated by the project.

Special attention will be given to "**Open Access**" to scientific information and "**Open Research Data**". Open access (OA) refers to the practice of providing online access to scientific information that is free of charge to the end-user and reusable without restrictions. In the context of research and innovation, 'scientific information' can mean: peer-reviewed scientific research articles (published in scholarly journals) or research data (underlying data from publications, curated data and/or raw data).

Why give open access to publications and data in Horizon 2020?

Firstly, for the benefits of society in general. Modern research builds on extensive scientific dialogue and advances by improving earlier work. The Europe 2020 strategy for a smart, sustainable and inclusive economy underlines the central role of knowledge and innovation in generating growth. Broader access to scientific publications and data therefore helps to:

- build on previous research results (improved quality of results)
- encourage collaboration and avoid duplication of effort (greater efficiency)
- speed up innovation (faster progress to market means faster growth)
- involve citizens and society (improved transparency of the scientific process).

Secondly, also the EVERLASTING partners benefit from giving open access to publications and research data by increasing the visibility of the project results, leading to more citations for the research partners and increased collaboration potential for setting up new projects or for the quicker adoption and valorisation of the built up knowledge.

Deliverable D8.2 "Data Management Plan" describes the handling of research data that will be collected, processed or generated by the EVERLASTING project according to the guidelines for data management in the H2020 Online Manual. This deliverable will evolve during the lifetime of the project in order to describe the status of the project's reflections on data management.

EVERLASTING Deliverable D8.2 "Data Management Plan" must be considered as a "**living document**" and will be updated when important updates are available: new datasets, updates on existing datasets, changes in consortium policies (e.g. on exploitation of results and patenting) or other external reasons (e.g. changes in consortium members and suggestions from advisory board).

The DMP will be updated as a minimum in time with the periodic evaluation/assessment of the project. This update will be in parallel with the update of **D8.1 "Dissemination and exploitation plan"**. Obviously, there is a close link to D8.1 "Dissemination and exploitation plan" since the generated data within the EVERLASTING project is input for future exploitation and dissemination activities. Some of the generated datasets will be used as "underlying data" for the dissemination of EVERLASTING project results and the Data Management Plan will describe how these datasets will be shared as "Open Data". By sharing data, we further improve the quality level and impact of the dissemination activities within EVERLASTING.

2.2 Scope of Data Management Plan version 1.0

The DMP is not a fixed document, but evolves during the lifespan of the project.

The scope of this **first version of the EVERLASTING DMP** contains the current status of reflection within the consortium about the overall types of data that will be collected or produced during the project and on how and what data will be made open available to external stakeholders such as research institutes and companies. In the next version of the EVERLASTING DMP, more detailed datasets and their specific handling will be described.

Existing guidance material will be used to structure this work such as the use of **DMPOnline** (https://dmponline.dcc.ac.uk), which has been developed by the Digital Curation Centre to help writing data management plans. **OpenAIRE** also provides a range of resources, FAQs, webinars and support pages. OpenAIRE can also be contacted via the local representatives in all EU countries: the National Open Access Desks or NOADs. More information can be found on www.openaire.eu.

The **Horizon 2020 FAIR DMP template,** which is available on DMPOnline, has been designed to be applicable to any Horizon 2020 project that produces, collects or processes research data. A single DMP should be developed to cover its overall approach. However, where there are specific issues for individual datasets (e.g. regarding openness), these should be described in the specific dataset. In general terms, research data should be 'FAIR' i.e. findable, accessible, interoperable and re-usable.

2.3 Open Access Scientific Publications

In this section, the scientific dissemination will be described briefly. For more details, we refer to D8.1 "Dissemination and exploitation plan", but since **"underlying data"** of scientific publications forms the core part of the "open data" we will describe briefly the intended scientific dissemination.

