SUBLIME

Solid state sUlfide Based LI-MEtal batteries for EV applications

D8.2: Interim IPR report & exploitation strategy & business plan

Jens EWALD
FEV

Boschidar GANEV
AIT

Jacqueline WINTER
AIT

Kathrin METSELAAR
Uniresearch

Sublime is funded by the European Union's H2020 research and innovation programme under GA Agreement no. 875028

Deliverable No.	SUBLIME D8.2	
Related WP	8	
Deliverable Title	Interim IPR report and exploitation strategy and business plan	
Deliverable Date	2022-04-29	
Deliverable Type	REPORT	
Dissemination level	Public (PU)	
Written By	Name author (Organisation short name) Jens EWALD (FEV) Boschidar GANEV (AIT) Jacqueline WINTER (AIT) Kathrin METSELAAR(UNR)	2022-04-24
Checked by	Boschidar GANEV (AIT)	2022-04-29
Reviewed by (if applicable)	Rahul GOPALKRISHNAN (ABEE)	2022-04-27
Approved by	Jens EWALD	2022-04-29
Status	Final	2022-04-29

Disclaimer / Acknowledgment

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 875028. 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

This Deliverable report has the intention to compile the Intellectual Property Report (IPR) with inputs from all project partners, and update the Exploitation Strategy as well as the SUBLIME business plan from the mid term of the project. The underlying target is to verify whether the project is considering the project results gained so far and the changes in global boundary conditions remains on track to maximise the impact of the current and future to be expected project results. This deliverable report will be superseded with an update report towards the end of SUBLIME.

Since the time when the proposal for SUBLIME was developed and the project had been started, on the political level several initiatives have been launched. The European Green Deal was announced by the president of the European Commission in December 2019 and decided in January 2020 by the European Parliament. „Fit for 55“ is the corresponding EU plan to reduce greenhouse gas by 55% based on the 1990 level targeted until 2030.

This strategy launched by the European Commission to tackle the implications of climate change focuses towards making the European Union „a net-zero emitter of greenhouse gases by 2050 and to demonstrate that economies will develop without increasing resource usage.“[1]

The present SUBLIME target and strategy complies with both initiatives, and will support with its output to reach the aforementioned goals.

The SUBLIME project has a dedicated IPR manager, whose responsibility is to support SUBLIME beneficiaries in identifying and fairly allocating any intellectual rights and contributions to project results, and in protecting results through intellectual property rights (IPRs), if applicable or desired. In case of jointly generated results, the IPR manager also supports joint IPR generation to ensure that workable and fair agreements can be reached quickly.

To acquire the information for the first step, the IPR manager conducted two rounds of qualitative telephone or video-conference interviews with each beneficiary – once in the timeframe January to March 2021, and then again in February and March 2022 as an update.
Subsequently, in April 2022 the WP8 leader held an exploitation workshop with the beneficiaries, where the results gathered in the preceding interviews were reviewed, refined, and further developed along the dimensions of protection (IPR) and exploitation. Finally, for each result, beneficiaries were requested to indicate the envisaged exploitation measures in the next one to two years as well as in the next three to five years. To update the status of the results, envisaged IPRs, and exploitation pathways, an update of all three domains is planned towards the end of the project, and the results will be reflected in *D8.3 Final IP report and exploitation strategy after SUBLIME – Roadmap to 2030*.

[1] https://en.wikipedia.org/wiki/European_Green_Deal

Count of the type of result, grouped by type of beneficiary. IND=industrial, RTO=Research and Technology Organisation, SME=Small and Medium-Sized Enterprise, UNI=university.

Beneficiary Type	Type of Result	Count of Type of Result
IND	Knowledge/skills	4
	Model	4
	Protocol	2
RTO	Data	4
	Knowledge/skills	11
	Model	2
	Process improvement	3
	Protocol	1
SME	Data	1
	Knowledge/skills	2
	Model	3
	Prototype(s)	1
UNI	Data	3
	Model	2
	Protocol	1

Primary expected exploitation measures in the next two years, by type of result.

