Revitalise

Recycling of low value components using high purity pre-treatment, direct recycling and green hydrometallurgical approaches for recycling of Lithium Ion and Sodium Ion batteries.

Deliverable D6.1 Plan for Dissemination, Exploitation and Communication (PDEC) - I

WP6 – Dissemination and Exploitation

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LIST OF ABBREVIATIONS

ER	Expected Result
FF	Future Funding
FTO	Freedom to Operate
KER	Key Exploitable Result
KM	Key Messages
LCA	Life Cycle Assessment
PDEC	Plan for Dissemination, Exploitation, Communication
S-LCA	Social Life Cycle Assessment
TEA	Techno Economic Assessment
T-FA	Tech-Futures Analyses
TG	Target Group

1. Executive Summary

This document is a deliverable of Work Package 6 "Dissemination and Exploitation" within the REVITALISE project, financed by the European Commission through the Horizon Europe program.

This document defines target audiences, communication and dissemination activities, tools, channels and instruments with the aim to raise awareness about the project, ensure efficient support, and multiply synergies in communicating the activities and results of the REVITALISE project.

2. Introduction

The Plan for Dissemination, Exploitation and Communication (PDEC) exists to maximise the impact of the Key Exploitable Results (KERs) and Expected Results (ERs) of the REVITALISE project.

Research and Innovation activities are undertaken by people and solve problems for people, so understanding the needs and requirements of all stakeholders, so that they can be considered and acted upon, lies at the core of the plan. This person-centric approach should: i) enable a norm-creative innovation approach to ensure REVITALISE and its outputs are inclusive and designed to help and benefit a wide-range of people; ii) ensure that REVITALISE activities and results are promoted positively to a wide range of audiences; and iii) reduce and remove barriers to exploitation, to enable REVITALISE's outputs to achieve the expected outcomes and address the wider impacts specified in the Horizon Europe topic HORIZON-CL5-2023-D2-01-02: New processes for upcoming recycling feeds (Batt4EU Partnership).

3. Definition and objectives

Exploitation refers to the use of results in developing, creating, marketing and improving products and processes, or in creating and providing services. Exploitation activities can be commercial, societal, political, or educational in the aims. Above all, exploitation focuses on the translation of work done in the project (Table 1) to concrete solutions that contribute to achievement of the expected outcomes and impacts of the call.

REVITALISE's Key Exploitable Results are listed in the table below:

Table 1. REVITALISE's Key Exploitable Results and Expected Results

Key Exploitable Results (KERs) and Expected Results (ERs)	Exploited by
KER 1. Optimised pre-treatment/separation approaches based on water, or solventless processes, that can concentrate and achieve very high levels of purity for the separated parts.	REEL
KER 2. Process for manufacturing high-quality high-value recycled graphite + SiOx anodes that retain their initial structure, or are up-cycled with superior properties.	Hydro, VKR
KER 3. Process for direct recycling of (Pre-)Cathode Active Material for Li- and Na-based batteries with re-lithiation/resodiation (UoB – Under licence) determined through smart characterization and re-lithiation/re-sodiation.	Hydro, VKR
KER 4. Production of battery-quality lithium salts, from Hi-Nickel NM(C) and LFP black mass using hydrometallurgical approach based on leaching with water and anti-solvent crystallization.	REEL, WCT
KER 5. Hydrometallurgical approach to produce battery-quality lithium salts and mixed NM(C) and Fe precursors from Hi-Nickel NM(C) and LFP black mass based on leaching with green organic acids from food waste,	WCT

such as vitamin C (ascorbates), vinegar (acetate) and citric acid (citrates) and inorganic acids produced from industrial wastes.	
KER 6. Process for recovery of intermediate high-value compounds, such as sodium sulfate (semi-products, precursors).	WCT
KER 7. Process for water remediation and lithium recovery (water from pre-treatment and hydrometallurgy approaches) using membranes and DLECTM (WCT), with harmful compound, including fluoride and graphite removed (NTNU).	WCT
KER 8. Process for manufacturing optimised LiBs made from recycled materials (Verkor) – Up to 100% recyclates.	VKR
Expected Results (ERs)	
ER 1. Characterisation of fractions for impurity levels	UoB, MEET
ER 2. Materials data for battery passports	All
ER 3. Techno-economic assessment and comparison with primary materials	EUT
ER 4. LCA – sustainability and CO2, emissions, chemical usage assessment	EUT
ER 5. Process for recovery of graphite from Hi-Nickel NM(C) and LFP Cathode Active Materials through either/or: Water extraction (NTNU) and filtration (WCT) and/or froth floatation (NTNU).	NTNU
ER 6. Process Hazard Analysis- recommendations and measures to improve processes' safety.	

Dissemination refers to the sharing of results with specific stakeholders that can use them. Dissemination requires a target audience, which in REVITALISE is primarily automotive, materials, battery and recycling community networks and academic representatives.

Communication refers to the sharing of information about the project, including the context and wider issues surrounding it, to a wider audience.

Stakeholder engagement refers to identifying, understanding, and involving people who have a stake in the outcome of the project. It covers: i) mapping activities to identify the needs, aspirations and concerns of stakeholders and consideration of the impacts of the project upon them; and ii) dissemination and communication of key messages and arguments to inform, educate, and persuade stakeholders to support the solutions developed.

The ultimate objective of the REVITALISE PDEC is to define a strategy to enable:

1. Selection of the most appropriate measures to ensure that project impacts are achieved.
2. Reduction or removal of barriers to exploitation.
3. Creation and promotion of socially sustainable innovations in the battery second life value and supply chain.

4. Overall Dissemination, Exploitation and Communication Strategy

REVITALISE follows a 6-step iterative strategy to maximize impacts (Figure 1) and ensure exploitation of project results (Table 1).

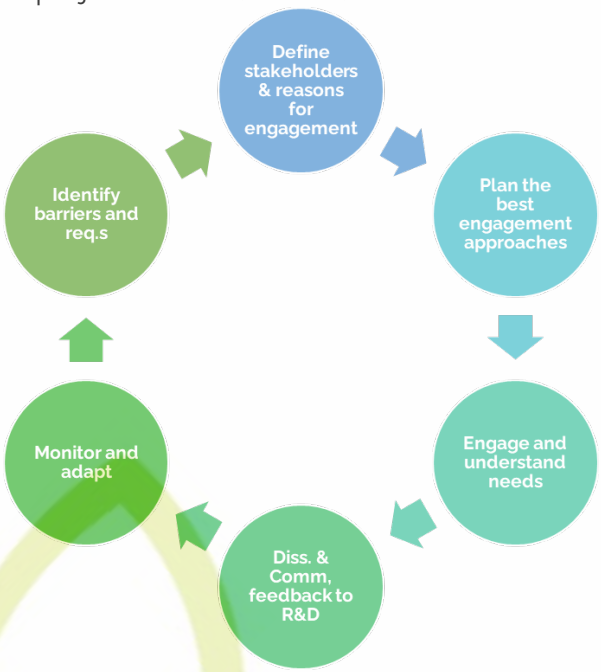


Figure 1. REVITALISE Strategy to Maximize Impacts

Step 1. Identify barriers and requirements. This involves recognizing factors that may impede the project's success and need modification for optimal utilization of its outcomes. Employing the PESTLE framework, these barriers and prerequisites may pertain to Political, Economic, Societal, Technological, Legal, or Environmental aspects. Understanding these factors aids in defining the objectives for communication and dissemination activities.

Step 2. Define stakeholders & reasons for engagement. Once the barriers and requirements are known, relevant stakeholders who need to be informed, consulted, involved, collaborated with, or empowered can be identified.

Step 3. Plan the best engagement approaches. Having identified stakeholders and reasons for engagement, strategies can be devised to maximize successful outcomes based on engagement objectives.

Step 4. Engage and understand needs. This phase involves implementing engagement approaches, including but not limited to dissemination and communication, to gain a deeper understanding of stakeholder needs and requirements.

