EVERLASTING

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

D8.1 - Dissemination and exploitation plan (M18 Update)

February 2018

Public Version

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PROJECT SHEET	
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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*
Website	www.everlasting-project.eu

DELIVERABLE SHEET	
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Lead Beneficiary	TU/e
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V0.1	16/02/2018	Will Hendrix (TU/e) Lead Beneficiary	First draft
V0.2	19/02/2018	Tijs Donkers	Modified report structure, now with direct mapping to WP8 tasks
V0.3	23/02/2018	Carlo Mol (VITO)	Complete V0.2 with final information
V0.4	26/02/2018	Will Hendrix (TU/e)	Finalize D8.1 version M18
V0.5	27/02/2018	All Partners	Final review D8.1 version M18 Web statistics added, Public version created
V1.0	28/02/2018	Carlo Mol (VITO)	Submission to the EC: D8.1 version M18

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EXECUTIVE SUMMARY

This Plan for Exploitation and Dissemination of Results (PEDR) is a document that will guide and report project exploitation and dissemination activities. The document will evolve in the course of the project. A first version has been issued in M6 (February 2017) and is mainly based on the Impact chapter of the EVERLASTING project proposal. Updated versions will be issued at each reporting period, which is at M18 and M36 with a final version at M48.

For both exploitation and dissemination activities the subsequent versions of the report present the general strategies and approaches, a status update on the completed activities and an overview of the planned activities. Depending on the work progress and the (intermediate) results, but also on developments in the project's technology field outside the project, specific strategic approaches and planned activities might be tuned to achieve maximum impact. The Exploitation and Dissemination Team formed by project partners TU/e and VDL ETS will monitor and steer the exploitation and dissemination activities and will take all necessary measures to enlarge the innovation potential and impact of the project.

Up till now the following has been achieved:

- 2 journal papers have been published
- 2 journal papers have been accepted for publication
- 3 journal papers are under review
- 2 refereed conference papers have been published
- 1 refereed conference paper has been accepted
- 9 non-refereed conference publications have been presented
- 2 non-refereed conference papers have been accepted for presentation
- 3 white papers have been written published on the EVERLASTING website
- 11 Public Deliverables have been written and published on the EVERLASTING website
- The project has been presented at 4 public events

- 9 Exploitation activities have been registered

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List of Abbreviations and Acronyms

ACRONYM	DEFINITION
WP	Work package
WPL	Work package leader
DOW	Description of Work
PEDR	Plan for Exploitation and Dissemination of Results
BMS	Battery Management System
SOC	State-of-Charge
SOF	State-of-Function
SOH	State-of-Health
RDM	Research Data Management

INTRODUCTION

This Plan for Exploitation and Dissemination of Results (PEDR) is divided in two main parts, with a similar structure for each part.

Chapter 1 will focus on exploitation of results. Section 1.1 will first explain the general strategy and approaches that the project consortium has agreed upon. In section 1.2 the completed activities up to the date of this report's appearance are listed and described including any IP settlements that were needed. Section 1.3 described the future planned exploitation activities looking ahead for a period that at least includes the next PEDR update.

Chapter 2 will focus on dissemination activities. Again section 2.1 will describe the general strategies and approaches, section 2.2 the completed dissemination activities and section 2.3 the planned activities for the coming period.

With this structure the document gives the required flexibility to incorporate periodic updates and modifications if project progress and results ask for this.

1 EXPLOITATION

1.1 EXPLOITATION STRATEGY AND APPROACH

1.1.1 PARTNER'S EXPLOITATION INTERESTS

The activities regarding exploitation of results is very much based on every partner's particular interest in the project research and development topics as formulated below.

VITO. VITO's battery related research activities are embedded in a mid- and long-term roadmap governed within the EnergyVille cooperation with the University of Leuven, IMEC and the University of Hasselt. The EVERLASTING project will support VITO in realizing important parts of this research roadmap mainly by enabling the validation of concept ideas and the development of technologies towards a higher TRL. In this perspective the project nicely links with recently closed or running projects like MAT4BAT, SPICY and NAIADES. Within the EVERLASTING project, VITO will gain more in depth knowledge and expertise in assessing the state of health of a battery, how to implement this on a battery management system (BMS) and relate this to a battery state of function. Next to this, innovative active thermal management techniques will be developed to extend the battery's lifetime. The project provides the opportunity to have demonstrations outside the lab environment, closing the gap towards market exploitation. Thanks to this, VITO will be able to make an important technology transfer by licensing innovative BMS features to commercial partners, boosting the future research activities. As a research institute, VITO will also maintain its strong position in the field by disseminating on the project results via high quality scientific publications.

CEA. Although no direct impacts on employment or any deployment in activity or changes in strategies can be foreseen for CEA, its substantial activity in the project on battery safety management is certainly an important commitment for future activities. Indeed, renewable energies and energy efficiency are two of the 3 main research programs led by CEA-LITEN. Inside these two programs, electrochemical storage for transport and stationary applications are key activities bound by industrial collaborations (e.g. Renault, Alstom). The project output on '*new model-based tooling & methods for smart detection and prediction of safety hazards*' will be of strategic importance within this context to consolidate and enlarge CEA R&D activities in the field.

Siemens PLM. The EVERLASTING project will allow Siemens PLM to extend its software sales to battery control business, as previously done for other automotive domains. These results combined with the IMPROVE project's one will enable a complete and validated EV offer, covering simulation, controls and RT models for HiL. An ESS solution growth of 100% over the 3 years after the end of the project is expected. Current market size and Siemens business shares couldn't be disclosed. In terms of employment, EVERLASTING will contribute to the Siemens French team's skill and support their growth in France.

TU Munich (TUM). The participation of TUM in the EVERLASTING project will give its researchers and students a foundation to grow and continue current research activities on Battery Management topics. Academic and industrial partners within the consortium will establish a network for scientific exchange, allowing Master and PhD students to complete their internships outside Germany. It will not only form new long-term international relations for future projects, additionally it will also have a positive impact on lecture and seminar quality.