The scientific dissemination will be implemented through:

- The publishing of the generated results in open access peer-reviewed scientific journals
- The presentation of project results in scientific conferences and events

Partners will publish scientific articles with Green or Gold-standard open access to share results generated from the project. TU/e will ensure that rules in the Consortium Agreement are respected concerning scientific publications before their submission to journals. Prior to any disclosure (conference, publications, defence of PhD theses or Masters) the protection of the project progress must be secured. The project will generate research data in a wide range of levels of detail from simulation and lab results to demonstrator validation. Most data will be associated with results that may have a potential for commercial or industrial protection and therefore cannot be made accessible for verification and reuse in general due to intellectual property protection measures. However, relevant data necessary for the verification of results published in scientific journals can be made accessible on a case by case basis. The decision concerning the publication of data will be made by the Management Board, as the decision-making body of the consortium. Research data of public interest such as those underlying scientific publications will be made available via open access data repositories while hyperlinks to these datasets will be placed on the EVERLASTING website.

Here you can find the list of planned scientific publications which will generate "underlying data". Besides these publications some deliverables will also generate "open data" like D2.3 "Report containing aging test profiles and test results" (Type: ORDP & Due Date: M42).

Topic	Dissemination method	Partners
WP1: Improved simulation and modelling tools		
Dissemination of research results with respect to tools and methods achieving a relevant prediction of pack behaviour, with coupled controls, including validation (Siemens)	Conference presentation	Siemens PLM
Presentation of (pre-)industrialized new models, tools and features allowing the modelling and prediction of battery pack behaviour and BMS coupling	Siemens user conference (including major carmakers, suppliers, OEMs, battery suppliers…)	Siemens PLM
Demonstrating multi-level battery modelling, simulation, reduction and control coupling applied to automotive transportation	Simulation@Siemens (Siemens divisions)	Siemens PLM
Modelling order reduction techniques	Conference presentation, Journal paper (Open Access)	TUM, TU/e
WP2: Increased reliability		
The use of self-learning algorithms for estimation of SoH	Conference presentation, Journal paper (Open Access)	VITO, ALGOLiON
Test procedures for BMS testing	Conference presentation, Standard proposal	TÜV SÜD, VITO
WP3: Extended vehicle range		
Challenges of parametrization of physico-chemical battery model and comparison to standard electro chemical battery models	Conference presentation	RWTH
Deduction of minimum parameter set for physico-chemical model and adaption of model for application on embedded hardware	Journal paper (Open Access)	RWTH
Maximizing operation range of Li-Ion batteries to maximize energy output without losing safety	Conference paper, Journal Paper (Open Access)	RWTH
Embedded BMS hardware requirements towards execution of extended battery models	Conference paper	RWTH
Costs for more complex BMS hardware, enabling the extraction of more energy vs. higher capacity of battery cells	Conference paper	RWTH
Development of common BMS software towards integration of more complex battery models	Conference paper	RWTH
Advanced BMS Models and Model Adaptation	University courses and seminars	RWTH
Full Physico-Chemical Parameterization of the Battery Cell	Journal paper (Open Access)	RWTH
Aging behaviour of the Battery Cell	Journal paper (Open Access)	RWTH
Methodology for onBoard estimation of lithium loss and anode and cathode degradation	Journal paper (Open Access)	RWTH, ALGOLiON
Drive power prediction of electric busses	Conference presentation and journal paper (Open Access)	TU/e
Online real-time vehicle parameter estimation	Conference presentation and journal paper (Open Access)	TU/e
Energy Management of Electrified Auxiliaries of electric busses	Conference presentation and journal paper (Open Access)	TU/e
Range extension and optimization: tradeoff between travel-time and energy consumption	Conference presentation and Journal paper (Open Access)	TU/e