Step 5. Ongoing communication, dissemination and feedback to research and development. Enhanced insight into stakeholder needs and requirements should

continually inform and adjust product and process design approaches in an ongoing and iterative manner within the project.

Step 6. Monitor and adapt. Regularly assess communication, dissemination, and exploitation activities against Key Performance Indicators (KPIs) to evaluate the effectiveness of the strategy and adapt approaches as necessary.

4.1. Requirements and Barriers

In the context of the REVITALISE Project, we started to explore the specific barriers to the project, with special regards to the Key Exploitable Results (KER) that we expect as an outcome from this project. The following initial barriers to exploitation during and beyond the project have been identified:

Consumer/manufacturer/policy-maker opinions on recycled content in LiBs; not believing in the performance, value or benefits of switching to LiBs made with recycled content: Currently, customers do not have confidence that batteries with >50% recyclate will be acceptable. Consortium partner VKR already use 50% recyclate in new batteries, above legally required limits from EC. However, to reach up to 100% recyclate levels, for circular economy and reduced costs, the batteries must be validated to gain customer confidence. This will be validated during REVITALISE as part of OBJ-6, where VKR will make secondary batteries (coin cells) for Hi-Ni(NMC) and LFP for testing from the recovered parts and testing will be conducted within WP5. As part of exploitation activities, REVITALISE will outline key messages for different stakeholder groups (in WP6); i) the need for use of recycled materials in LiBs will be explained to generate consumer demand; and ii) the performance of LiBs with recycled content (vs. virgin material) will be disseminated to secure manufacturer buy in, and help policymakers set achievable and realistic targets for recycled content in LiBs.

Low market demand in the long-term due to alternative battery chemistries: Researchers are exploring new types of batteries, such as solid-state batteries and sodium-ion batteries, that could offer better performance and be more environmentally friendly than LiBs. If these alternative batteries become more cost-effective and widely adopted, there will be upcoming feeds of end-of-life batteries with different types of chemistries that need to be recycled. In order to address future requirements and needs for battery recycling in Europe, REVITALISE will develop its recycling method as a platform technology that can be easily adapted to other upcoming battery chemistries and configurations. Furthermore, REVITALISE will tackle the cross-contamination by optimising separation robustness as part of WP1 during the project, which might be a very common problem in the future end-of-life battery feeds. REVITALISE will investigate other markets for materials if secondary material supply drops due to changing chemistries.

Increase in raw materials sourcing: If new reserves of Lithium (or other CRMs) are found, their criticality might diminish and their price could plunge, making recycling a less attractive option. However, the EU policies strongly favour and even urge the circular economy concept, which is also a requirement for this project. Thus, in the EU, it is very likely that these steps towards green transition will probably offset any changes in the upstream material sourcing situation.

High CAPEX costs also pose a significant barrier to enter to the market. HYDRO already co-owns a recycling facility with 12,000t/year capacity and will potentially work together with VKR post-project to build a recycling plant near VKR giga-factory.

Requirements that will arise from Battery Regulation: EU battery regulation sets mandatory targets for recycled content of materials as well as other aspects such as battery passports, mandatory sharing of data on materials etc. As part of the battery value chain, REVITALISE will need to ensure that its processes are complying with and facilitating these other targets to be met in the wider industry. As an example, the material data generated by consortium partners throughout the processes will be interoperable and suitable for use in future battery passport systems, ensuring compliance with upcoming regulations for batteries built out of recycled materials from REVITALISE process.

4.2. Stakeholders and Target Audiences

Stakeholder engagement is a two-way process that:

i) aids understanding of stakeholder requirements and concerns (which, where appropriate, enables modification of project approaches to ensure solutions meet the needs of a wider population); and

ii) enables dissemination and communication of concepts and solutions to target audiences to promote the project, drive adoption and support exploitation.

To achieve these goals, it is crucial to pinpoint target groups and provide them with information tailored to their interests, utilizing the most suitable communication channels. The project communication activities will reach the following target audiences (Table 2):

Table 2. REVITALISE Target Audiences

TG #	Target group	Description	Why are they important?
1	Researchers (including in other Horizon projects)	Post-doctoral researchers, research group leaders in Universities, RTOs and industrial R&D departments	Further collaboration is needed to accelerate innovations/combine with REVITALISE's approaches and develop equipment and processes beyond TRL4 after the project, in order to achieve outcomes and impacts required.
2	Recyclers	Recycling organisations (collection, disassembly, metallurgy)	Existing organisations needed to adopt and promote new optimised direct recycling and hydrometallurgy processes and develop recycling infrastructure/utilise or modify existing infrastructure.
3	Manufacturers	Electrode active material, battery component, cell module and pack manufacturers; manufacturers in secondary value chains	Manufacturers needed to build a market for recycled materials. Battery manufacturers need to be persuaded to adopt recyclates in components for new batteries to improve material independency. Also need to explore whether the recycling sites should be situated close to the manufacturers to recycler off-specification materials directly.

4	Raw material providers	Mining and mineral processing organisations; plastic and chemical producers	Raw material processors have existing infrastructure and expertise that can be used to aid scale-up of metallurgical processing. Chemical producers may also need to scale solvent production to meet demand.
5	Automotive OEMs	Car manufacturers	Automotive OEMS have an opportunity to: i) promote their sustainability credentials to consumers to drive EV sales; and ii) provide downstream demand for efficient, cost-effective, sustainable battery recycling and remanufacturing processes.
6	Financial actors	Private investors and public funding professionals	Needed to provide financial support for further collaborative R&D and facilitate the spin-out of REVITALISE's innovations to help make European organisations more competitive globally.
7	Special interest groups	Trade associations, environmental and consumer protection groups	Provide pressure on industry and regulators to create the right business conditions for REVITALISE's innovations to thrive.
8	Policymakers	Local, regional, and pan-European legislators, regulators and politicians	Needed to drive environmental and safety policies that push industry to adopt REVITALISE's innovations whilst encouraging further innovation and creating commercial opportunity.
9	Consumers/ general public	Car buyers/users, general public	Needed to drive demand for green, efficient and cost-effective recycling and remanufacturing processes.

Stakeholder Engagement refers to identifying, understanding, and involving people who have a stake in the outcome of the project. It covers: i) mapping activities to identify the needs, aspirations and concerns of stakeholders and consideration of the impacts of the project upon them; and ii) dissemination and communication of key messages and arguments to inform, educate, and persuade stakeholders to support the solutions developed.

The overall goal is to build a community of relevant stakeholders that we can trigger and get engaged to push REVITALISE's objectives. This is especially important to create a user-centred design to ensure successful exploitation and adoption of project results.

For identifying relevant stakeholders, we will start using the 5Ps approach. We will first identify the major groups within the 5P categories:

- **PArtners:** Stakeholders part of the value chain (current or future), be it in the upstream (suppliers) or downstream (distributors, customers, and users).

- **PEers:** Stakeholders whose activities are similar to that of the partners, and possibly operating in the same sector. E.g.: for researchers, they could be from other university groups or RTOs; for SMEs, these could be other companies with similar customer segments and activities.
- **Potential Investors:** Stakeholders with funding potential, especially if they have shown interest in activities similar to the results of the project.
- **POlicy makers:** Stakeholders with influence in the policies that could affect this project or its outcomes. This could be administrative bodies, lobbying bodies, pressure groups.
- **PUblic:** Stakeholders who participate in mass media, broadcast communication, and stakeholders that could be interesting but do not match any other category.

After the initial categorization, we will populate a more granular database with individual entities that respond to the identified categories. In this database we will identify the organizations that are relevant to the different stakeholder groups, but also the contact means at our disposal and all the information available for future steps.

An initial mind map of the stakeholders has been produced and is the basis for developing a database of specific stakeholders and categorizing them.

To this end, a stakeholder database (Appendix 8.1) has been developed, categorizing by organisation type, target group, country, and the spectrum of engagement.