TÜV SÜD. The EVERLASTING project will allow TÜV SÜD to improve its knowledge for test setups and testing of cells, modules and packs with the aim to customer service. This can be offered by the compiled knowledge as well as the new test procedure. The scientific and technical prospects of success 1-3 years after project end are to be seen in the removal of the test benches what becomes

possible by the compiled knowledge. During the following two years originate the other individual testing methods which check even more typically the security of cells, modules and packs. From 5 years manufacturers are supported in cell, module and pack development, while easy and adaptable tests can be carried out. This project has no direct impacts on employment or any deployment in activity or changes in strategies.

ALGOLiON. This project will provide ALGOLiON with an excellent opportunity to evaluate its safety predictive algorithms on cells made with real and proxy internal shorts created by a variety of methods. The project also provides a means for the company to gain experience in integrating its algorithms with the host BMS in the Demonstrator for predicting/early warning of internally developed shorts, monitoring dc internal resistance, and data processing techniques and analysis. Finally, cooperation with project partners who may be potential customers and academic institutions for providing basic knowledge.

RWTH Aachen. The project will allow RWTH Aachen to continue and extend research on battery modeling and management – specifically in parameterizing and applying physical models to be integrated on embedded systems. This generates employments for new researchers and opens new research aspects for dissertations and final theses for students in the section of electronics / software development and battery fundamentals research. In long term view the gained knowledge is used for a better education of students in lectures and seminars. The publication of highly relevant research results will strengthen the visibility of RWTH Aachen and further improve the dialog in the international research community.

LION Smart GmbH. EVERLASTING will support LION Smart with the unique opportunity of assimilating the company's own developments in its production cycles, while simultaneously gathering the accumulated experience provided by the leading institutions that share the consortium's membership. To broaden and to strength those valuable relationships will be an important revenue for LION Smart during the cooperation within EVERLASTING. Especially valuable for the company will be to lead and to participate in the activities of formulation, validation and further dissemination of a new technical standard of Battery Management Systems due to, among other reasons, the early possibility of discussing and formulating as a standard what it is the consortium's shared concept of a standardized BMS. From the most general point of view, EVERLASTING will consolidate the presence and prestige of the organization in the field of the ion-lithium batteries and its managements systems and, in particular, in the young sector of the electro mobility.

TU/e. The EVERLASTING project allows TU/e to collaborate with industries, thereby providing novel research questions to TU/e. Also, these industrial/academic collaborations will give TU/e access to state-of-the-art demonstrators and real-vehicle measurement date, which allows TRLs to be achieved that are not possible within the existing facilities of the TU/e. Finally, it should be noted that TU/e is also an institute of higher education. This means that this project allows establishing long-term contacts to participate in student exchange programs and to set up internships. Finally, because of intensive collaborations between TU/e and industries, TU/e graduates might find a way to becoming future employees of the industrial parties involved in the project.

Voltia. With the availability of a standardized BMS, Voltia expects to increase the reliability of its battery packs and to slightly decrease their prices. This will result in a more affordable and attractive product for a bigger end-user group. Realistically, a better product could directly lead to two to three times' increase of the end-user portfolio, which is equivalent to an increment of five to ten new end-users in the next year after project completion. New clients will bring adequate revenues, but will also require new products in order to serve them appropriately. We expect to triple our team within the next 5 years. Voltia is at the beginning of its international expansion and it is planned to cover 7 EU countries till 2020. The correct battery health monitoring has influence in a better second-life battery utilization. Based on findings and data of EVERLASTING project, Voltia is expecting to develop its new products/services in the area of stationary energy storage application.

VDL ETS. The EVERLASTING project allows VDL ETS to improve its knowledge and models with the aim to further reduce the energy consumption of hybrid and fully electric buses. With the growing demand of low CO2 foot print transport in our cities the demand for fully electric buses will grow very fast; every city or route in the city will need a specific solution for their operations. So without an affordable control system and simulation models this growing demand of customized CO2 optimized transport solutions will be blocked by the high costs of the traditional integration processes and the limitations of the current testing methods. It is impossible to have extensive road- and functional tests for every customized adapted low series of buses or their components.

1.1.2 IPR MANAGEMENT

Any exploitation activity will be subject to the procedures on ownership of results and transfer of ownership as laid down in article 8.1, 8.2, and 8.3 of the Consortium Agreement.

1.2 COMPLETED AND ON-GOING EXPLOITATION ACTIVITIES

Exploitation activities based on results from the Everlasting project will be registered by the partners using the following simple form.

EVERLASTING EXPLOITATION ACTIVITY	
Registration number	*Use <partner shortname>_<number>, for example VDLETS_001*
Title	*Descriptive title of the activity.*
Date	*Date of registration through this form on EVERLASTING Share point*
Reported by	<partner>, <name>, <email address> *The person who registers will be considered as the main contact person for this particular activity.*
Description of activity	*Briefly describe the activity. Indicate how EVERLASTING project work contributed to your company's product/service development, R&D choices, company strategic policies etc..*
Joint ownership	YES/NO *Is the IP that lead to the results and this exploitation activity owned by more partners?*
Partners involved	*If the results have been obtained in collaboration with other EVERLASTING partners, list the partners that were involved.*
WP tasks	*What are the WP tasks that directly relate to this exploitation activity*
Status	*At the time of registering this activity, what is the status (exploring possibilities, negotiating IPR with joint owners, completed etc..)* *What are the envisioned next steps?*
Nature	PUBLIC/CONFIDENTIAL *Do you want this exploitation activity to be reported in the confidential part of the Plan for Exploitation and Dissemination (PEDR), or can it be reported Public?*

Notes:

1. Also register Exploitation activities that are not finalized yet. If at a later stage a registered exploitation activity will be stopped this can also be reported.
2. When saving the registration form on the EVERLASTING Sharepoint (*Workpackages/WP8 - Dissemination/T8.5 – Exploitation and IPR Management* , use a file name constructed as follows:
   EXPACT_<partner shortname>_<number>.doc , so for example: **EXPACT_VDL_001.doc**
   The partners is the one who is the main contact, use a number if you have multiple exploitation activities.