WP4: Safer batteries		
Battery and cell safety and failure modes, early degradation mechanisms of materials leading to cell thermal runaway	Conference presentation, Journal paper (Open Access)	CEA
Safety monitoring of Li-ion batteries: signal processing for battery safety applications, multi-sensing safety algorithms	Conference presentation, journal paper (Open Access), demonstration at trade exhibitions, trade journal article	CEA, ALGOLiON
Multi-scale, multi-physics modelling of safety hazards in Li-ion batteries	Conference presentation, Journal paper (Open Access)	CEA
WP5: Longer battery life		
Active and passive thermal management of Li-ion batteries	Conference presentation, Journal paper (Open Access)	CEA, VITO
Battery reconfiguration	Conference presentation, Journal paper (Open Access)	VITO
Influence of cell-to-cell parameter variations on cell balancing	Conference presentation, Journal paper (Open Access)	TUM
Optimal utilization of dissipative cell balancing	Conference presentation, Journal paper (Open Access)	TUM
Optimal utilization of non-dissipative cell balancing	Conference presentation, Journal paper (Open Access)	TUM
WP6: Standardized architecture		
BMS architecture	Standard proposal	LION Smart
Requirements and architecture concept of a highly modular prototyping hardware platform.	Journal paper (Open Access)	TUM
Implementation of a selection of the developed technologies in WP2-W5 according to their readiness levels on standardized BMS	Journal paper (Open Access)	LION Smart
WP7: Demonstrator		
Battery pack demonstrator, integrated in electric vehicle	Presentation to scientific community and general public	VOLTIA

2.4 Data Repositories

The EVERLASTING project will collect or generate a lot of different types of datasets. Some of these datasets will be only for internal use between the EVERLASTING consortium partners and will be stored in EVERLASTING repositories, while other datasets will be made publicly accessible in open access repositories.

2.4.1 Data repositories - Data Owner

The main data type collected in the EVERLASTING project is measurement/testing data of which one of the partners is the owner. If the data is considered to be privacy related, it is the responsibility of the data owner to inform the impacted person(s) and provide the necessary terms and agreements.

The data owner will store its data on its own servers following its internal data management procedures during the research project. Most partners have a dedicated Data Protection Officer (DPO) and some partners have a Research Data Management team (RDM).

2.4.2 Data repositories - EVERLASTING

To facilitate the exchange of information and data between the EVERLASTING partners, the project coordinator has set-up 2 dedicated sites:

EVERLASTING SharePoint site to exchange all general information and documents like MB and GA meeting minutes, WP related documents, such as the Grant Agreement and the Consortium Agreement, deliverables and publications (for more information see D9.1 "Project collaborative platform").

EVERLASTING Secure FTP site to facilitate the exchange of research data between the EVERLASTING partners

2.4.3 Data repositories - Open Access

A data repository is a digital archive collecting and displaying datasets and their metadata. A lot of data repositories also accept publications, and allow linking between publications and their underlying data. During the first 6 months, the EVERLASTING partners have been studying the different options where to store the data that can be made open. An overview of repositories can be found at **Re3data** (www.re3data.org).

The EVERLASTING partners prefer to use an open access data repository which is co-developed by one of the own partners and the choice was made to use the "**4TU.Centre for Research Data**" **repository** as **main data repository for EVERLASTING "Open Data"**.

The 4 Technical Universities in the Netherlands have created this research data repository (http://data.4tu.nl) and are further developing this. TU/e has an own RDM group and can help the EVERLASTING partners in using this repository. A dedicated workshop has been held in March 2017 during the last General Assembly meeting in Eindhoven. It is possible to deposit EVERLASTING data as open data or deposit it with embargo when it contains confidential data. The TU/e RDM team can help in offering guidelines for sustainable data formats and metadata standards, as well as support for dealing with sensitive data and licensing.