The database will be updated regularly by all partners as the project progresses.

4.3. Stakeholder Analysis

To further specify the best engagement approaches with the mapped stakeholders, it is necessary to understand why we want or need to engage with them. This is why a more detailed categorization of stakeholders is needed.

As part of the identification process, we will assess the impact and interest that each identified stakeholder may have in the project outcomes. With this information, we will plot the different entities in a 2-axis plot diagram where we will measure the Interest against the Power to influence the project. This data will inform the final objective of our engagement strategy.

Additionally, we will evaluate the knowledge and attitude towards the project that they have at the moment of the analysis, to better understand the starting point for future engagement activities with said stakeholders.

These initial levels are:

- **Resistant:** They know about the project and are against its progress.
- **Unaware:** They don't know about the project.
- **Neutral:** They are aware of the project, but they are not active about it.

- **Supportive:** They know about the project and participate in related activities and share its progress.
- **Proactive:** They know about the project and are active in building upon its outcomes and collaborating in further initiatives.

4.4. Stakeholder Engagement Strategy

We will use 5 categories —based on the Spectrum of Engagement— to define the final goals for engaging with a stakeholder:

- **Inform** – Provide stakeholders with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions addressed by the project.
- **Consult** – Obtain stakeholder feedback on analysis and/or decisions made in the project.
- **Involve** – Work directly with the stakeholder to ensure that concerns and aspirations are consistently understood and considered.
- **Collaborate** – Partner with stakeholders to co-develop solutions and strategies.
- **Empower** – Give stakeholders decision-making power on the implementation of solutions.

After analysing the relevance, starting point and end goal of each stakeholder, a strategy will be tailored to engage them and open further collaborations.

4.5. Sex and Gender dimensions

Sex and Gender considerations are an integral part of the user-centred design approach, not only in terms of meeting customer needs and addressing pain points, but also by considering the needs and requirements of value chain participants and potential participants.

REVITALISE considers Sex and Gender dimensions to achieve the following objectives:

- Reducing barriers to participation in the battery value and supply chain to foster a more diverse and inclusive workforce.
- Reducing barriers to accessing and using REVITALISE's solutions by designing for inclusivity.

Sex and Gender issues will be considered from upstream to downstream (how we make and provide products and processes) and downstream to upstream (how we access and use things). Needs and requirements for change will be identified through stakeholder engagement and review of value and supply chain practices, to provide feedback to product and process design and communication and dissemination activities designed to lower barriers through effecting behavioural change as required.

Planned activities throughout the REVITALISE project include:

- Introduction to Sex and Gender in Innovation, training session

- Planning (goal & scope, focus areas)
- Gender Equality Promotion activities
- Data monitoring
- Gender equality plan, including research and corporate gender considerations

4.6. Clustering and Partnerships

REVITALISE will establish synergies with other relevant European, national, or regional initiatives, funding programmes and platforms is required in order to boost awareness about the project and maximize the use of the results among the key stakeholders.

The list of the relevant projects and initiatives will be created during the initial stakeholder mapping efforts. This list will be used as a roadmap for clustering and further collaboration activities across relevant projects.

Battery 2030+
As part of Task 6.7, REVITALISE will participate in the BATTERY 2030+ large scale initiative on Future Battery Technologies and collaboration with B2030 CSA3 and with other battery projects. The objective is to ensure synergies between the projects to reach the full impact of the common goals of the large-scale research initiatives of Future Battery Technologies. For this, a strong collaboration with the other battery projects as necessary. The B2030 CSA3 project funded under HORIZON CL5-2022-D2-01-08 will oversee the overall coordination of the joint efforts. Project partners will actively contribute to the joint effort coordinated by the B2030 CSA3 comprising the following tasks: communication & dissemination exploitation and IPR strategy, identify and contribute to guidelines and best practice for data sharing & FAIR Data, standardisation, educational curricula, roadmap development, infrastructure and interoperability.

5. Communication and Dissemination Plan, Tools and Channels

The Communication and Dissemination (C&D) plan exists to support exploitation of the project's results and to maximise the impacts in line with the Horizon Europe call text.

This section outlines the tools, communication channels and approaches that will be used in building awareness about circular business models, objectives and the expected results of the project as well as effectively engaging with key stakeholders to enable adoption and exploitation of the project's results.

Early communication activities (M1-12) will focus on raising awareness of the project, building a network and establishing strong communication channels. After this point, when results start to be produced and can be shared publicly, communication activities will focus more on disclosure of the project results.

5.1. *Key Messages*

REVITALISE will target a broad range of stakeholders with key messages (Table 3):

Table 3. Key Messages

KM #	Key message	Purpose	Target Audience	Info to be disseminated
1	REVITALISE develops scalable battery recycling solutions to deal with the volume and variety of NMC, LFP and Na-ion battery waste, which is otherwise expected to become an environmental and safety issue in the coming years.	Raise awareness of the problem and the REVITALISE solution to: i) generate popular and financial support for the research; ii) generate interest from the research community to drive follow-up R&D; and iii) generate interest from financial actors to encourage investment for post-project R&D.	TG1-9	KER1-7
2	European battery production relies on overseas material supply chains impeding EU independency and financing potentially unsustainable and unethical primary resource extraction.	Raise awareness of challenges and REVITALISE's solutions to promote: i) public support for LiB recycling; and ii) financial & political investment in the development of a favourable ecosystem for EU recyclers.	TG1-9	ER3
3	REVITALISE processes can be used to achieve cost-effective high-performance battery components made with up to 100% recycled content.	Address industrial and consumer perception-barriers surrounding performance of components with recycled content vs. virgin material, to encourage adoption of recycled battery components by manufacturers/OEMs.	TG1, TG2, TG3, TG4, TG5, TG6, TG9	KER8, ER3
4	REVITALISE presents a pathway to commercialise flexible and adaptable efficient cost-effective, environmentally-friendly and socially-conscious recycling and remanufacturing processes	Generate a demand for and promote commercial investment in REVITALISE processes.	TG1-9	KER1-8
5	There are more efficient and cost-effective as well as environmentally-friendly recycling routes.	Promote more sustainable alternatives to current battery recycling processes, enabling more efficient, cost-effective recycling in future.	TG1, TG2, TG3, TG5, TG8, TG9	KER1-8, ER3,4,6

5.2. *Dissemination and Communication KPIs*

REVITALISE's dissemination measures (Table 4) are designed to maximise the impact of the project results on the expected outcomes.

Table 4. Dissemination Measures and KPIs

Dissemination measure	Groups targeted	Key Messages	Month	KPIs
Scientific publications in relevant journals such as: *Resources, Conservation & Recycling, Sustainable Energy & Fuels, Separation and Purification Technology, Hydrometallurgy, Chemical Engineering, Water Science and Technology, Science, Nature, Applied Sciences*	TG1	KM1-5	M12 (2), M18 (2), M24 (2), M36 (2)	At least 4 scientific journal publications and 4 industrial journal publications
Share results on online media (research data, software, reports)	All	KM1-5	M12, M24, M33	At least 3 results-focussed online publications
Training and workshop sessions	TG2,3,5	KM3-5	M30	At least 1 training session with min. 50 attendees. At least 2 workshops (M18/M34) with min. 50 attendees
Project demonstration events at major conferences such as: *ACI Battery Recycling Europe*	All	KM3-5	By M18 and M33	At least 2 events with min. 150 attendees
Clustering activities: establishing synergies with other relevant European, national or regional initiatives, funding programmes and platforms	TG1-6	KM3-5	M6, 18, 33	At least 2 joint events (virtual or physical) with other projects organised and completed; REVITALISE presence in at least 6 events organised by other projects

REVITALISE's key messages (Table 3) are designed to: i) drive further investment & collaborative research and development of the processes developed in the project; and ii) promote spin-out (where necessary) and adoption of the technologies developed to drive a greener, more efficient, and more cost-effective battery recycling strategy in Europe. These aims will be achieved by mobilising stakeholders (Table 2) using the communication measures outlined below (Table 5):