When submitting the M18 update of the PEDR, 9 forms have been filled, presenting various exploitation activities by the Everlasting partners. These forms can be found in Appendix A of this report. As the partners would like to keep the planned and on-going exploitation confidential this appendix will not be added to the public available version of the PEDR.

1.3 FUTURE EXPLOITATION ACTIVITIES

The EVERLASTING consortium consists of a complementary mix of industrial parties, who can valorize the results directly and universities and research organisations, who can valorize the results indirectly through subsequent cooperation with industrial partners or by founding spin-offs. The table below gives an overview of the exploitation opportunities.

Exploitation mechanism	Exploitable foreground	Partner
Software as a Product (SaaP) for sale and/or license	Advances in knowledge, safety, battery control	ALGOLiON
Software as a Service (SaaS) for sale and/or license	Improved device user experience, data base for machine learning and crowd-sourcing	ALGOLiON
Application for BMS communication with cloud servers	Novel data recording, storage, transmission and analysis technology	ALGOLiON
Use in industrial bilateral and collaborative projects at national and European level	Novel algorithmic architectures for early detection of thermal runaways	ALGOLiON
Use in industrial bilateral and collaborative projects at national and European level	Novel algorithmic architectures for early detection of thermal runaways	CEA
Use internally on CEA battery platform to consolidate current know-how in the field. Will also be exploited for industrial bilateral and collaborative projects at national and European levels.	New knowledge on degradation of Li-ion materials/components/cells in overuse and abuse conditions.	CEA
Use in industrial bilateral and collaborative projects at national and European level	New knowledge on PCM design, PCM integration into battery systems and passive thermal management efficiency	CEA
Use in industrial bilateral and collaborative projects at national and European level	New knowledge on critical degradation roots and kinetics. New software tool for safety prediction and safe battery design.	CEA
Product	Safer and more reliable mechanical architecture of battery pack	Voltia
Product	Advanced battery management systems for battery packs of electric utility vans.	Voltia
Service	E-mobility services based on pay-per-km principle offered by EVs with prolonged drive range	Voltia
Service	Acquisition of precise and standardized SoH records for EV battery second life usage	Voltia
Exploitation through spin-off Batterie Ingenieure	Advanced BMS hardware and software	RWTH
Engineering services for European industry partners	New knowledge in advanced BMS systems	RWTH
Product	New features, models and demonstrators in our Electrochemical Storage Systems (ESS) library of our Amesim product: new battery models, identification/reduction tools (fast models), BMS detailed coupling and methodologies.	Siemens
Licensing	Physico-chemical state estimation model for BMS application	TUM
Licensing	Optimal balancing algorithm for non-dissipative circuits	TUM
Use in industrial bilateral and collaborative projects at national and European level	Highly modular prototyping BMS hardware and software platform for research purposes	TUM
Service	Testing according to new BMS testing standard proposal	TÜV SÜD, VITO
Licensing	Battery reconfiguration architecture and algorithm	VITO
Use in industrial bilateral and collaborative projects at national and European level	Self-learning algorithms for the estimation of battery SoH	VITO
Licensing	Efficient heat-pump architectures	VITO
Software as a Product (SaaP) as a Service (SaaS), for sale and/or license. Use in industrial bilateral and collaborative projects at national and European level	Application Programming Interfaces for the implementation of Safety Features, data Transmission, States Estimations, Graphical User Interfaces and Network Communications in BMS	LION Smart

Software as a Product (SaaP) as a Service (SaaS), for sale and/or license. Use in industrial bilateral and collaborative projects at national and European level	Hardware Abstraction Layers for BMS	LION Smart
Software as a Product (SaaP) as a Service (SaaS), for sale and/or license. Use in industrial bilateral and collaborative projects at national and European level	Implementation of Complex, single cells States Estimation Algorithm on Open Computing Language	LION Smart
Product. Use in industrial bilateral and collaborative projects at national and European level	Standardized-modular BMS hardware and software, also as part of a demonstrator	LION Smart
Product	New features, models and controllers for newly produced buses in order to improve the total cost of ownership (TCO).	VDL ETS
Service	Improved energy management model to be able to provide a better estimation of the range, battery life and energy consumption to VDL customers.	VDL ETS
Use in industrial bilateral and collaborative projects at national and European level	New knowledge on models integration in (test) vehicles and control development.	VDL ETS
Product	BMS Standard proposal	All

2 DISSEMINATION

2.1 DISSEMINATION STRATEGY AND APPROACH

In the world of EV (and stationary) batteries, the focus is almost exclusively on battery materials. Battery management systems are almost entirely neglected or considered to be a 'necessary evil'. Obviously battery chemistry and cell design are main determinants of the system behaviour. Nevertheless the battery management can also play a major role by reducing certain drawbacks of the battery chemistry or even enabling promising battery types that would not be possible without a powerful BMS. To raise awareness on this vital and positive role of the BMS, the consortium will write a number of white papers (1-3 pages) that will be distributed via the EVERLASTING website and by the partners. The target audience of these white papers will be the 'general technical public', not the battery (management) experts.

2.1.1 DISSEMINATION OF SCIENTIFIC RESULTS (TASK 8.3 AND TASK 8.4)

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 on scientific conferences and events

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, data necessary for the verification of results published in scientific papers will be made accessible in a data repository according to the approaches as described in the Data Management Plan (D8.2). Only in case this data contains confidential information it will be stored under embargo and will be opened for use after protection is no longer needed. The decision concerning the publication of data will be made by the decision-making bodies of the consortium. Details on the agreed procedures regarding dissemination have been described in the Consortium Agreement (Article 8.4). All scientific publications will be done through 'open access' and can also be found on the project web site. Further details concerning the research data management (specification of datasets, underlying database management system, accessibility, etc.) will be

specified in a data management plan which will be elaborated in Task 8.2 'Data management planning'. Like the PEDR, the data management plan will also be a "living document" with regular updates whenever important changes occur in the available datasets like e.g. in the underlying data of scientific publications.