Type of Result	Not sure yet	Use as input to standardisation	Use for customer-funded research	Use for further co-funded research	Use for product/service development
Data				4	
Knowledge/skills	1		1	7	
Model				7	2
Process improvement		1			
Protocol		1		2	
Prototype(s)				1	
Total	**1**	**2**	**1**	**21**	**2**

Secondary expected exploitation measures in the next two years, by type of result.

Type of Result	Not sure yet	Use for customer-funded research	Use for further co-funded research	Use for product/service development
Data				1
Knowledge/skills	1	3		1
Model		1	2	3
Process improvement				
Protocol				
Prototype(s)				1
Total	**1**	**4**	**2**	**6**

Contents

List of Tables

Abbreviations

SYMBOL	SHORTNAME
t	Time
EU	European Union
IND	Industrial
IPR	Intellectual Property Rights
NDA	Non-Disclosure Agreement
RTO	Research and Technology Organization
SME	Small and Medium Sized Enterprise
UNI	University
WP	Work Package

1 Introduction

This Deliverable report has the intention to compile the Intellectual Property Report (IPR) with inputs from all project partners, and to update the Exploitation Strategy as well as the SUBLIME business plan from the mid term of the project. The underlying target is to verify if the project is considering the project results gained so far and the changes in global boundary conditions remains on track to maximise the impact of the current and future to be expected project results. This deliverable report will be superseded with an update report towards the end of SUBLIME.

Since the time when the proposal for SUBLIME was developed and the project had been started, on the political level several initiatives have been launched. The European Green Deal was announced by the president of the European Commission in December 2019 and decided in January 2020 by the European Parliament. „Fit for 55“ is the corresponding EU plan to reduce greenhouse gas by 55% based on the 1990 level targeted until 2030.

This strategy launched by the European Commission to tackle the implications of climate change focuses towards making the European Union „a net-zero emitter of greenhouse gases by 2050 and to demonstrate that economies will develop without increasing resource usage.“[2]

The present SUBLIME target and strategy complies with both initiatives, and will support with its output to reach the aforementioned goals.

This report is structured as follows: In Chapter 2 the Methodology of Data Acquisition, conducted by the SUBLIME IPR manager and the expected results are explained. Raw information, which have been obtained mainly from partner interviews are given in Section 3.1. The interim IPR and the Exploitation Strategy are elaborated in Sections 3.2 and 3.3, respectively. The updated Business Plan is given in Section 3.4.

[2] https://en.wikipedia.org/wiki/European_Green_Deal

2 Methods and Results

2.1 Methodology of Data Acquisition and Update

The SUBLIME project has a dedicated IPR manager, whose responsibility is to support SUBLIME beneficiaries in identifying and fairly allocating any intellectual rights and contributions to project results, and in protecting results through intellectual property rights (IPRs), if applicable or desired. In case of jointly generated results, the IPR manager also supports joint IPR generation to ensure that workable and fair agreements can be reached quickly.

IPRs are understood as a means of protecting results generated in the project such that they may be (more effectively) exploited by the entities that generated them (or by those to whom the rights for exploitation may have been transferred). While the generation of IPRs is not mandatory, it can be a helpful measure to protect results from unfair or unlawful by exploitation by entities that were not involved in their generation or have not been granted exploitation rights.

IPRs may be applied to results, and results may be exploited in a variety of ways, depending on the organization and its objectives. To map the path from result generation through to (optional application of IPRs and subsequent) exploitation in SUBLIME, the following structured approach was taken for each beneficiary:

1. Identification of (expected) results
2. Determination whether the results are to be protected with IPRs (e.g. patents)
3. Determination of expected exploitation measures for each result.