Table 5. Communication Measures and KPIs

Comms measure	TG	KM	Implementation	Communication KPIs
Strong visual identity, brand, project website and blog	TG 1-9	KM1-5	Created at M3 and updated at regular intervals, SEO will be used to maximize impact within search results. Blog posts will be recirculated through social media channels to drive website traffic. The website will be supported for at least 4 years after the project to provide an ongoing repository of project info.	10,000 hits from at least 10 countries in the first year. Bounce rate <50%; >25,000 project lifetime views; At least 36 (1/month) website updates
Social media posts	TG 1-9	KM1-5	Twitter, LinkedIn, Instagram, Facebook & YouTube accounts will be set up by M3, regularly updated with project information, and will be used to promote training and workshop events and drive interaction with other projects.	At least 360 (min. 10/month) posts (across the project duration) with >1,000 followers across all channels M36.
Project videos	TG 1-9	KM1-5	Digital video interviews and infographics will be developed to promote REVITALISE at key milestones. These will be disseminated through social media platforms and used to advertise the project at trade exhibitions.	At least 3, to be communicated at M3, M20 and M34
Press releases	TG 6-9	KM3-5	Partner organisations will use existing media channels (e.g., links to local/regional news outlets) to distribute press releases on project results at key milestones to reach a wider audience. These will be timed to promote open access/commercial publications.	At least 6 press releases throughout the project to be reshared by all partners and through all social media platforms.
Participation in industry and academic events	TG 1-6	KM3-5	Participation by partners in key events, such as: European Recycling Conference, Battery Recycling Europe, European EV Batteries Summit	REVITALISE partners to present at a min. of 9 events.

5.3. *Brand Identity and Visual*

To aid communication and dissemination activities, the REVITALISE brand should be visually recognizable by the target groups, and a project website should be developed and promoted. To this end, the project's logo (Figure 2) and visual style (Figure 3) were created and integrated into all marketing materials throughout all channels, including the website, profiles on social media, printed marketing materials, and other relevant media.

Figure 2. Revitalise Logos in Colour & Black-white

Figure 3. Revitalise Visual Styles

5.4. *Website*

The REVITALISE website, www.revitalise-project.eu , communicates the activities and purpose of the project, its partners, key milestones, project activities and results.

To evaluate the performance and efficiency, website traffic will be carefully measured, including such parameters as the number of visits, unique visitors, and page views to gauge website engagement and interest.

5.5. Social media

The channels and groups of the REVITALISE project were created on the most relevant social media platforms (Table 6), including YouTube, LinkedIn (Figure 4) and X (Twitter) (Figure 5) to increase the reach while distributing information about the project, key milestones and results.

Table 6. REVITALISE Social Media Links

#	**Social media platform**	**Link**
1	LinkedIn	https://www.linkedin.com/company/revitalise-project/
2	X (Twitter)	https://twitter.com/Revitalise_EU
3	YouTube	https://www.youtube.com/@RevitaliseProject

Social media platforms are consistently and will continue to be regularly updated with project announcements, along with industry news disseminated by associations, industrial media, and member organizations.

The first foreseen posts to be created include partner-infographic posts, project meetings and other updates and information focusing on project milestones.

Figure 4. Revitalise LinkedIn Profile

Figure 5. REVITALISE X Page

5.6. *Marketing Materials*

Creation of the marketing materials in the REVITALISE visual style will help build the project's brand and make it more recognizable among the target audiences. To this end, the communication and dissemination team will create marketing assets, including the REVITALISE branded presentation deck, report templates, project's roll-up, flyers, leaflets, social media assets, infographics, etc.

5.7. *Events*

Events are considered an essential tool to announce the project, demonstrate the key results to the industry, strengthen the synergies of the community, facilitate the sharing of best practices, and above all, engage and understand stakeholders. Thus, project demonstration events on EV battery recycling and circular economy will be organized following the key milestones of the project and by inviting renowned experts, policymakers, industry leaders, and academics.

To communicate the project's key phases and milestones, participation in the key industrial and academic events is planned. Following a non-exhaustive list of selected conferences, fairs, and exhibitions (Table 7) shall be offered to and completed to identify the most suitable events for a joint presentation:

Table 7. Selected events for REVITALISE public communication.

Event	Date	Location	Status

ACI Battery Recycling Europe	28-29 Feb 2024	London, UK	HYDRO presented update on REVITALISE project
Battery 2030+ Annual Conference	28-29 May 2024	Grenoble, FR	REVITALISE will be represented by several partners
EUROBAT GA and Forum 2024	4-5 Jun 2024	Brussels, BE	TBD
Battery Recycling / Metal Recycling	24-27 June 2024	Frankfurt, DE	TBD

5.8. Peer-reviewed publications

To create awareness among the scientific community and build more future collaboration opportunities between the Consortium and academia, REVITALISE will target peer-reviewed publications and publish academic papers with the focus on the archived results.

The following journals will be initially targeted, and this list will be reviewed as the project progresses (Table 8):

Table 8. Target journal for publication of REVITALISE scientific results.

Journal	**Description**
Sustainable Energy & Fuels	Sustainable Energy & Fuels publishes high quality scientific research that will drive the development of sustainable energy technologies, with a particular emphasis on innovative concepts and approaches.
Water Science and Technology	An open access journal with the scope including: Treatment processes for wastewater; Resource recovery and residuals management; Anaerobic digestion, solid and hazardous waste management, including source characterization and the effects and control of leachates and gaseous emissions; Environmental Impacts, including sources of pollution, hazardous wastes, source control and remediation for non-potable water reuse; Socio-economic policy, strategy and control and management within wastewater treatment plants.
Batteries	An international, peer-reviewed, open access journal of battery technology and materials published monthly online by MDPI.
Resources, Conservation & Recycling	An open access journal for publishing cutting-edge research on sustainable management and conservation of resources, circular economy, and resource sustainability. RCR Advances

Advances (RCR Advances)	strives to implement a high standard and rapid peer review process to ensure timely and high-quality communications on emerging resource management and sustainability topics. The journal is a companion journal to the highly reputed journal Resources, Conservation & Recycling.
Journal of Cleaner Production	An international, peer-reviewed journal focusing on cleaner production, environmental and sustainability research and practice.
Journal of Sustainable Metallurgy	International and peer-reviewed journal on metallurgical processes and related research aimed at improving the sustainability of metal-producing industries, both from a unit operation and system viewpoint, including innovative approaches and solutions that minimize energy consumption; improve materials recovery, reuse, and recycling; and ultimately minimize environmental impacts.
Separation and Purification Technology	An international, peer-reviewed journal focusing on dissemination of novel methods for separation and purification in chemical and environmental engineering for homogeneous solutions and heterogeneous mixtures.
Chemical Engineering Journal	An international, peer-reviewed journal focusing on five aspects of chemical engineering: catalysis, chemical reaction engineering, environmental chemical engineering, green and sustainable science and engineering, and novel materials.
Hydrometallurgy	An international, peer-reviewed journal focusing on novel processes, process design, chemistry, modelling, control, economics and interfaces between unit operations, and to provide a forum for discussions on case histories and operational difficulties.

5.9. Workshops and Training sessions

Multiple workshops with project participants, as well as third parties, are planned during the project to define and assess problems and solutions and engage stakeholders. We recognise that every engagement with project participants and other stakeholders is an opportunity to listen to and understand stakeholder concerns and requirements and to inform, educate and persuade stakeholders about the benefits of the project results.

The design of workshops will be developed from M13-M15, based on the initial mapping and categorising of stakeholders, and revisited as our understanding of stakeholders grows. At least 2 workshops (M18/M34) are planned with min. 50 attendees, mixed format (online/in person).

Once the key stakeholders are identified and engaged, to further educate the target audience about the REVITALISE project, we will conduct a practical training session on relevant topic(s), their importance and strategies for implementation. At least 1 training session with min. 50 attendees is planned.

