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In the published version of this decision, some information has been omitted, pursuant to articles 30 and 31 of Council Regulation (EU) 2015/1589 of 13 July 2015 laying down detailed rules for the application of Article 108 of the Treaty on the Functioning of the European Union, concerning non-disclosure of information covered by professional secrecy. The omissions are shown thus […]		PUBLIC VERSION This document is made available for information purposes only.

Subject: **State Aid SA.54793 (2019/N) – Belgium**
State Aid SA.54809 (2019/N) – Finland
State Aid SA.54794 (2019/N) – France
State Aid SA.54801 (2019/N) – Germany
State Aid SA.54806 (2019/N) – Italy
State Aid SA.54808 (2019/N) – Poland
State Aid SA.54796 (2019/N) – Sweden

Important Project of Common European Interest (IPCEI) on Batteries

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Excellencies,

1. PROCEDURE

(1) On 26 June 2019, Finland, followed by Italy, France and Sweden on 27 June 2019 and by Belgium, Germany and Poland on 28 June 2019 (collectively "the Member States"), pre-notified their plans to participate in an Important Project of Common European Interest ("IPCEI")[1] on batteries ("the IPCEI Batteries" or "the Project") on the basis of a common draft overall descriptive text (so-called "Chapeau" document) and of the detailed information on the Project and its components.

(2) The Commission requested complementary information from all the participating Member States and companies ("Direct Participants" or "participating companies") in the course of July to October 2019, to which the Member States replied in the course of August, September and October 2019.

(3) The Commission services took the initiative to organise high-level meetings at senior administrative level in order to enhance coordination between the Member States and ensure progress.

(4) High-level meetings took place on 4 July 2019 and 5 September 2019. In addition, during the pre-notification stage several meetings at technical level with the Member States and the participating companies took place.

(5) Italy notified its participation to the IPCEI Batteries on 8 October 2019, Belgium, Finland, France, Germany and Poland, on 9 October 2019 and Sweden, on 10 October 2019.

(6) By letter of 28 June 2019 the Swedish authorities, by letters of 1 October 2019 the German and the Italian authorities, by letter of 3 October 2019, the Finnish authorities, by letter of 10 October 2019 the French authorities and by letters of 8 November 2019, the Belgian and Polish authorities agreed to waive their rights deriving from Article 342 of the Treaty of the Functioning of the European Union ("TFEU") in conjunction with Article 3 of Regulation 1[2] and to have this Decision adopted and notified in English.

2. OBJECTIVES AND DESCRIPTION OF THE IPCEI BATTERIES

2.1. Objectives of the IPCEI Batteries

(7) The Member States view the development of sustainable and performing batteries as key for the rollout of clean mobility and for enabling a higher penetration of renewable electricity sources in the European Union ("EU") final energy consumption. The participating Member States therefore intend to grant aid to companies that will participate in the IPCEI Batteries, aiming at

[1] COMMUNICATION FROM THE COMMISSION Criteria for the analysis of the compatibility with the internal market of State aid to promote the execution of important projects of common European interest ("the IPCEI Communication"), OJ C188/4, 20.06.2014.

[2] Council Regulation No 1 determining the languages to be used by the European Economic Community, OJ 17, 6.10.1958, p. 385.

developing an innovative and sustainable battery value chain that goes substantially beyond the state-of-the-art. This Project will bring together companies operating at different levels of the battery value chain, as illustrated in the figure below. The participating companies' projects under the IPCEI Batteries relate to different levels of the value chain up to the battery management system and including the repurposing, recycling and refining.[3]

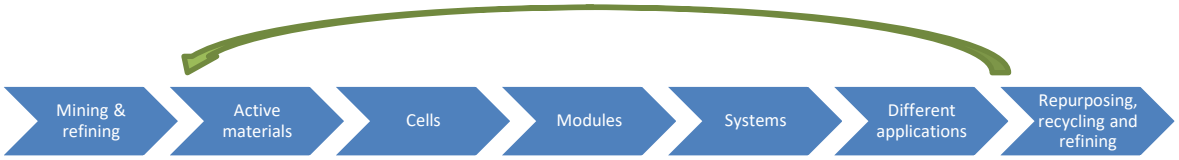

Figure 1: Batteries value chain[4]