To acquire the information for the first step, the IPR manager conducted two rounds of qualitative telephone or video-conference interviews with each beneficiary – once in the timeframe January to March 2021, and then again in February and March 2022 as an update.
Subsequently, in April 2022 the WP8 leader held an exploitation workshop with the beneficiaries, where the results gathered in the preceding interviews were reviewed, refined, and further developed along the dimensions of protection (IPR) and exploitation.

For each result, the qualitative data was further structured to allow later aggregate analysis:

- By result type (Data, Knowledge/skills, Model, Process improvement, Protocol, Prototype, or Other)
- By confidentiality (whether the results may be talked about vs. the SUBLIME Stakeholder group)
- Status of the result (Not started yet, Work in progress, Result hat materialized, No longer expected)
- By other partners involved in the generation of the result
- By WP in which the result was mainly generated.

Similarly, for each result the beneficiaries were asked whether any protection measures were envisaged to be applied to it. Possible answers were “file a patent”, “file a joint patent”, “keep it secret (NDA)”, “None”, “Not sure yet” or “Other”.

Finally, for each result, beneficiaries were requested to indicate the envisaged exploitation measures in the next one to two years as well as in the next three to five years. For each timeframe, partners were able to indicate up to two exploitation measures and this is reflected in tables 5, 6, 7, 9 and 10.
All results were tabulated in an Excel file for analysis. They are rendered in section 2.2. It should be noted that data on the path from expected result through to protection and exploitation was not fully populated in several instances, for which reason the totals across the different tables do not always add up/may appear inconsistent. This indicates on one hand an uncertainty on the part of beneficiaries, on the other hand missing data from some of them.

To update the status of the results, envisaged IPRs, and exploitation pathways, an update of all three domains is planned towards the end of the project, and the results will be reflected in *D8.3 Final IP report and exploitation strategy after SUBLIME – Roadmap to 2030*.

2.2 Expected Results, IPR and Exploitation

This section presents the data gathered according to the methodology described in the previous section.
The expected results per beneficiary and result type are in given Table 1.

Table 1: Expected results per beneficiary, and with classification of the type of result.

Beneficiary	Expected Results	Type of Result
ABEE	• P2D (particle 2D models) on cell level, calibrated with parameters from cell characterization	Model
	• A tool to simulate Li ion transport at various conditions within the solid electrolyte and the effect of different parameters	Model
	• Knowledge and data from cell characterisation.	Data
	• Protection layer candidates (inorganic) that can suppress dendrites	Prototype(s)
	• Model of dendrite growth under different conditions	Model
AIT	• Knowledge about problems/differences that occur during scale-up	Knowledge/skills
	• Knowledge about processing, formulation and integration of sulfide	Knowledge/skills
	• Knowledge about electrode processing	Knowledge/skills
CEA	• Knowledge about synthesis of sulfur active material for electrolyte, and subsequently optimized for conductivity	Process improvement
	• Knowledge about stability control of solid-state electrolyte	Knowledge/skills
	• Testing data from electrochemical testing of partners' single and multilayer pouch cells and samples	Data
CICE	• Atomistic model of sulfide electrolyte	Model
	• Knowledge about processing, formulation and integration of sulfide electrolyte into cells	Knowledge/skills
	• Knowledge about synthesis of high-ionic-conductivity-sulfide electrolyte	Knowledge/skills
	• Testing results from electrochemical characterization at coin cell level	Data
	• Knowledge and data from post-mortem characterization at coin cell level	Knowledge/skills
CRF	• Li-ion transport model for SUBLIME electrolyte	Model
	• Mechanical properties of argyrodite electrolyte useful to couple it with metallic Li-anodes	Model
	• Test protocols for large capacity (min 40 Ah) solid state electrolyte cells for OEM needs;	Protocol
FEV	• Multi-scale mechanistic model including cell ageing, useful for engineering purposes (end-user perspective, SoX estimation), esp. thermal aspects	Model
FORD	• Equivalent circuit model updated with cell parameters for SUBLIME chemistry/cell properties	Model
	• Test protocols for pouch cells for OEM needs	Protocol