6. Exploitation Plan

6.1. Overview

The exploitation plan outlines the strategy and specific approaches that will be used to ensure successful exploitation of project assets (see Key Exploitable Results in Table 1). Exploitation incorporates a multi-dimensional group of activities balancing identification of problems and provision of targeted solutions to enable commercial and societal benefits to flow from the project. The planned considerations and activities are described in the following sections. They will be further adapted and elaborated during the project, depending on the progress and outcomes of the individual project related activities.

Results from REVITALISE will be exploited by the partners via several routes, as will be outlined in more detail in the following Table 9. The initial exploitation strategy will be formulated and updated regularly throughout the project to take into consideration the needs of stakeholders, market dynamics, and the findings of the sustainability assessment and techno-economic assessment of the overall approach (ER3 and 4).

Potential uses of the results can be summarised as follows:

- **Financial exploitation:** REVITALISE will generate multiple results that provide opportunities for commercialisation through establishing new products and processes. The exploitable results are summarised in Table 1, and the different partner's initial exploitation options are summarised in Table 7.
- **Scientific exploitation:** REVITALISE will achieve TRL4, meaning additional R&D activities will be required to achieve market adoption of the innovations developed. This provides an opportunity for follow-on research by scientists in academia and industry and scaling of developments into pilot lines. In addition, REVITALISE is expected to raise new questions about direct recycling and hydrometallurgy processes that will form the basis for further scientific research and commercial developments. Furthermore, it is expected to lead to further research for building circular-by-design batteries made almost fully from other recycled batteries.
- **Political/legislative exploitation:** The results of REVITALISE will provide all stakeholders with information on optimised processes for recycling of different types of batteries. This is expected to provide decision-makers with the knowledge required to shape the legislative structures to support and nourish Europe's battery recycling ecosystem. REVITALISE is in-line with the Battery 2030 roadmap and the European battery legislation, aiming to hit and exceed the 2030 goals.

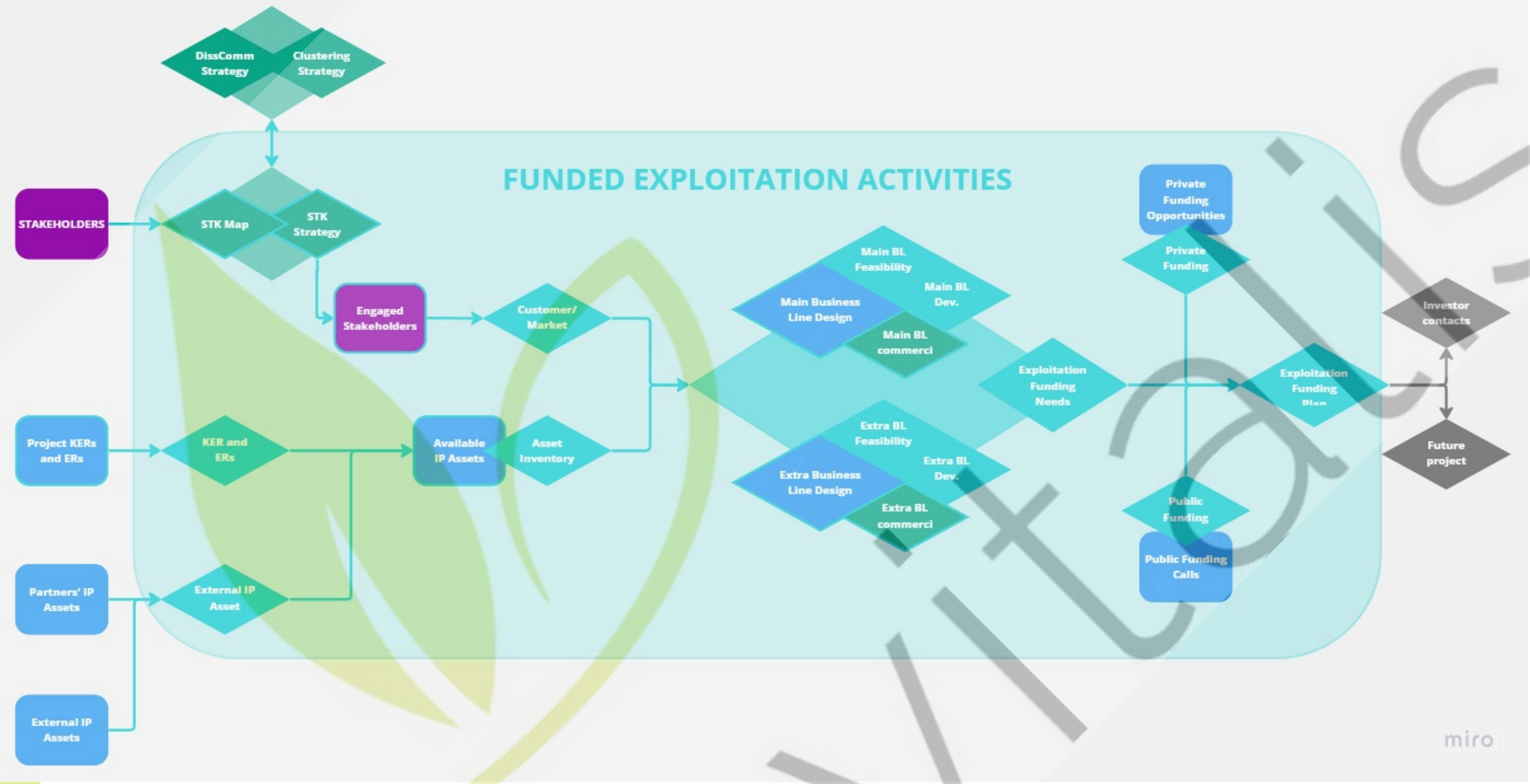
- **Societal exploitation:** Societal exploitation of REVITALISE's results is expected to be a factor in the exploitation routes outlined above. The public and consumers are important stakeholders (TG9). Some results, for example the eLCA/sCA (ER3,4) are expected to raise questions that demand consideration at a societal level. For example, how do consumers feel about using products that might contain materials from recycled batteries? The answers to such questions will likely influence financial investment decisions, provide direction for scientific research, and impact legislative changes.

The key activities to ensure successful exploitation will include:

- Market analysis and competitor watch (need, size, prospects, routes to market, competition & SWOT analysis);
- Outlining of operations plan;
- Identification and mapping of legal, societal and market dependencies;
- Financial model development and funding requirements (reasonable and coherent analysis of production costs, sales, revenues necessary external investments);
- Future funding, determine requirements for private or public funding (grant funding for demonstration and development projects; equity funding for commercialisation; debt funding for large role out schemes);
- Clustering activities, including creation of networking hub. Bring together value chain partners, link with large initiatives, ensure alignment with strategies and roadmaps, form alliances with synergistic projects; (see Section 4.5)
- Engagement in standardisation and policy activities including attendance at or hosting of workshops.

All these activities are summarised in Figure 6. Hydro will lead the commercial aspects focusing on engagement with networks and development of business models and recycling value chain development. Iconiq Innovation will co-develop exploitation plans with Hydro, who will have the executive leadership. This will allow Hydro to focus on scalability, commercialization, and deployment aspects of business plan, while performing an executive role.