Targeted publications and presentations		
Timing	Publications	Presentations
Year 1	1	2
Year 2	5	6
Year 3	5	6
Year 4	5	6
Total	**16**	**20**

The following peer reviewed scientific journals have been identified as possible targets:

- Journal of the Electrochemical Society
- Journal of Power Sources
- World Electric Vehicle Journal
- International Journal of Electric and Hybrid Vehicles
- IEEE Transactions on Signal Processing
- IEEE Transactions on Control System Technology
- Applied Energy
- Journal of Applied Physics
- International Journal of Energy Research
- Power Electronics Journal
- Journal of Electrical Storage

The following scientific conferences will be targeted:

- International Meeting on Lithium-ion Batteries (IMLB)
- Electrochemical Society Meetings (ECS)
- Advanced Automotive Battery Conference (AABC)
- Power our Future (organised by CIC)
- Industrial Conference on Acoustics, Speech and Signal Processing (ICASSP)
- Lithium Battery Power and Safety
- IFAC World Congress and Advances in Automotive Control
- IEEE Conference on Decision and Control
- Vehicle Power and Propulsion Conference (VPPC)
- International Telecommunications Conference (INTELEC)
- Kraftwerk Batterie

A considerable part of the EVERLASTING project is focused on the development of a standard interface and architecture, which will be publicly shared with the rest of the industry. A workshop (probably at an existing automotive or EV event such as the Advanced Automotive Batteries Conference, AutoMechanika…) will be organized to involve industry stakeholders

2.1.2 Interaction with Advisory Board (Task 8.6)

The partners in the project are supported by an Advisory Board. This advisory board consists of a panel of experts, which can provide input to the project. The members of the Advisory Board, which are independent from the project consortium will be consulted at key stages of the project, will follow the project progress and will provide feedback on main deliverables:

- Feedback on progress of standardization working groups in the field of battery management system architecture, progress on other research projects at national, European or international level
- Assistance to write recommendations in line with standardization organizations expectations, for a fast dissemination and integration.

The consortiums aims to include AB members from different application areas (like aviation and maritime) as a complement to the automotive focus the project has. This will increase the impact and valorisation potential.

2.1.3 Interaction with complementary projects (Task 8.7)

The hurdles for the introduction of electric vehicles can only be tackled by a system-wide approach. Therefore time and resources will be reserved for interaction and alignment with other projects in the GV8-2015 call (NeMo and Electrific), on the complementary topics of EV architecture and integration with the IT and charging infrastructure. Through this interaction, opportunities for dissemination and exploitation of the results across the consortia will emerge.

2.1.4 Public Website (Task 8.8)

The public website will contain general information about the project (background, objectives and so on) and the partners. Moreover, it will publish all public deliverables and dissemination materials.

2.1.5 White Papers (Task 8.9)

To raise the awareness of the vital and positive role of battery management systems, a three-monthly white paper will be written on a general BMS topics, aimed at a general technical public (not BMS experts). These white papers are 1-3 pages long and will be distributed via the EVERLASTING website and through the partners. In paragraph 2.2.6 the list of white papers already published can be found.

2.1.6 Other dissemination activities

EVERLASTING project will make results available to parties outside the project consortium in the following way:

- Taking into account the important contribution of academic partners in the EVERLASTING project and their natural role to use the knowledge gained for education and further research, a number of the EVERLASTING results will be spread among students and academic partners.
- The demonstrators developed in WP7 will be shown to the general public and this will be an additional opportunity to share results of the EVERLASTING project through presentations and workshops and to raise the awareness and interest of the relevant industrial and non-industrial parties.

2.2 COMPLETED AND ON-GOING DISSEMINATION ACTIVITIES

2.2.1 SCIENTIFIC PUBLICATIONS (TASK 8.3)

Journal Publications								
Lead partner	WP	Status	Open access	RDM	Year	Authors	Title	Journal
TUM	1	Published	Gold	Data DOI: https://doi.org/10.4121/uuid:c10a6b3f-efe9-41ce-99f6-4093df68c653	2017	J. Sturm, F.B. Spingler, B. Rieger, A. Rheinfeld, A. Jossen	Non-Destructive Detection of Local Aging in Lithium-Ion Pouch Cells by Multi-Directional Laser Scanning	Journal of the Electrochemical Society
TUE	1	Published	Gold	No	2017	L. Xia, E. Najafi, Z. Li, H.J. Bergveld, M.C.F. Donkers	A computationally efficient implementation of a full and reduced-order electrochemistry-based model for Li-ion batteries	Applied Energy
TUE	3	Accepted	Green	No	2018	T.C.J. Romijn, M.C.F. Donkers, J.T.B.A. Kessels, Siep Weiland	Real-time Distributed Energy Management for Complete Vehicle Energy Management	IEEE Trans Control Systems Technology
TUE	1	Accepted	Green	Data DOI: https://doi.org/10.4121/uuid:0d19258e-8fe2-44b7-b390-cfc205669528	2018	N. Jin, D. Danilov, P.M.J. Van den Hof, M.C.F. Donkers	Parameter Estimation of an Electrochemistry-based Lithium-ion battery model using a Two-Step Procedure and Sensitivity Analysis	Int J Energy Research

Refereed Conference Publications								
Lead partner	WP	Status	Open access	RDM	Year	Authors	Title	Conference
TUE	3	Published	Gold	No	2017	Z. Khalik, T.C.J. Romijn, M.C.F. Donkers	Effects of Battery Charge Acceptance and Battery Aging in Complete Vehicle Energy Management	IFAC World Congress, Toulouse, France
TUE	1	Published	Gold	No	2017	L. Xia, E. Najafi, H.J. Bergveld, M.C.F. Donkers	A Fast Implementation of an Electrochemical Model of a Lithium-ion Battery	IFAC World Congress, Toulouse, France
TUE	3	Accepted	Green	No	2018	Z. Khalik, G.P. Padilla, T.C.J. Romijn, M.C.F. Donkers	Vehicle Energy Management with Ecodriving: A Sequential Quadratic Programming Approach with Dual Decomposition	American Control Conference, Milwauke, Wisconsin, USA

2.2.2 CONFERENCES AND PUBLIC EVENTS (TASK 8.4)

The aforementioned refereed conference papers have also been presented at the conference. Besides these presentations, the following presentations have been given or abstracts have been accepted for presentation.