As complementary solution for storing open access publications and open research data, the EVERLASTING partners can use the "Zenodo" repository (www.zenodo.org). Zenodo repository is provided by OpenAIRE and hosted by CERN. Zenodo is a catch-all repository that enables researchers, scientists, EU projects and institutions to:

- Share research results in a wide variety of formats including text, spreadsheets, audio, video, and images across all fields of science.
- Display their research results and get credited by making the research results citable and integrating them into existing reporting lines to funding agencies like the European Commission.
- Easily access and reuse shared research results.
- Integrate their research outputs with the OpenAIRE portal.

2.5 DATA SUMMARY

2.5.1 INTRODUCTION

EVERLASTING is focussing on model based battery management systems (BMS) for Li-ion batteries.

New or improved BMS features will be developed by performing intensive research activities in the field of physical testing, simulations, modelling and validation on battery cell and pack level to improve the reliability, lifetime, performance and safety of Li-ion batteries when being used in electric vehicles.

The first 3 years of the EVERLASTING project, the research activities will be mainly performed in the different labs of the research partners. In a later phase, also real-life validation activities will be performed on the electric van from VOLTIA and the electric bus from VDL ETS.

Some of the research data (such as lifetime and safety test data) obtained in the project will be publicly shared via the Open Research Data Pilot. The next version of the DMP plan will elaborate on these datasets more in detail. In this chapter, the reader can already get a first idea of the different datasets to be expected from the EVERLASTING project and on the FAIR Data principles.

2.5.2 FAIR DATA

The datasets will be made available following the FAIR Data principles which means findable, accessible, interoperable and re-usable.

Making data findable, including provisions for metadata [fair data]

Outline the discoverability of data (metadata provision)

All data underlying journal articles will be archived and made available via the data archive of 4TU.Centre for Research Data (http://data.4tu.nl). 4TU.Centre for Research Data is the data archive for technical and scientific research data, mainly from The Netherlands. It offers data archiving services also to researchers at non-Dutch institutions and to H2020 projects such as the EVERLASTING project.

4TU.Centre for Research Data makes data openly available with a user license which is comparable to a CC BY-NC license.

Discoverability of the data in 4TU.Centre for Research Data is achieved by:

- Adding bibliographic (descriptive) metadata to each dataset (according to the Datacite metadata standard);
- Allowing the metadata to be harvested by Google and portals such as Narcis (http://www.narcis.nl);
- Presenting metadata in the open linked data RDF format;
- Providing a DOI to each dataset;
- Linking the data set to the accompanying publication.

Recognisability or visibility of the data as originating from the EVERLASTING project will be enhanced by creating a special collection of these data in 4TU.Centre for Research Data.

Outline the identifiability of data and refer to standard identification mechanism. Do you make use of persistent and unique identifiers such as Digital Object Identifiers?

Each data set deposited in 4TU.Centre for Research Data is assigned a DOI so that it is uniquely identifiable and can be cited in scholarly articles.

Making data openly accessible [fair data]

Specify which data will be made openly available? If some data is kept closed provide rationale for doing so.

All data underlying the scholarly publications produced by the EVERLASTING project will be made openly available.

Specify how the data will be made available

The data will be made openly available via the data archive of 4TU.Centre for Research Data (http://data.4tu.nl).

Specify where the data and associated metadata, documentation and code are deposited

As part of the dataset, a data guide will be deposited with data specific information (parameters and/or variables used, column headings, codes/symbols used, etc.) and with information on the provenance of the data. When software is needed to reuse the data, the code will also be deposited together with the data itself.

Making data interoperable [fair data]

Assess the interoperability of your data. Specify what data and metadata vocabularies, standards or methodologies you will follow to facilitate interoperability.

Specify whether you will be using standard vocabulary for all data types present in your data set, to allow inter-disciplinary interoperability? If not, will you provide mapping to more commonly used ontologies?

These questions do not yet apply to the project. To make the data interchangeable between the project partners and future users of the data, we are developing a metadata scheme.

Related to standard vocabulary for data types, we can refer to our white papers (see D8.1 for more details) in which we will explain the definitions of some data types such as SOC and SOH.