Figure 6 - Overall strategy for Exploitation (Business Model Generation and Future Funding activities)



6.2. *Individual Exploitation Plans and Roadmap*

Table 9. Individual Exploitation Plans of Project Partners

Partner	Exploitation Plan
NTNU	NTNU will build on their know how in hydrometallurgy process to (1) For NMC, generate a simplified flowsheet for extraction with fewer steps and chemicals, based on solvent extraction, antisolvent crystallization and heterogenous precipitation to produce high grade Li salt and NMC precursors. (2) For LFP, develop a hydrometallurgical flowsheet to regenerate LFP cathode from black mass as raw material. As a result of REVITALISE, NTNU will investigating licensing their hydrometallurgical extraction processes (KER 2,3,7).
WCT	WCT holds a patent on its membrane design as well as three patents-pending on the membrane module and process design (GB 2202830.2/GB 2201820.4/GB 2201823.8 / WO2022038344A1), WCT will build on their 2-stage precipitation process (after leaching) that can be combined with concentration and crystallization step that, after chemical extraction recovers Li and Sulfate/oxide. As a result of REVITALISE, WCT will sell containers as a solution (KER 4,5,6,7). These systems will have 2 containers in it, one for black mass and one for hydrometallurgy (see Business Model for details).
REEL	REEL has a pilot-scale recycling plant and will offer an exploitation route for KER1, KER4. REVITALISE will help REEL advance in their prioritized topics, in particular: (i) processing of near future battery chemistries, (ii) recovery of non-CAM battery substances and (iii) the exploration of both hydrometallurgical and direct recycling routes of the cathode black mass. These areas will support REEL´s further development of the EHF process to ensure that required qualities of output materials can be improved and quality can by sustained when implemented at a larger scale. This will ensure they are prepared for future battery chemistries with a process that has an improved robustness regarding new chemistries and can sustain a high-quality output. REEL collaborates closely with a wide range of enterprises who are directly or indirectly involved in the treatment of LiBs that are no longer suitable for their initial purpose, that range from Automotive OEMs and battery manufacturers to first stage treatment companies (for logistics and initial dismantling) to companies developing second life storage applications. As the recycling of LiBs is still in its initial stages there is also a high interest from local authorities to support new technological approaches and to develop efficient, competitive industry sector.
Verkor	VKR will commercialise the secondary batteries that they will build using the recycled materials (KER8). They are currently building a gigafactory for battery production, to be finalised by 2024 and REVITALISE will enable them to produce batteries from recycled materials at volume. During the project, internal know-how on the cell manufacturing process will be used and built on to develop optimised LiBs made from recycled materials. They will benefit from REVITALISE in terms of A) Sustainability – reduction of CO_2 footprint in the new cell production; b) Economical – Material cost reduction due to increasing the recycled content. Further follow-up projects will be planned to scaleup the implementation.

Hydro	Hydro is active industrial owner of Hydrovolt (recycling), Vianode (synthetic graphite anode material), Corvus (marine battery systems) and has strong connections also through Hyrdovolt (JV 50:50) and they will play a major part in the exploitation of REVITALISE results through Hydro. In addition, Hydro has strong business connections to major OEMs for supply of aluminium metal products. Hydro will explore potential for scale up and industrialisation of processes and techniques that are developed in the project. Hydro supports businesses that recycle batteries and sell black mass to battery cell manufacturers. Hydro will exploit project results to leverage the existing interest in building competence leading to value uplift in current products, e.g., black mass processing and direct recycling of current and future battery chemistries.
MEET	As a university, Muenster MEET will exploit the project results for use in further development of portfolio with the generated knowledge and usage in training of students. They have a range of contacts and projects with national and international OEMs and suppliers/recyclers who will be included in the dissemination and communication of project results. They will license smart characterization and re-lithiation/re-sodiation (KER3).
UoB	UoB will build on their background IP (patent WO 2022/263812 for electrostatic + Magnetic separation of cell components (electrodes + separator) at a coarse size range prior to separation of active material from current collector) to develop process for manufacturing high-quality high-value recycled graphite+SiOx anodes (KER2) and process for direct recycling of (Pre-)CAM for Li- and Na-based batteries with re-lithiation/re-sodiation (KER5) in REVITALISE project. This project will allow UoB to further develop their understanding of these recycling processes, and strengthen their existing European Collaborations (SIMBA project and PhD student shared with Fraunhofer). UoB will develop IP, and engage with SMEs to exploit this IP through licensing in collaborative research projects and/or spinouts. UoB will primarily leverage their collaborative links with several recyclers such as Ecobat, EMR, RSBruce, Recyclus, and one large Automotive OEM to ensure exploitation beyond consortium.
EUT	EUT will license their hydrometallurgical recovery of Ni, Mn content on Na-Ion cathodes that they will develop in REVITALISE. EUT will carry out Techno-economic analysis as well as LCA including material recovery and recycling efficiency, operational energy efficiency, less wastewater, mass- and energy balance, purity of the recycled material and verified holistically decreased carbon footprint for the exploitation of project results.

6.3. Market research, customer discovery and user-centric design

Customer discovery forms part of the stakeholder engagement activities (covered in Section 4.3) designed to understand customer's situations, needs and pain points. This information, which will be gained through a spectrum of stakeholder engagement activities (e.g., surveys, B2B meetings, workshops, research and reviews) will feed-back through work package leaders to enable a user-centred design approach. This will be further supported by activities such as SWOT analysis, competitor research and analysis that aim to understand the wider supply chain and the industry needs.

By taking user and industry needs into account, REVITALISE will aim to develop out-of-the-box solutions that lower barriers to adoption. However, a key element of the discovery journey and the solution design shall aim at the development and exploitation of the business models.

6.4. *Innovation Management*

Innovation Management in REVITALISE will focus on two areas: i) tech-futures analysis to screen the patent landscape and ensure ongoing freedom to operate and exploit; and ii) Intellectual Property Rights (IPR) management to determine how to protect and exploit innovations developed in the project.

The Innovation Manager (Juan Carlos Trejo, IIL) will determine how to protect and exploit IPR and will provide input for the PDEC development. The Innovation Manager will also sign off on confidentiality issues during dissemination and exploitation, and present and discuss innovation issues at the 6-monthly face-to-face General Assemblies.

6.4.1. *Tech-futures analysis*

Iconiq Innovation will undertake Tech-Futures Analyses (T-FAs) on behalf of the REVITALISE partners. A T-FA includes a review of the current state of the art in each relevant technology sector, set alongside prior art, patent landscape and Freedom to Operate (FTO) analyses. Three iterations will be completed throughout the project – one early on after the K.O Meeting (M4), one for the Mid-term Review (M16) and one for the Final Report (M34). These analyses will be part of this document, the PDEC.
In between these iterations, Iconiq Innovation will monitor the project outputs and implement the "RAPID" algorithm and IPR strategy for each.

6.4.2. *IPR management*

To identify critical aspects and novelties related to Intellectual Property (IP) management in the context of collaborative research and innovation projects funded under the European Union's current Framework Programme for Research and Innovation "Horizon Europe" (2021-2027). We will consider the guide to intellectual property management in Horizon Europe (see https://intellectual-property-helpdesk.ec.europa.eu/regional-helpdesks/european-ip-helpdesk/ip-guides_en).

REVITALISE will use the **RAPID process** to cover the management of intellectual property that is both brought to the project as background and developed during the project as foreground. As the project develops, all outputs will be Recorded as part of the REVITALISE IPR Portfolio, assessed for their potential to be exploited and Protected as necessary. Following protection, the individual exploitation strategies for each output will be implemented before Dissemination occurs. Development and monitoring of the IPR portfolio (an IP register) will be conducted by the Innovation Manager. IPR assets generated through the project will be covered by the broadest possible types of IP (Patents, Copyright and related rights, Trademarks, Know-how, Trade secrets, Designs, Drawings, Reports, Data etc).
The default position for ownership will follow the Horizon Europe rules; each beneficiary owns the results it generates; joint ownership only if results are jointly

generated and it is impossible to determine the respective share of the work or to separate results for protection purposes. Protection and exploitation strategies for results will be the responsibility of respective beneficiaries. In line with Horizon Europe rules, beneficiaries will be expected to begin exploitation of project results within the first-year post-project. If this is not achieved, partners will be required to use the 'Horizon Results Platform' to make their results visible and encourage other interested stakeholders to get involved with exploitation (mainly non-financial). Appropriate access rights will be discussed and negotiated within the consortium as part of the ongoing IPR management.