Beneficiary	Expected Results	Type of Result
Fraunhofer	• Device-tool for performing electrochemical measurements under constant, defined pressure	Process improvement
	• Electrodes	Knowledge/skills
	• LCA studies	Model
	• Production of electrodes	Protocol
MIM	• Lifecycle analysis for entire battery system according to the ILHD Handbook following the ISO 14040 and 14044 standards	Knowledge/skills
	• Theoretical recycling concept based on SUBLIME-cell design and chemistry	Knowledge/skills
POL	• Data about ageing behaviours depending on the cell compositions	Data
	• Data about behaviours in abuse conditions depending on the cell compositions	Data
	• Data about sulfide-based electrolyte	Data
	• Model of dendrite growth/formation (from Li anode)	Model
	• Model of the electrochemical behaviour of coin cell Li metal/sulfide-based electrolyte/NMC	Model
	• Testing protocols for full cells with sulfide-based electrolyte	Protocol
SAFT	• Electrochemical testing: cell design, cell assembly parameters; cycling conditions (pressure, temperature, currents, ...) and lab layout (specific equipment and protocol for Gen4 sulfide).	Knowledge/skills
	• Processing paths and parameters to manufacture electrodes/separator at semi-industrial scale (wet and dry processing)	Knowledge/skills
	• Safety considerations: - more precise risk assessment at different scales (material, electrode, cell, waste); - recommendations and feedback to define/update protocols and good practice at semi-industrial scale; - assessment of the safety risk at cell level	Knowledge/skills
TNO	• Knowledge about production of spatial ALD-based interfaces for Li metal batteries	Knowledge/skills
	• Data from physical characterization (SEM, XPS, etc.) of ALD-coated materials	Data
	• Improved ALD technique based on partners' electrochemical and other characterization of coated materials	Process improvement
	• Knowledge about passivation layers for SUBLIME cathodes	Knowledge/skills
	• Knowledge about nucleation layer development for Li metal batteries	Knowledge/skills
UMC	• Optimized cathode active material that is compatible with sulfide electrolyte	Knowledge/skills

Table 2: Results by status.

Status of Result	Result
Not started yet	2
Result has materialized	1
Work in progress	23

Table 3: Count of the expected results, grouped by type.

Type of Result	Count of Type of Result
Data	8
Knowledge/skills	17
Model	11
Process improvement	3
Protocol	4
Prototype(s)	1

Table 4: Count of the type of result, grouped by type of beneficiary. IND=industrial, RTO=Research and Technology Organisation, SME=Small and Medium-Sized Enterprise, UNI=university.

Beneficiary Type	Type of Result	Count of Type of Result
IND	Knowledge/skills	4
	Model	4
	Protocol	2
RTO	Data	4
	Knowledge/skills	11
	Model	2
	Process improvement	3
	Protocol	1
SME	Data	1
	Knowledge/skills	2
	Model	3
	Prototype(s)	1
UNI	Data	3
	Model	2
	Protocol	1

Table 5: Primary expected exploitation in the next two years, by type of result.

Type of Result	Not sure yet	Use as input to standardisation	Use for customer-funded research	Use for further co-funded research	Use for product/service development
Data				4	
Knowledge/skills	1		1	7	
Model				7	2
Process improvement		1			
Protocol		1		2	
Prototype(s)				1	
Total	**1**	**2**	**1**	**21**	**2**

Table 6: Secondary expected exploitation pathway in the next two years, by type of result.

Type of Result	Not sure yet	Use for customer-funded research	Use for further co-funded research	Use for product/service development
Data				1
Knowledge/skills	1	3		1
Model		1	2	3
Process improvement				
Protocol				
Prototype(s)				1
Total	**1**	**4**	**2**	**6**

Table 7: Expected exploitation in the next three to five years, by type of result.