Increase data re-use (through clarifying licenses) [fair data]

Specify how the data will be licenced to permit the widest reuse possible
Data sets deposited in 4TU.Centre for Research Data will have a user license comparable to a CC BY-NC license. 4TU.Centre for Research Data is in the process of offering data depositors a choice of different Creative Commons user licenses. When this is realized a CC BY license will be selected.

Specify when the data will be made available for re-use. If applicable, specify why and for what period a data embargo is needed

Data will be made available for re-use immediately upon publication of the accompanying article. There will be no embargo period for the data.

Specify the length of time for which the data will remain re-usable

4TU.Centre for Research Data archives data for a minimum of 15 years. Data from the EVERLASTING project are provided in a format that is recommended by 4TU.Centre for Research Data for long term preservation and re-use. 4TU.Centre for Research Data has received a Data Seal of Approval which guarantees that the research data deposited here will continue to be able to be found and shared in the future.

Describe costs and potential value of long term preservation

The costs of archiving data in 4TU.Centre for Research Data depends on the size of the data. If the data is deposited on behalf of one of the partners of 4TU.Centre for Research Data (the 4 special Dutch universities, including Eindhoven University of Technology) and doesn't exceed 100 Gb per year, then 4TU.Centre for Research Data can absorb these costs. Above 100 Gb per year, the costs will be € 3,60 per Gb per 15 years. Archiving data from non-partners is free till 10 Gb per year. Above 10 Gb, the costs are € 4,50 per Gb per 15 year.

2.5.3 DATA INVENTORY

The data inventory is structured by partner and is not comprehensive. The next version of the DMP plan will elaborate on all expected datasets more in detail on topics such as description, formats, metadata and whether the data will be shared/made open access or not. In this section, based on the current preliminary insights, the reader can already get a first idea on some of the datasets to be expected from the EVERLASTING project.

ALGOLiON

Raw Data: cell and small pack measurements for current, voltage, temperature and single frequency impedance data.

Raw Data Format: CSV time series.

Derived Parameters: electrochemical based parameters to diagnose the state of safety and predict the development of safety hazards.

Derived Parameters Format: time domain normalized values.

Analysis of Derived Parameters: statistical analysis of hazard parameters. The goal is to obtain data that will be helpful in identifying how the signature of a healthy battery differs from the signature of a damaged battery. The work will collect sufficient data to ascertain that the signatures are consistent across cells, various conditions of cells and charge-discharge cycles. A large statistical base will be used to quantify the extent to which signatures are repeatable across these platforms.

Modelling: trace the development of internal short circuits to determine empirical time constant for changes in cell resistance and state of safety; projected time to threshold for thermal runaway.

CEA

Data	**OPEN**	**EVERLASTING Partners**	**CEA only**
WP4-T4.2: Multi-sensing strategy			
Type of sensors and specifications		Temperature, constraint gauge, IR, voltage, current	
Physical implementation		Number of sensors, location…	
Raw data coming from the multi-sensing experiments		*	
Post treated data			*

WP4-T4.3: Safety Testing Campaign			
Raw data	*		
Post treated data		*	
WP4-T4.4: Post Mortem Analysis			
Raw data	*		
Post treated data		*	
WP4-T4.5: Thermal and electrical modelling			
Physical models (set of equations chosen to describe the model)	*		
Model implementation (software)			*
SIMPLIFIED CASE	Data Input: - Simple Geometry - Mesh (Finite element) - State of the art material physical specifications and models Data Output: - Simulation Results		
EVERLASTING CASE	Data Output : - Simulation results	Data input generated by EVERLASTING partners: - Material specifications and models deduced from experimental characterization - Experimental safety tests measurements (voltage and temperature time records)	Data output generated: - Geometry - Mesh
WP4-T4.6: Safety warning and prediction algorithms			
Database from multi-sensing measurements: exploitation		Common data with ALGOLiON	*