Non-refereed Conference Publications (acceptance based on abstract. Paper not peer-reviewed or no paper at all)						
Lead partner	WP	Status	Year	Authors	Title	Conference
TUE	1	Presented	2017	E. Najafi, L. Xia, H.J. Bergveld, M.C.F. Donkers	Fast Simulation of an Electrochemical Model of a Lithium-ion Battery	Benelux Meeting on Systems and Control, Spa, Belgium
TUE	1	Presented	2017	D. Danilov, N. Jin, M.C.F. Donkers	Parameter Estimation of an Electrochemical Model of a Li-ion Battery Using Two-Stage Estimation Procedure	Benelux Meeting on Systems and Control, Spa, Belgium
TUM	1	Presented	2017	I. Zilberman, A. Jossen	Efficiency of Dissipative Balancing Systems	Batterie Forum Deutschland, Berlin, Germany
TUM	5	Abstract accepted	2018	I., F. Spingler, A. Rheinfeld, A. Jossen	Temperature Path Dependent Voltage and Thermal Expansion Hysteresis in Li-Ion Cells	233rd ECS Meeting, 13-05-2018, Seattle, USA.
TUM	1	Presented	2017	J. Sturm, F.B. Spingler, B. Rieger, A. Rheinfeld, A. Jossen	Non-Destructive Detection of Local Aging in Lithium-Ion Pouch Cells by Multi-Directional Laser Scanning	Kraftwerk Batterie, Aachen, Germany
TUM	1	Presented	2017	J. Sturm, A. Rheinfeld, A. Jossen	Modelling the Electrochemical-Thermal Behaviour of Cylindrical Lithium-Ion Cells under Internal Short Circuit Scenarios	ModVal14, Karlsruhe, Germany
CEA	4	Presented	2017	M. Gerard, M. Chandesris, L. Daniel, D. Buzon	Further insights into battery safety understanding and optimization: a multi-scale modeling approach coupled with advanced characterization	Int Battery Safety Workshop (IBSW), Albuquerque, USA
CEA	4	Presented	2017	A. Delaille, N. Guillet	In-operando techniques for battery monitoring and safety issues prevention	Int Battery Safety Workshop (IBSW), Albuquerque, USA
CEA	4	Presented	2017	N. Guillet, C. Primot, F. Degret, P.-X. Thivel	In-operando techniques for battery monitoring and safety issues prevention	EEVC, Geneva, Switserland
CEA	4	Presented	2017	N. Guillet, C. Primot, F. Degret, P.-X. Thivel	Acoustic emission and thermal flow measurement as in-operando techniques for battery monitoring and safety issues prevention	E-MRS, Strasbourg, France
TUE	3	Accepted	2018	G.P. Padilla, S. Weiland, M.C.F. Donkers	On Convexity of the Eco-driving Problem	Benelux Meeting on Systems and Control, Soesterberg, Netherlands

Other presentations						
Lead partner	WP	Status	Year	Presenter(s)	Title	Event
Voltia	7	Presented	2017	Mario Paroha		Electromobility Stakeholder Forum, Brussels, Belgium
Voltia	7	Presented	2017	Mario Paroha	Innovative ecotechnologies for a greener Europe	Project ECO INN DANUBE Kick-off event, Bratislava, Slovakia
Algolion	3	Presented	2017	Niles Fleisher	Early Warning Algorithm Diagnostics for Preventing Electric Vehicle Battery Fires	Conf on Future Automotive Technology, Munich, Germany
Algolion	3	Presented	2017	Niles Fleisher	International Cooperation in Transport EU Horizon 2020 Programme Green Vehicles: Smart, Green and Integrated Transport Calls	Fuel Choices and Smart Mobility 2017. 31-Oct-1 Nov 2017 Tel Aviv, Israel

EVERLASTING dissemination activities are also conducted via INEA and EGVI (European Green Vehicle Initiative).

EVERLASTING contributed to the INEA GV brochure and participated in the EGVI survey for the yearly monitoring report 2016. This yearly report is prepared by EGVI in collaboration with the European Commission to monitor and coordinate project evolution and achievements within the cPPP. EVERLASTING also contributed to the EGVI brochure in preparation for TRA2018 Vienna.

2.2.3 Advisory Board (Task 8.6)

The EVERLASTING Advisory Board (AB) currently has two members:

- Renault, France, contact person Michel Mensler and Samuel Cregut.
- Damen Shipyards, Netherlands, contact person Robert van Koperen.

As a first step, we had bilateral (teleconference) meetings with the individual AB members to (1) present the current status of the project and, (2) to hear what aspects of our project research are of special interest for every AB member. In particular,

- we visited Damen Shipyards on 4th of October 2017
- we have had a telephone call with Renault on 28th of September 2017.

The minutes of these meetings can be found in Appendix B of this report. Both companies would like to receive more detailed reporting on project results, based on this they could then give feedback and request for further interaction with specific partners that are closely aligned with their field of work.

The consortium will now see if the first Periodic Reporting, which nicely gives an overview of the current status and intermediate project results, could serve this purpose. If needed an NDA could be signed if the Periodic Report contains confidential information. Or another option is to derive an 'Advisory Board' version from the first Periodic Report. Also some of the confidential deliverables could be part of the information exchange between EVERLASTING partners and Advisory Board members.

People from Damen shipyards will visit the GA meeting at RWTH, Aachen on 5-6 March 2018. They will present the company and their work on electrification of ships, and will have first face-to-face discussions with EVERLASTING project partners.

2.2.4 INTERACTION WITH COMPLEMENTARY PROJECTS (TASK 8.7)

Contacts with complementary GV8 projects NeMo and Electrific have been further intensified.

A first bilateral meeting EVERLASTING-ELECTRIFIC was held at Gfi (Leuven, Belgium) in May 2017. During this first meeting both projects presented its objectives more in detail and first topics for further collaboration were detected.

The EVERLASTING Project Coordinator was also present at the first NeMo Stakeholder Forum in October 2017. At this forum topics for further collaboration were discussed.