Type of Result	Not sure yet	Use as input to standard-isation	Use for customer-funded research	Use for educational material develop-ment	Use for further co-funded research	Use for product/ service development
Data		1		3		
Knowledge/skills	1		3		1	2
Model		3		2		3
Process improvement						
Protocol				1	1	
Prototype(s)		1				
Total	**1**	**5**	**3**	**6**	**2**	**5**

3 Discussion and Conclusions

3.1 Results

The beneficiaries have clear expectations as to the results they expect to obtain from their participation in the SUBLIME project (Table 1). Regarding the nature of the expected results, these are mainly gains in knowledge and skills in the domains relating to solid-state batteries – most of the classifications of the expected result being *knowledge/skills* and *models* relating to physical/electrochemical behaviours of the cell system or parts of it, or to do with materials handling, processing and scale-up ().
However, at time of writing, project month M24, most of the expected project results were still work-in-progress, i.e., had not yet fully materialized, as evidenced by .

3.2 Interim IPR Report

Regarding possible protection of results through IPR such as patents, at time of data collection, none of the beneficiaries had any firm plans to file patents (though two had indicated considering the possibility). Most indicated they were "not sure yet" or intended to keep their results confidential for the time being (). We may surmise that, since the results have largely not materialized yet, it is uncertain whether they lend themselves to patenting. Another possibility may be that patenting might not be considered an appropriate protection measure lest they disclose process know-how that, with some modifications, could side-step the patent.
At present, no joint IPR or potential conflicts are visible. This should be re-evaluated when the information is updated towards the end of the project.

Table 8: Envisaged result protection measures in the next three to five years, by organisation type.

Partner Type	Keep it secret (NDA)	None	Not sure yet
IND	6	1	1
RTO			3
SME	2	1	2
UNI	1		5
Total	**9**	**2**	**11**

3.3 Exploitation Strategy

Regarding exploitation, the beneficiaries were asked to consider how they plan to exploit a given result in the next two years, as well as in the next three to five years. shows clearly that most of the expected results are intended to be further developed as part of subsequent co-funded research. Secondary intended exploitation measures suggest that once the maturity of the results (~TRL) has been sufficiently raised through further research, these can be used for product or service development (). Here it is noteworthy that in the near term (next two years) SMEs, in particular, intend to use results for product or service development – see supplemental analysis in , below. In the longer term (three to five years), it is interesting to note that the university partner in the project, Politecnico di Torino, clearly expects to factor almost all of its results into educational materials, whereas industrial partners envisage product or service development ().

Table 9: Exploitation in the next two years, by partner (organisation) type.

Partner Type	Not sure yet	Use for customer-funded research	Use for further co-funded research	Use for product/service development
IND	1	3	2	1
RTO				
SME		1		5
UNI				
Total	**1**	**4**	**2**	**6**

Table 10: Exploitation in the next three to five years, by organisation type.

Partner Type	Not sure yet	Use as input to standard-isation	Use for customer-funded research	Use for educational material develop-ment	Use for further co-funded research	Use for product/service development
IND	1				2	5
RTO			3			
SME		5				
UNI				6		
Total	**1**	**5**	**3**	**6**	**2**	**5**

3.4 Business Plan

The original Business Plan was laid out during the proposal phase of SUBLIME in 2019, therefore at M24 of the project in April 2022 it is beneficial to check this original plan and update it. Compared to the initial situation, potential changes in the market boundary conditions need to be evaluated. They do not change the situation fundamentally, however, they even further emphasise the need for increased availability of battery storage solutions for EVs developed in Europe.
A recent study by FEV Consulting[3] indicates that „the (future) market growth is dominated by electric powertrain types, such as battery electric and fuel cell powertrains. The sales volume of vehicles with an ICE should decrease by 16% by 2040 compared to 2019.