Following regular IP reviews, any issues regarding dissemination of results will be captured. and beneficiaries given the right to raise any concerns of results dissemination if it affects legitimate interests. The planned dissemination measures are listed in the previous section; for any peer-review scientific publications, open access will be the default approach.

6.5. Business model development

The approach to develop the business model for each of the KER (see Table 1) will be: to undertake market analysis (need, size and prospects); perform competitor and SWOT analysis; undertake risk assessment; map route to market; develop understanding of legal, societal and market dependencies; develop financial model and understand future funding requirements; develop and confirm business model.

6.6. Future Funding

The funding strategy depends on the respective business model and has to be adapted accordingly. This means that the funding strategy for any business model that we expect to develop in the REVITALISE project will be designed individually, considering the respective phase and needs of the implementation in each case.

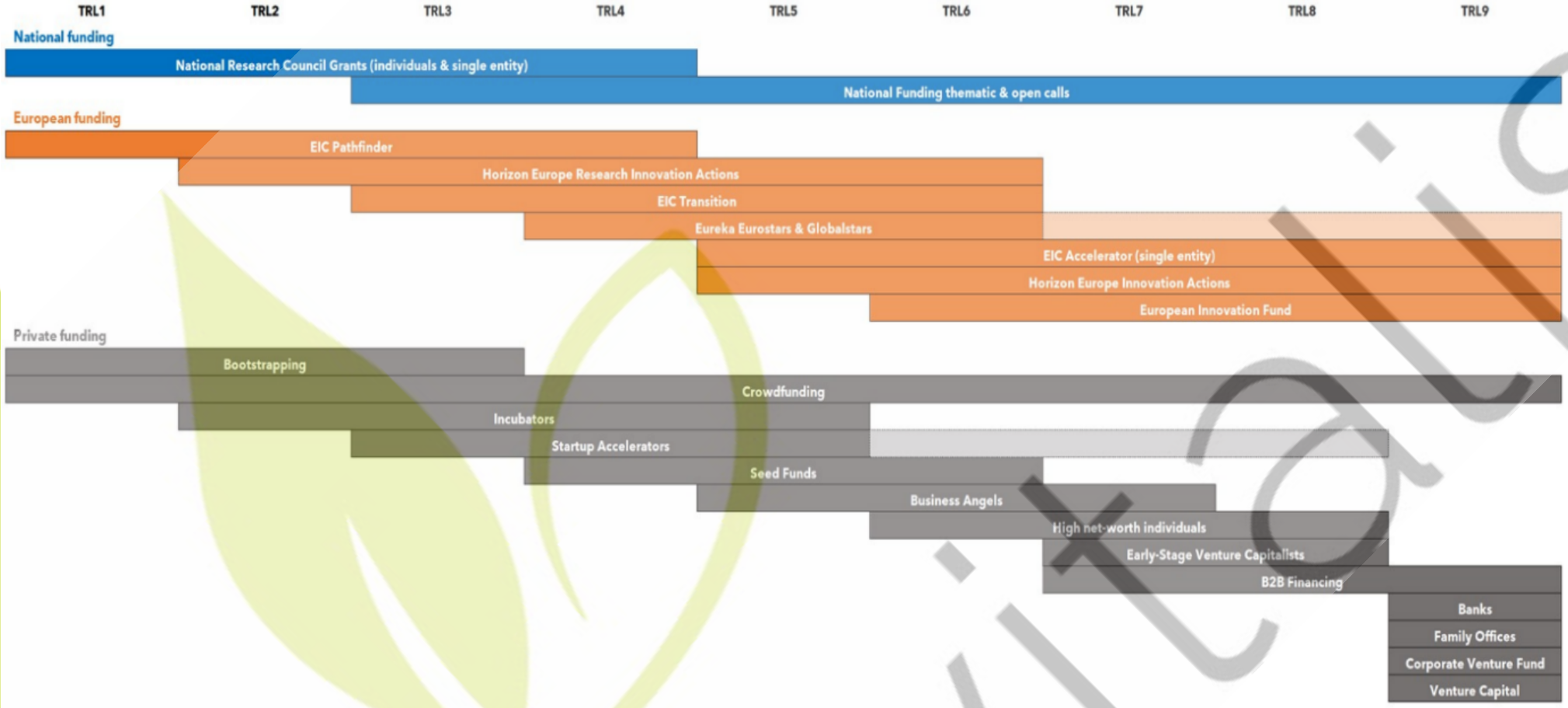
In general, there are two principal types of economic barrier to further exploitation of the project's assets:

1. Investment required to complete commercialisation of results developed in the project (direct)
2. Investment required to develop solutions to external barriers beyond the project (indirect)

Iconiq Innovation will continuously monitor the project's IP (and related IPR) and consider the financing landscape, including private and public funding opportunities, to determine how best to support exploitation (see Figure 7 for the approach options). At the same time, Iconiq Innovation will scan the public funding landscape to identify opportunities to accelerate R&I in relevant IP areas and to support consortium partners so that they are well-placed to bring their innovations to market and achieve the desired impacts of the call.

Iconiq Innovation, together with the project participants, will continuously monitor the project's IPR (and related IPR) and the funding landscape to identify funding opportunities and synergies that will support the project's aims, maximise impact and accelerate achievement of the aims of the Horizon Europe call.
Moreover, we will try to leverage clusters and synergies with other relevant European, national or regional initiatives, funding programmes and platforms. Upcoming Horizon calls of interest will be monitored and be explored from the early stages of the REVITALISE project. Also, market pulls and technology challenges will be analysed for application-agnostic results.

Figure 7. Future funding options roadmap



7. Conclusions

This document defines the key components for achieving successful communication, dissemination and exploitation for the REVITALISE project. It outlines the target audiences, communication strategies, and various tools, channels, and instruments that will be employed. This comprehensive approach is designed to enhance awareness about the REVITALISE project, foster efficient support, and facilitate the creation of synergies that will amplify the impact of the project.

Additionally, continuous monitoring and evaluation of the communication and dissemination activities will be essential. This will enable the project team to measure the effectiveness of the strategies and make any necessary adjustments to optimize impact. Proactive engagement with the identified target audiences, including stakeholders, partners, and the wider community, will be crucial for the success of these efforts.

Furthermore, this document defines the strategy and specific approaches that will be used to ensure successful exploitation of project assets, that will need to be further defined and specified as the project evolves, as part of an updated exploitation plan.

During the REVITALISE project and through achieving key milestones, this document will be further developed and evaluated to ensure more efficient communication, dissemination and exploitation.

8. Appendixes

8.1. *Appendix I: Stakeholder Data Gathering Form*

Target Groups (from Project)	
TG1	
TG2	
TG3	
TG4	
TG5	
TG6	
TG7	
TG8	
TG9	
TG10	
TG11	
TG12	
TG13	
TG14	
TG15	
TG16	
TG17	
TG18	
TG19	
TG20	

PArtners	PEers	Potential Investors	POlicy makers	General PUblic

Cover | Instructions | 1. Categories | 2. PArtners | 3. PEers | 4. Potential Investors | 5. POlicy makers | 6. general PUblic | 7. PROJECTS

Category	Organization	Country	Webpage	Type of Org	Sector /Activity	eMail	Person of Contact	eMail	Social Profile	Already in our network?	Level of awareness	Interest in our project (0 -10)	Power/Influence over our project (0 - 10)	Why they matter	Special remarks/Additional info

Cover | Instructions | 1. Categories | 2. PArtners | 3. PEers | 4. Potential Investors | 5. POlicy makers | 6. general PUblic | 7. PROJECTS