Detection & Learning algorithms Matlab Code		Share knowledge with ALGOLiON	*
Results: statistics, figures, precision and robustness of the algorithms	*		
WP5: Longer battery life			
Thermal and hydraulic simulation		Detailed comparison with experimental performances	
Experimental tests	General evaluation of 2 cooling solutions	Detailed tests results in terms of thermal performance	

RWTH Aachen

	Electrical cell measurements	**Simulations with physico-chemical model**	**Post mortem laboratory data**
Data	• Voltage • Current • Temperature • (Complex impedance data)	• Internal Cell Potentials • Currents • Temperatures	• Sizes • Weights • Microscopic Pictures • ICP Data
Format	CSV time series	Binary file with Matlab parsing script	Text Files, jpeg, Excel
Metadata	• Measurement Program • Cell ID • Time • Further measurement conditions (e.g. ageing test the cell is part of)	• Simulation revision • Parameter set (Stripped XML File)	• Protocol of cell opening • Cell ID

Siemens

Some of the simulation results in WP1 (data produced by the simulators, not the models and simulator themselves) may be considered as open: if the data used for parameterizing the models is be public or if the partners give their approval for making simulation results public.

TU/e

WP	**Data**	**Format**	**Metadata**
WP1	Implemented battery simulation models Implementation of parameter estimation procedures	Matlab	Documentation of the simulation models
WP3	Simulation models implementing range estimation techniques	Matlab and AmeSIM	Documentation of the simulation models

TUM

Task	Author	Publication	Existing dataset used	Dataset generated
T5.3	Ilya Zilberman	Statistical analysis of self-discharge in lithium-ion cells		1.1 Check Up and EIS Measurement of 48 LG MJ1 cells: Distribution of the capacity and of the impedance 1.2 OCV measurement of 48 LG MJ1 cells 1.3 Self-discharge measurement of 24 LG MJ1 cells (SOC, T) 1.4 Correlation analysis between single cell parameters 1.5 Simulation of the influence of different self-discharge rates on the cell voltage within the battery pack
T5.3	Ilya Zilberman	Influence of cell-to-cell variations, thermal conditions and balancing on the scalability of large lithium-ion battery packs	1.1, 1.2, 1.3, 1.5	Thermal characterization 2.1 Heat capacity measurement of the LG MJ1 cell 2.2 Heat generation measurement over the whole SOC range for 0.2C, 0.5C and 1C charge and discharge Electrical characterization 2.3 EIS and pulse measurements (SOC, T) 2.4 Simulation of electrical long-term and short-term behaviour of a battery pack with different balancing circuits
T5.3	Ilya Zilberman	Analysis of balancing effort during the ageing of the battery module	1.5, 2.4	3.1 Module aging data with controlled temperature gradient 3.2 Balancing effort during the aging of the module
T5.4	Sebastian Ludwig	Multi-objective non-dissipative balancing	2.4	4.1 Temperature distribution of a battery module during a driving profile with applied multi-objective non-dissipative balancing
T1.1	Johannes Sturm	Multi-dimensional simulation of internal short circuits	ECM parameters (RWTH)	4.2 Progression of the temperature within the cell during an internal short circuit 4.3 Progression of the voltage during an internal short circuit 4.4 Influence of different cooling conditions for a state of the battery for an internal short circuit
T1.2	Johannes Sturm	Internal cell state estimation via electro chemical based EKF	ECM parameters (RWTH)	5.1 Different approximation methods for solid state diffusion 5.2 Estimation of the anode potential with Extended Kalman Filter (EKF) during CCCV charge

TUV SUD

TUV SUD performs electrical cell measurements and cycling tests (WP2) and abuse tests (WP4). These tests are recorded in great detail (15 Gb from 5 Cell tests) because it might be useful also for other partners at a further stage in the project.