In September 2020 the groups TotalEnergies/Saft and PSA/Stellantis/Opel have signed an agreement for the creation of the joint venture ACC. Target of this partnership is the setup of „a world-class player in the development and manufacture of high-performances batteries for the automotive industry from 2023“. The worksplit according to the announcement has been agreed that TotalEnergies/Saft will bring in its R&D and industrialization expertise and Stellantis its “knowlege of the automotive market and its experience in production”. In SUBLIME, Saft has asked the partners to add ACC as an affiliated partner to be able to access project results of Saft. This request was agreed by the project partners[4].

The original SUBLIME business case is based on the assumption that the EV market share in EUROPE until 2050 is increasing. The criterion for addressing the attractiveness for customers has led to the identification of three main targets: 1) decreased EV prices; 2) longer range per single charge, and 3) reduced charging time. These targets had been previously discussed already, therefore they will not be elaborated further in this report. Below the original wording is given in quotes.

[3] https://www.fev-consulting.com/fileadmin/user_upload/Consulting/Downloads/Publikationen/Study_VehicleElectrification.pdf

[4] https://www.saftbatteries.com/media-resources/press-releases/psa-a-total-automotive-cells-company

Decreased EV prices:
„The impact of cutting the retail price of EVs across the U.S. mid-size market segment on sales volume is shown for a more detailed range of cost brackets in Figure 2-7. Getting EV price below $40k is needed to begin to compete with market segments that have significant sales; getting it below $28k opens the door to much greater increases in the numbers of vehicles it may compete with (at least on price). Each $1000 drop in price increases the total number of vehicles that an EV is price-competitive with by about 1.5% between $40k and $28k, and this percentage rises to 6.5% below $28k. Thus, for mid-size EV car models that enter the market at $28k, each $1000 of price incentive leverages the price competitiveness of the model. The point of these figures is to demonstrate that a) for EVs to have a chance to sell in large numbers, they probably need to be offered with a retail price (with incentives) that puts them into market price segments where a lot of cars are sold, and b) that once they are into such price segments, cutting their price further can make them price competitive with many more vehicles than if it is done when they are situated well above the high volume segments. From a cost perspective it is evident that for EVs to make a really significant impact, they need to be able to compete with their counterparts of vehicles with internal combustion engines (ICE. If the retail prices between EVs and ICE vehicles are close, then the lower cost per driven km for EVs starts to dominate the total financial equation. The SUBLIME vision is to increase the energy density of batteries to 1200 Wh/l, thus giving OEMs an opportunity to offer an EV with a smaller battery size at a reduced cost while at the same time not compromising on the range of the vehicle. Such price differences will increase the EV's competitiveness and attractiveness with respect to ICE vehicles, leading to higher sales volumes. Once the enormous, ICE dominated, automotive market can be tapped into by EVs through these cost reductions, this opens up further cost savings due to economies of scale."

Longer range per single charge
„SUBLIME project aims to set in motion developments, increasing battery energy density to 450 Wh/kg by 2025. To examine what the impact of this development will be, let us consider a practical example. For example, the Tesla Model S P100D has a reported range of above 500 km at an assumed energy density of 266 Wh/kg. Just swapping out the energy storage for SUBLIME's battery will almost double this range, which will be just shy of 900 km. That too without changing or engineering any of the system level components like thermal management, pack design or management software. Of course, designing new car concepts also considering the high volumetric energy density of 1200 Wh/l and above will have an even bigger impact as it will give an opportunity to completely overhaul the EV offerings."

Considering the big step from today's state-of-the-art EV gravimetric energy density to the targeted SUBLIME energy density even in case that at the end of SUBLIME this value cannot fully met the project result will contribute to more attractive EV concepts in future concepts.