2.2.5 PROJECT WEBSITE (TASK 8.8)

The EVERLASTING website has been launched in M3. Its URL is: http://everlasting-project.eu/. All project partnres have placed a link to the project website on their website to increase visibility:

- VITO: http://energyville.be/en/project/electric-vehicle-enhanced-range-lifetime-and-safety-through-ingenious-battery-management
- CEA: http://liten.cea.fr/cea-tech/liten/en/Pages/techno%20Energy%20Efficiency/LiionBatteries.aspx
- SIEMENS PLM: www.plm.automation.siemens.com/fr_fr/products/lms/imagine-lab/automotive/electrical-systems/electric-storage.shtml
- TUM: http://www.ees.ei.tum.de/en/research/everlasting/
- TUV SUD: www.tuev-sued.de/home-en/focus-topics/e-mobility/battery-testing
- ALGOLiON: www.algolion.com
- RWTH Aachen: https://www2.isea.rwth-aachen.de/de/content/everlasting-0
- LION SMART: *http://www.lionsmart.com/research-development/*
- TU/e: https://www.tue.nl/universiteit/faculteiten/electrical-engineering/onderzoek/onderzoeksgroepen/control-systems-cs/research/all-projects/electric-vehicle-enhanced-range-lifetime-and-safety-through-ingenious-battery-management-everlasting/
- VOLTIA: http://voltia.com/eu-projects
- VDL ETS: www.vdlets.nl/?page/6948682/Everlasting+Project.aspx

The project website is updated regularly and currently features the following Public Deliverable Reports:

Deliverable number	Deliverable title	WP	Lead beneficiary	Type	Due date
D8.4	Public website	WP8	TU/e	Website	M3
D6.1	Analysis of the state of the art on BMS	WP6	LION Smart	Report	M6
D6.2	Requirements and architecture concept of a highly modular prototyping hardware platform	WP6	TUM	Report	M6
D8.3	White Paper 01: BMS Functions	WP8	VITO	Report	M12
D8.5	White Paper 02: SoC Definition	WP8	VITO	Report	M15
D2.5	Proposed standard reliability test procedures for BMS	WP2	TUV-SUD	Report	M18
D8.1	Dissemination and exploitation plan (M18 Update)	WP8	TU/e	Report	M18
D8.2	Data management plan (M18 Update)	WP8	VITO	Report	M18
D8.6	White Paper 03: Evaluation of SoC accuracy	WP8	VITO	Report	M18

Below a screenshot of the website statistics for the year 2017.

Statistics for:	everlasting-project.eu
Last Update:	01 Jan 2018 - 05:29
Reported period:	Month Dec 2017

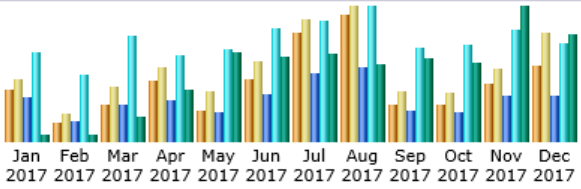
When:	Monthly history Days of month Days of week Hours
Who:	Countries Full list Hosts Full list Last visit Unresolved IP Address Robots/Spiders visitors Full list Last visit
Navigation:	Visits duration File type Downloads Full list Viewed Full list Entry Exit Operating Systems Versions Unknown Browsers Versions Unknown
Referrers:	Origin Referring search engines Referring sites Search Search Keyphrases Search Keywords
Others:	Miscellaneous HTTP Status codes Error Hits (404)

Summary

Reported period	Month Dec 2017				
First visit	01 Dec 2017 - 00:27				
Last visit	31 Dec 2017 - 22:45				
	Unique visitors	Number of visits	Pages	Hits	Bandwidth
Viewed traffic *	**1,630**	**2,338** (1.43 visits/visitor)	**5,388** (2.3 Pages/Visit)	**11,475** (4.9 Hits/Visit)	**3.71 GB** (1661.92 KB/Visit)
Not viewed traffic *			**15,701**	**22,436**	**524.26 MB**

* Not viewed traffic includes traffic generated by robots, worms, or replies with special HTTP status codes.

Monthly history



Month	Unique visitors	Number of visits	Pages	Hits	Bandwidth
Jan 2017	1,129	1,348	5,174	10,547	243.97 MB
Feb 2017	397	613	2,382	7,875	248.76 MB
Mar 2017	784	1,186	4,372	12,371	898.77 MB
Apr 2017	1,300	1,586	4,837	10,086	1.77 GB
May 2017	665	1,074	3,460	10,839	3.05 GB
Jun 2017	1,348	1,719	5,607	13,278	2.94 GB
Jul 2017	2,352	2,648	8,042	14,209	3.02 GB
Aug 2017	2,718	2,911	8,803	15,886	2.64 GB
Sep 2017	796	1,085	3,596	10,956	2.89 GB
Oct 2017	802	1,062	3,459	11,440	2.71 GB
Nov 2017	1,260	1,569	5,415	13,086	4.66 GB
Dec 2017	1,630	2,338	5,388	11,475	3.71 GB
Total	15,181	19,139	60,535	142,048	28.74 GB

Statistics for:	everlasting-project.eu
Last Update:	01 Jan 2018 - 05:29
Reported period:	Month Dec 2017

Close window

Downloads

Downloads	Hits	206 Hits	Bandwidth	Average size
/wp-content/uploads/2016/11/EVERLASTING_D6.1_final_20170228.pdf	870	387	3.28 GB	2.67 MB
/wp-content/uploads/2016/11/EVERLASTING_D6.2_final_20170228.pdf	41	20	28.29 MB	474.86 KB
/wp-content/uploads/2017/09/EVERLASTING_D8.1_final_20170228.pdf	34	6	29.75 MB	761.66 KB
/wp-content/uploads/2017/09/EVERLASTING_D8.2_final_20170428_DMP_...	30	14	19.73 MB	459.28 KB
/wp-content/uploads/2017/09/EVERLASTING_D8.3_final_20170831.pdf	26	7	13.52 MB	419.56 KB
/wp-content/uploads/2017/11/EVERLASTING_D8.5_final_20171130.pdf	26	2	15.25 MB	557.57 KB