	Electrical cell measurements and cycling (WP2)	**Abuse Testing on Cells and Packs (WP4)**
Data	• Voltage • Current • Temperature • Impedance data	• Voltage • Current • Temperature • Videos • Photos
Format	• CSV • Open source video and picture codecs	• CSV • Open source video and picture codecs
Metadata	Test report containing: • Measurement Program • Cell ID • Time • Further experiment information if needed	Test report containing: • Measurement Program • Test Set-up • Cell/Pack ID • Time • Further experiment information if needed

VITO

1. Data Summary	
What is the purpose of the data collection/generation and its relation to the objectives of the project?	The tests consist of ageing commercial Li-ion cells within several stress conditions (temperature, current, …). The results will allow to better understand how these cells age when exposed to these conditions which can be similar to the conditions that the cells will undergo in an electric vehicle. Additionally these tests will be used to build an ageing model that can estimate the state of health of a battery and also predict its lifetime.
What types and formats of data will the project generate/collect?	The ageing tests will generate measurements collected at cell level. The data will contain time, current, voltage, impedance and temperature values.
Will you re-use any existing data and how?	We might use some data collected from previous EU projects.
What is the origin of the data?	The data will be generated from experimental measurements.
What is the expected size of the data?	Some gigabits
To whom might it be useful ('data utility')?	Researchers working on Li-ion battery ageing; Li-ion battery user in automotive applications
2. FAIR data	
Are the data produced and/or used in the project discoverable with metadata, identifiable and locatable by means of a standard identification mechanism (e.g. persistent and unique identifiers such as Digital Object Identifiers)?	We can use metadata according to standards.
What naming conventions do you follow?	A naming agreed within the consortium.

Will search keywords be provided that optimize possibilities for re-use?	yes
Do you provide clear version numbers?	yes
What metadata will be created? In case metadata standards do not exist in your discipline, please outline what type of metadata will be created and how.	An excel file with an overview of all the tests is usually created which makes easier to follow up the tests and to identify the test conditions and results.

VOLTIA & VDL ETS

As demonstrator partners, VOLTIA and VDL ETS, can support the other participants by supplying real vehicle data of their existing e-fleet to help verifying and optimising algorithms and models. In the final year, VOLTIA and VDL ETS also play a role in the real life validation of the EVERLASTING BMS features in their respective electric vehicles.

Task	Author	Existing dataset used	Dataset generated
T3.1 T3.3	VOLTIA	Driving data from operation of electric utility vans. The data consists of: GPS coordinates, driving range, battery SOC, maximal, current and average speed, voltage, current, energy flow, temperature on cell and pack level. Monitored vehicles have been driven more than 1 million km cumulatively.	Driving data from operation of electric utility vans. Measurement of data during specially designed driving profiles: voltage, current and SOC will be measured with high data sampling rate (5Hz).
T5.1	VOLTIA	-	Experimental validation of prototype of passive cooling system of battery pack
T7.5	VOLTIA, TÜV SÜD	-	Measurement of electrical, thermal and functional parameters of demonstrator battery pack.

3 CONCLUSIONS

EVERLASTING Deliverable D8.2 "Data Management Plan" must be considered as a "**living document**" and will be updated when important updates are available: new datasets, updates on existing datasets, changes in consortium policies (e.g. on exploitation of results, patenting, …) or other external reasons (e.g. changes in consortium members, suggestions from advisory board, …).

The scope of this **first version of the EVERLASTING DMP** contains the current status of reflection within the consortium about the overall types of data that will be collected or produced during the project and on the way how and what data will be made open available to external stakeholders like research institutes, companies, … The different data repositories for the EVERLASTING research data have been set-up and/or identified.

In the **next version of the EVERLASTING DMP**, more detailed datasets and their specific handling will be described. The DMP will be updated as a minimum in time with the periodic evaluation/assessment of the project. This update will be in parallel with the update of **D8.1 "Dissemination and exploitation plan"**.