Reduced charging time
„SUBLIME aims at achieving advanced energy efficient electrified vehicles that are attractive for customers in terms of functionality, performance, and safety while having an affordable price tag compared to conventional ICE models in competitive passenger car classes, thus enabling the transition towards electric mobility. The business case is to achieve the next generation EVs that are engineered based on the actual needs of the consumer. This will lead to energy efficient EVs that are attractive for customers in terms of affordability, safety and range. This will aid the successful marketing of the OEMs' new generation zero emission EVs. At the same time, it will enable the OEMs and their suppliers to start series production of components, systems and EVs. The consumers' perception of EVs will continue to play a major role in the evolution of the market. This means that OEMs have a window of opportunity to shape and make the most of the market's promise. SUBLIME targets affordability, fast charging and long trip capabilities."

In the following, new criteria are given which evaluate SUBLIME in today's context.
The geostrategic development of the past 2 years, however, has resulted in additional requirements regarding sustainable materials sourcing and independence from energy imports.

Sustainability of materials sourcing
When talking about battery storage solutions we need to shed light on the strong environmental impact as well as its impact on people of the battery industry and the need for a more sustainable production process, which already starts at the beginning of the supply chain – with the responsible sourcing of raw materials.

Battery storage solutions - especially lithium-ion batteries - play an important role in our daily lives and will play an even more important one in the next few years. However, environmental pollution and ethical issues have been a cause of concern in this sector for years.

Current lithium-ion batteries can be both ethically and environmentally problematic. Only a small percentage of lithium-ion batteries are recycled and the cobalt needed to make them is mined using child labor in some cases. The World Economic Forum found that metal-free batteries could make the industry more ethical and sustainable.[5] SUBLIME is trying to reduce cobalt as much as possible while at the same time paying attention to high recycling rates.

Independence from energy imports
In the light of recent developments in Russia and Ukraine, Europe has learned that dependence on imports of energy from instable/hostile states is very uncomfortable, to say the least. Huge funds are being transferred from Europe on a daily basis to Russia for gas (and oil), thus partially funding an illegitimate war in Ukraine. This situation is not easily solved, since stopping gas (and oil) imports can simply not be done overnight. However, these developments have meant a new boost to discussions on how to become more independent and to satisfy our energy needs with electricity produced in Europe in a sustainable manner.

It also means we need to find ways of reducing the role of Internal Combustion Engines in road transport, and to thus increase our efforts to develop battery storage solutions for EVs developed in Europe.

[5] https://www.weforum.org/agenda/2021/05/scientists-are-developing-a-new-metal-free-battery-which-is-more-ethical-and-environmentally-friendly/

4 Recommendation

No further recommendations are given.

5 Risk register

We do not foresee any risks for the project that are specifically connected to this Deliverable and the related activities

6 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

Table 11: Project Partners

#	PARTICIPANT SHORT NAME	PARTNER ORGANISATION NAME	COUNTRY
1	FEV	FEV Europe GmbH	Germany
2	ABEE	AVESTA BATTERY & ENERGY ENGINEERING	Belgium
3	CICE	CENTRO DE INVESTIGACION COOPERATIVA DE ENERGIAS ALTERNATIVAS FUNDACION, CIC ENERGIGUNE FUNDAZIOA	Spain
4	FORD	FORD OTOMOTIV SANAYI ANONIM SIRKETI	Turkey
5	CRF	CENTRO RICERCHE FIAT SCPA	Italy
6	AIT	AIT AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH	Austria
7	MIM	MIMI TECH GMBH	Germany
8	POL	POLITECNICO DI TORINO	Italy
9	SAFT	SAFT	France
10	SOL	RHODIA OPERATIONS	France
11	TNO	NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO	Netherlands
12	Fraunhofer	FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.	Germany
13	CEA	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	France
14	UMC	Umicore	Belgium
15	UNR	Uniresearch BV	Netherlands

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 875028.

This publication reflects only the author's view and the Innovation and Networks Executive Agency (INEA) is not responsible for any use that may be made of the information it contains.