2.2.6 WHITE PAPERS (TASK 8.9)

The following White Papers have been written and published on the Everlasting public website:

WHITE PAPER	DATE	TITLE
D8.3, White Paper 01	August 2017	BMS Functions
D8.5, White Paper 02	October 2017	SOC Definition
D8.6, White Paper 03	February 2018	Evaluation of SoC Accuracy

- **White Paper 01: BMS functions**
  In this white paper we discuss the reasons for having a BMS (safety, predictability…). We also list what functions are typically part of a BMS (balancing, SoC…), what functions can be considered to be optional and how typical BMS's are implemented. Last but not least we will discuss the extent to which a BMS is only monitoring or whether it should also be predicting and managing.
- **White Paper 02: The definition of SoC**
  In this paper we discuss the different possible definitions of SoC. SoC is based on battery capacity so first we discuss what is meant with capacity: is it the currently available capacity or the initial capacity. Furthermore, we will deal with remaining capacity: is it the remaining capacity under ideal circumstances or under the current circumstances? State-of-Function (SoF) will also be introduced in this context. Based on these different definitions, a number of different ways of calculating SoC can be distinguished, each with their own benefits and drawbacks. Last but not least we will deal with how to communicate SoC to the user in a clear and consistent way.
- **White Paper 03: Evaluation of SoC accuracy**
  In this white paper we will discuss how to evaluate the accuracy of an SoC estimation algorithm. We first have to agree on a reference measurement that we trust to be correct. It is often claimed that an algorithm is x% accurate but what does that mean? Is this the average error or the maximum error? Under which circumstances was this measured? What charge/discharge cycle was used? In order to be able to compare the accuracy of several algorithms, a standard definition and measuring procedure will be needed.

White papers are scheduled to be issued every three months starting from M12.

2.3 FUTURE DISSEMINATION ACTIVITIES

Following the 'dissemination strategy and approach' as described in section 2.1, the paragraphs below present the concrete lists of planned future dissemination activities. The lists will be updated frequently. As the project work progresses, new items will be added based on intermediate and expected results, items that have been completed will be removed and presented in section 2.2.

2.3.1 SCIENTIFIC PUBLICATIONS (TASK 8.3)

The following journal papers are under review:

Journal Publications								
Lead partner	WP	Status	Open access	RDM	Year	Authors	Title	Journal
RWTH	3	review	Yes	Yes		Markus Lelie, Thomas Braun, Marcus Knips, Hannes Nordmann, Florian Ringbeck, Hendrik Zappen, Dirk Uwe Sauer	Battery Management System Hardware Concepts, an Overview	Journal of Applied Sciences
TUM	5	review	Yes	Reserved DOI: https://doi.org/10.4121/uuid:65ed2b75-9cb7-469d-b55a-f4599e5b2126		Ilya Zilberman, Alexander Rheinfeld, Andreas Jossen	Uncertainties in Entropy due to Temperature Path Dependent Voltage Hysteresis in Li-Ion Cells	Journal of Power Sources
TUM	1	review	Yes	Yes		Johannes Sturm	State Estimation of Lithium-Ion Cells during Charging Scenarios using Extended Kalman Filtering based on Physicochemical Model	Journal of Applied Energy

Refereed Conference Publications								
Lead partner	WP	Status	Open access	RDM	Year	Authors	Title	Conference
TUE		planned	Yes	Yes	2018	tbd	tbd	Conf on Control Technology and Applications, 21-8-2018, Copenhagen, Denmark
TUE		planned	Yes	Yes	2018	tbd	tbd	Conf on Decision and Control, 17-12-2018, Miami Beach, USA.
CEA		planned	Yes	Yes	2018	tbd	tbd	Aimes 2018 ECS, 30-10-2018, Cancun, Mexico.

2.3.2 CONFERENCES AND PUBLIC EVENTS (TASK 8.4)

Abstracts have been submitted to the following conferences.

Non-refereed Conference Publications (acceptance based on abstract. Paper not peer-reviewed or no paper at all)						
Lead partner	WP	Status	Year	Authors	Title	Conference
RWTH	2	Abstract submitted	2018	Florian Ringbeck, Alexander Blömeke, Dirk Uwe Sauer	Requirements for Actively Controlled Impedance Measurements on Battery Management Systems	Electric Vehicle Symposium (EVS31), 30-09-2018, Kobe , Japan
TUM	5	Abstract submitted	2018	Ilya Zilberman, Andreas Jossen	Influence of Long-term Equalization Processes on the Voltage Based Self-discharge Measurements in Li-Ion Cells	International Meeting on Lithium Batteries, 17-06-2018, Kyoto, Japan.
VITO	All	Abstract submitted	2018	Carlo Mol	Joint NeMo-ELECTRIFIC-EVERLASTING session "Enabling electromobility services interoperability and enhanced performance of electric vehicles"	ITS World Congress, 17-21-9-2018, Copenhagen, Denmark.
VITO	2	Abstract submitted	2018	Khiem Trad	Poster: Cycle-life analysis of commercial lithium ion battery	Transport Research Arena, 16-04-2018, Vienna, Austria.
VITO	All	Abstract submitted	2018	Carlo Mol	EVERLASTING: Electric Vehicle Enhanced Range, Lifetime And Safety Through INGenious battery management	Electric Vehicle Symposium (EVS31), 30-09-2018, Kobe , Japan
TUM	1	Submitted	2018	Johannes Sturm	Comparison of Reduced Order Electrochemical Models and Multi-Physically coupled Models of a Lithium-Ion Cell during Fast Charging	International Meeting on Lithium Batteries, 17-06-2018, Kyoto, Japan.
TUM	1	Submitted	2018	Johannes Sturm	State Estimation of Lithium-Ion Cells using a Physicochemical Model based Extended Kalman Filter	15th Symposium on Modeling and Experimental Validation, 12-04-2018, Aarau, SUI

2.3.3 ADVISORY BOARD (TASK 8.6)

We tried to include Airbus in the AB, as the electrification of aviation would nicely complement the application fields we now have (passenger cars and ships). However, we did not succeed up to now since our original contact person at Airbus moved to another company. We are now trying our contacts inside Siemens as Siemens collaborates with Airbus on electric propulsion of aircrafts.

