

## EUROPEAN COMMISSION

HORIZON 2020 PROGRAMME - TOPIC H2020-LC-BAT-2019  
Strongly improved, highly performant and safe all solid-state batteries for  
electric vehicles.

GRANT AGREEMENT No. 875189



### **SAFELiMOVE – Deliverable Report**

<< D9.4 – Validated &  
improvement of  
SAFELiMOVE battery  
models >>

<b>Deliverable No.</b>	SAFELiMOVE D9.4	
<b>Related WP</b>	WP9	
<b>Deliverable Title</b>	Validated & improvement of SAFELiMOVE battery models	
<b>Deliverable Date</b>	2023-12-12	
<b>Deliverable Type</b>	REPORT	
<b>Dissemination level</b>	Confidential – member only (CO)	
<b>Written By</b>	Arpit Mishra (ABEE) Diego Del Olmo (CID) Jon Gastelurrutia (IKR)	2023-12-12
<b>Checked by</b>	Arpit Mishra (ABEE)	2023-12-15
<b>Reviewed by (if applicable)</b>	Maider Usabiaga (IKR)	2023-12-18
<b>Approved by</b>	Maria Martinez-Ibañez (CICe)	2023-12-21
<b>Status</b>	Final	2023-12-21

### *Disclaimer/ Acknowledgment*



Copyright ©, all rights reserved. This document or any part thereof may not be made public or disclosed, copied or otherwise reproduced or used in any form or by any means, without prior permission in writing from the SAFELiMOVE Consortium. Neither the SAFELiMOVE Consortium nor any of its members, their officers, employees or agents shall be liable or responsible, in negligence or otherwise, for any loss, damage or expense whatever sustained by any person as a result of the use, in any manner or form, of any knowledge, information or data contained in this document, or due to any inaccuracy, omission or error therein contained.

All Intellectual Property Rights, know-how and information provided by and/or arising from this document, such as designs, documentation, as well as preparatory material in that regard, is and shall remain the exclusive property of the SAFELiMOVE Consortium and any of its members or its licensors. Nothing contained in this document shall give, or shall be construed as giving, any right, title, ownership, interest, license or any other right in or to any IP, know-how and information.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 875189. The information and views set out in this publication does not necessarily reflect the official opinion of the European Commission. Neither the European Union institutions and bodies nor any person acting on their behalf, may be held responsible for the use which may be made of the information contained therein.

## Publishable summary

The document outlines two integral models developed in the SAFELiMOVE project: the pseudo-two-dimensional (p2d) model and the electrothermal model. The p2d model is a computational tool designed for pouch cell batteries, enabling the prediction of battery behavior across various conditions. This model is essential for addressing the challenges of upscaling from coin cells to pouch cells. It incorporates mechano-electrochemical aspects to simulate the internal stress within the cell during charge and discharge cycles, ensuring the model's relevance for real-world applications. Its validation against experimental data showcases its precision and reliability in battery performance simulation. Building upon the foundation of the p2d model, the electrothermal model presents a physical approach for analyzing thermal management in batteries. Utilizing Thévenin equivalent circuits and lumped heat transfer equations, it is calibrated against experimental data through non-linear parameter identification techniques, focusing on the physical phenomena rather than just data fitting. This model can simulate the thermal behavior of both single cells and battery modules, aiding in the pre-design phase to evaluate the necessity and efficiency of cooling systems. Such predictive capability is instrumental in optimizing thermal management strategies before empirical data collection, enhancing the early stages of battery module design.

## Appendix A- Acknowledgement

The author(s) would like to thank the partners in the project for their valuable comments on previous drafts and for performing the review.

### Project partners:

#	Partner	Partner Full Name
1	CICe	CENTRO DE INVESTIGACION COOPERATIVA DE ENERGIAS ALTERNATIVAS FUNDACION, CIC ENERGI GUNE FUNDAZIOA
2	SCHOTT	SCHOTT AG
3	UMICORE	UMICORE
4	HYDRO-QUEBEC	HYDRO-QUEBEC
5	SAFT	SAFT
6	RENAULT SAS	RENAULT SAS
7	TME	TOYOTA MOTOR EUROPE NV
8	IKERLAN	IKERLAN S. COOP
9	CEA	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
10	CIDETEC	FUNDACION CIDETEC
11	TUB	TECHNISCHE UNIVERSITAT BERLIN
12	RWTH AACHEN	RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN
13	ABEE	AVESTA BATTERY & ENERGY ENGINEERING
14	LCE Srl	LIFE CYCLE ENGINEERING SRL
15	UNIRESEARCH BV	UNIRESEARCH BV