8.2. *Appendix II: Dissemination and Communication Tracker*

REVITALISE Dissemination & Communication Tracker

GENERAL PROJECT INFORMATION

Grant Agreement #	GA101137585
Project Name	REVITALISE
Project Title	REcycling of low Value components using high purity pre-treatment, dIrecT recycling And green hydrometallurgical approaches for recycling of Lithium Ion and Sodium Ion BatteriEs.
Call reference	HORIZON-CL5-2023-D2-01
Call title	Cross-sectoral solutions for the climate transition (HORIZON-CL5-2023-D2-01)
Type of Action	HORIZON-RIA
Start Date	01/11/2023
End Date	30/11/2026
Duration	36 months
EC Reporting Periods	RP1 - M18, RP2 - M36

WORK PACKAGES

WP No.	Work Package Title	Lead Participant No.	Lead Participant Short Name	Start Month	End Month
WP1	Pre-processing, separation and delamination	2	REEL	1	30
WP2	Direct recycling	9	UoB	4	36
WP3	Hydrometallurgy	1	NTNU	4	36
WP4	Water remediation and lithium extraction.	8	WCT	4	36
WP5	Final materials evaluation and Life Cycle Analysis.	3	VKT	1	36
WP6	Dissemination and Exploitation	4	HYDRO	1	36
WP7	Project Management	1	NTNU	1	36

PROJECT PARTNERS

No.	Short name
1	NTNU
2	REEL
3	VKR
4	HYDRO
5	MEET
6	EUT
7	ILL-Ireland
8	WCT

General | KPI Dissemination | KPI Communication | Publications | Communications | REVITALISE Events & Training | Conferences & fairs

KPI Dissemination

Dissemination measure	Groups targeted	Key Messages	Month	KPI Target GA	KPI Actual	Comment
scientific publications	TG1	KM1-5	At regular intervals	≥ 4		
industrial journal pulications	TG1	KM1-5	At regular intervals	≥ 4		
share results on online media (research data, software, reports)	TG1-9	KM1-5	At regular intervals and upon agreement from Innovation Manager	≥ 3		
training sessions	TG2, 3, 5	KM3-5	M30	≥ 1		
workshop sessions	TG2, 3, 5	KM3-5	In accordance with major deliverables. M18 & M34 with min. 50 attendees	≥ 2		
project event for customer demonstrations	TG1-9	KM3-5	At M12 & 33, min. 150 attendees	≥ 2		
Organise joint events* (virtual of physical)	TG1-6	KM3-5	At regular intervals	≥ 2		
Attend joint events* (virtual of physical)	TG1-6	KM3-5	At regular intervals	≥ 6		

* with other relevant European, national or regional initiatives, funding programmes and platforms

General | KPI Dissemination | KPI Communication | Publications | Communications | REVITALISE Events & Training | Conferences & fairs

KPI Communication

Communication measure	Groups targeted	Key Messages	KPI Target GA	KPI Actual	When Completed	Summary Comments	KPI Feb'24	Comment
create visual identity, brand & logo			M3	complete	M3		complete	
project website and blog	TG1-9	All	M6					
website lifetime views			25.000					
bounce rate			<50%					
website updates			≥ 36 (1/month)					
informative materials	TG1-9	All						
v1 materials (poster, flyer, leaflet)			M6					
posters			20					
flyers, distributed			10.000					
multimedia	TG1-9	All						
general project video			1 (M3)					
project progress video			1 (M20)					
project final results video			1 (M34)					
video views								
newsletters & social media	TG1-9	All						
Newsletters								
Social Media started			M3	complete	M3		complete	REVITALISE LinkedIn and X
Social Media followers			1.000				130	
Social Media, total post			360				4	
Social Media, posts/month			10	0			0	
industry events (participation)	TG1-6	KM3-5	≥ 5 attended					
Press releases	TG6-9	KM3-5	≥ 6 (M1, M12, M24, M36)	1		Project KO press release	1	Project KO press release

General | KPI Dissemination | KPI Communication | Publications | Communications | REVITALISE Events & Training | Conferences & fairs

8.3. Appendix III: Technology Future Analysis (v1.0, Executive Summary)

EXECUTIVE SUMMARY

Principal objectives of the REVITALISE project

> Recycling of low value components using high purity pre-treatment, direct recycling and green hydrometallurgical approaches for recycling of lithium ion and sodium ion batteries

The main aims of the **REVITALISE** project are defined in this extract from the Grant Agreement [GA]:

> REVITALISE delivers a holistic solution for green, low-cost, and low environmental impact recycling of NMC (Hi-Ni), LFP and Na-Ion batteries, representing 85% of battery waste streams up to 2025.
> REVITALISE develops low-cost and green processes to recover a full range of battery materials, including NMC, LFP, Al, Cu, Li, graphite, fluorides, phosphates and plastics.
> Overall recycling rates of 91%+ will be proven at TRL4 for waste processed from post-production scrap and end-of-life battery black mass.

Purpose of this 1st Iteration REVITALISE Tech-Futures Analysis [T-FA]

To assess the potential of the proposed outputs of the **REVITALISE** project [FGIP] for patent-protection and exploitation, **IIL** has carried out this review into patenting activity in battery recycling, the **1st Iteration T-FA**, as part of Deliverable **D6.1** to:

- ✓ update the State of the Art [SotA] in each **REVITALISE** project technology development area
- ✓ identify any new competing technologies that have been published since the **REVITALISE** proposal was prepared in January-March 2023
- ✓ identify no-go areas where project technology developments might lead to third-party patent infringements
- ✓ confirm continued Freedom to Operate [FTO] with the planned technology developments.

The analysis was carried out as described in **Section 2** below. Key words, phrases and acronyms were used along with Cooperative Patent Classification codes (CPC codes) and citation algorithms in **T-FA** activities to identify the most recent and relevant granted patents and patent applications. The results of those activities are presented and summarised in **Section 3** and analysed in **Section 4** thereafter. Results of the summary and analysis are:

Summary of the SotA for REVITALISE technology developments

For each **KER**, except **KER 4**, the NPA searches unearthed publications disclosing one or more inventions that overlap with the proposed **Revitalise** project developments in the relevant technology sector(s). However, in no case did any of the publications disclose all or even most of the proposed developments. This means that the beneficiaries of the **Revitalise** grant are truly working at the cutting edge in a number of waste LIB, NaIB and LFPB recycling and reuse technologies.

Analysis of the patentability of the REVITALISE project results and the consortium's Freedom to Operate with them

One of the principal objectives of this **1st Iteration T-FA** listed above is to:

'…confirm continued Freedom to Operate [FTO] with planned technology developments'.

In **Section 4.1** the criteria for patentability are first addressed before the partners' FTO with the anticipated project results is examined.

Patentability – The three main criteria for an invention to attract patent protection are that it must be **novel over the prior art**, it must be **capable of industrial applicability**, and, most importantly, it must **involve an inventive step**, that is, the inventor must have made an unprecedented leap of imagination to create it that is non-obvious to 'one skilled in the art' in their particular technology sector or in related sectors. Should the partners in the **REVITALISE** project contemplate making patent applications for any of their inventions in the project, they must ensure that those inventions meet the three criteria listed above before doing so.

FTO – Should they be lucky enough to be eventually awarded a patent for their invention(s), the partners should then have freedom to operate [FTO] with it (them) on markets in that jurisdiction and in any other where a patent is granted[1].

As far as FTO with the actual **Revitalise** project results is concerned, this cannot yet be judged as none of the processes/products is completed and, therefore, their potential for patentability and/or for infringing third party IPRs cannot be properly assessed at the present time.

What can be said is that only a few relevant patents or patent applications were found during the searches for this **1st Iteration T-FA** and so the partners may well be able to get patent protection for their inventions and eventually enjoy FTO with them. However, each patent search provides only a snap-shot of the SotA on the day on which it was undertaken. Therefore, it will be essential for the partners to continue to monitor competitor patenting and commercial activity, which will be achieved in part through the **2nd** and **3rd Iteration T-FA**s and through using the likes of **Google Alerts**, throughout the remainder of the **Revitalise** project and beyond (see **Section 5** below for details).

[1] Note that there may be reasons why they do not have FTO with their granted patent, for example, it might be challenged in the courts by a competitor and subsequently revoked.