In addition, we recently have invited the innovative company Lilium (https://lilium.com/) to step into the Everlasting AB, we are hoping to receive their response soon. Lilium is developing small all-electric air-taxis.

Further interaction with the Advisory Board members will be set-up. The role of the Advisory Board members will grow during the project, when more research results become available. Especially related to the standardization activities an active contribution from the Advisory Board members is expected by giving feedback on progress of standardization working groups in the field of battery management system architecture, progress on other research projects at national, European or international level and assistance to write recommendations in line with standardization organizations expectations, for a fast dissemination and integration of the EVERLASTING results.

2.3.4 INTERACTION WITH COMPLEMENTARY PROJECTS (TASK 8.7)

The interaction with NeMo and ELECTRIFIC will be intensified in 2018 via further bilateral contacts between the project coordinators and common initiatives like e.g. the joint NeMo-ELECTRIFIC-EVERLASTING special session proposal within the framework of the ITS World Congress in Copenhagen (17-21 September 2018).

2.3.5 WEBSITE (TASK 8.8)

The website will be continuously updated. Besides updates on the project meetings and conferences that the partners will attend, the following list of planned Public deliverables that are due before the next Periodic Reporting (M36) will be made available:

Deliverable number	Deliverable title	WP number	Lead beneficiary	Type	Due date
D8.7	Three-monthly white paper; fourth issue	WP8	VITO	Report	M21
D8.8	Three-monthly white paper; fifth issue	WP8	VITO	Report	M24
D1.1	Report on electrochemical cell model	WP1	TUM	Report	M26
D8.9	Three-monthly white paper; sixth issue	WP8	VITO	Report	M27
D8.10	Three-monthly white paper; seventh issue	WP8	VITO	Report	M30
D6.7	Battery Management Standard	WP6	Lion Smart	Report	M31
D8.11	Three-monthly white paper; eighth issue	WP8	VITO	Report	M33
D1.2	Report on model order reduction	WP1	TUM	Report	M36
D1.3	Report on virtual test benches (MiL, SiL,HiL)	WP1	Siemens-PLM	Report	M36
D6.5	Application Programming Interface	WP6	Lion Smart	Report	M36
D8.12	Three-monthly white paper; ninth issue	WP8	VITO	Report	M36

2.3.6 WHITE PAPERS (TASK 8.9)

To raise the awareness of the vital and positive role of battery management systems, a three-monthly white paper will be written on a general BMS topics, aimed at a general technical public (not BMS experts). These white papers are 1-3 pages long and will be distributed via the EVERLASTING website and through the partners. In paragraph 2.2.6 the list of white papers already published can be found.

Here you can find a list of potential topics. This list can be updated based on feedback and requests we get from the readers:

- The definition of SoH
  In this white paper we will discuss the different possible definitions of SoH. In general, the SoH is a measure for the health of the battery. Depending on the application, the demands asked from the battery can vary. Does the health only involve the capacity that can be delivered or does it also take into account the internal resistance? Furthermore we will deal with how to communicate SoH in a clear and consistent way to the user.

- Evaluation of SoH accuracy
  In this white paper we will discuss how to evaluate the accuracy of SoH estimation. We first have to agree on a reference measurement that we trust to be correct. Another topic is the aging regime that is to be used to determine SoH accuracy. We will also briefly touch the ageing of a battery even when it is not used, calendar ageing, and the effect of temperature.
- Balancing: what vs how
  In this white paper we discuss a topic that is often given too little attention when discussing balancing. Most scientific papers on this topic deal with different electrical schemes to maximize the balancing current. However, another important aspect of balancing is deciding which current to apply to which cell: this is the so-called balancing strategy. We will explain that the balancing strategy is equally important as the electrical setup and smart combinations of both lead to the optimal balancing solution.
- Evaluation of balancing
  In this white paper we will discuss how to evaluate the performance of the balancing system. In most cases the maximum balancing current is given as a measure of performance, but as will be explained in the previous white paper, this is not entirely correct. Therefore we should evaluate the performance of the balancing system by measuring how well it is able to achieve its goal. So we will first define the goal of balancing. Is it used to maximize the module capacity or to reduce aging? In both cases the evaluation procedure will have to be different.
- Power capability
  Battery management systems often indicate the remaining energy that is left in the battery, but the power capability is not communicated. It is assumed to be constant and as specified in the datasheet of the battery. However, especially at low and high SoC, this can be different and in some cases it may be important to communicate this power capability. This relates to the State-of-Function (SoF) of a battery, a combination of SoC and SoH. We will offer a few ideas on how to calculate and communicate this measure.
- Energy management vs battery management
  In this white paper we will discuss the difference between battery management and energy management. We will list the features that are typically considered to be part of an energy management system and how these features are dependent on the features of the BMS.
- Battery management for different types of batteries
  Battery management systems are an accepted feature in Li-ion batteries, but their use with other types of batteries is discussed much less. In this white paper we will discuss whether battery management systems can be useful for other types of batteries (lead-acid, nickel-based, flow batteries…), what features would be useful and how they should be adapted.
- Thermal management
  Thermal management is an example of a feature that is often not considered to be part of a battery management system. In this white paper we discuss how this feature interacts with the features of a typical BMS (e.g. power capability).
- The future of BMS
  In this white paper we discuss the future of BMSs. Will BMSs still be needed? What will change? What features will become less important? What new features will be added ?

REFERENCES

EVERLASTING Consortium Agreement, 31-08-2016.

Fact Sheet, *The Plan for the Exploitation and Dissemination of Results in Horizon 2020*, European IPR Helpdesk, July 2015.

APPENDIX A: REGISTERED EXPLOITATION ACTIVITIES

Only available in the Confidential Version of this report.

APPENDIX B: BILATERAL MEETINGS WITH ADVISORY BOARD

Only available in the Confidential Version of this report.