(8) The overall objectives of the IPCEI Batteries are:

a. **Research, Development and Innovation objective ("R&D&I)**: to develop advanced and disruptive technologies in the sector of lithium-ion ("Li-ion") batteries (liquid electrolyte and solid-state) that would go substantially beyond the state-of-the-art in terms of meeting performance, costs, and safety targets, through research in advanced materials, battery chemistries, advanced cell and module design, advanced production/manufacturing processes, power electronics, battery repurposing, recycling and refining and raw materials' extraction, processing and refining;

b. **Sustainability objective**: to support the environmental sustainability of the battery value chain with a significant reduced CO_2 footprint, a reduction in the waste generated along the battery production process, a design for reparability, dismantling and net positive value recycling and refining, an enhanced tracking system of the corporate social responsibility ("CSR"[5]) performance of the supply chain, as well as responsible sourcing of raw materials, therefore participating to the clean energy transition;

c. **Societal objective**: to support new jobs and growth through the development and strengthening of highly skilled staff, aiming to mitigate

[3] The participating companies' projects under the IPCEI Batteries do not include development of applications as such (e.g. electric vehicles, power tools, home and garden appliances, industrial applications and marine applications), except for those that are part of the battery systems level of the value chain.

[4] Batteries are made of cells, modules and battery systems. **Cells** are devices that produce electrical energy by means of an electro-chemical interaction between a negative (anode) and a positive (cathode) electrode, through an electrolyte. **Modules**, are a first-level assembly of multiple cells equipped with thermal management add-ons, sensors and low-level monitoring electronics. **Battery systems** are assemblies of multiple modules managed by an electronic control unit that is called battery management system ("BMS"). Such systems may entail ancillary equipment, such as complementary thermal management, fire-detection and suppression systems, remote communication and diagnostic appliances.

[5] For all acronyms, please see Annex II.

the social impact of the clean energy transition and to attract in the EU world class experts in the field of batteries;

d. **Cooperation objective**: to contribute to the development of an entire ecosystem on batteries at EU level by facilitating the collaboration of the participating companies with research technology organizations ("RTOs") and within clusters across the EU.

2.2. Description of the IPCEI Batteries

(9) This section describes the IPCEI Batteries as it has been presented by the Member States in their notification.

(10) The IPCEI Batteries is organised along four different work streams ("WS"):

- WS#A: raw materials and advanced materials
- WS#B: cells/modules
- WS#C: battery systems
- WS#D: repurposing, recycling and refining

(11) Within each of these WS, the participating companies will conduct both R&D&I and first industrial deployment ("FID") activities[6].

2.2.1. Description of the WS

(12) Each WS focuses on key stages of the whole battery supply chain, from raw and advanced materials, cells and modules to battery systems and to repurposing, recycling and refining. Along the supply chain, within and across each of these WS, the participating companies will play a strong role in collaborating among themselves in order to adequately meet the objectives set and challenges identified (see sections below). The respective collaborations are explained and illustrated in section 2.4.3.

2.2.2. WS#A - Raw and advanced materials

(13) As regards raw materials, this WS aims at developing processes, which would allow extraction, concentration, processing, refining and purification of ores stemming from newly operated mines or refining facilities that are both highly sustainable and fulfil the high purity requirements of the developers and manufacturers of the advanced materials.

(14) As regards the advanced materials, this WS aims at developing advanced materials, i.e. traditional active/non-active materials, whose properties have been enhanced, or newly created active/non-active materials to be used in highly innovative cells of GEN 3-advanced Li-ion ("GEN 3") and GEN 4-solid-state ("GEN 4") cells. These include anode active material ("AAM") and cathode

[6] According to the IPCEI Communication, FID refers to the upscaling of pilot facilities, or to the first-in-kind equipment and facilities, which cover the steps subsequent to the pilot line, including the testing phase, but excluding mass production and commercial activities.

active material ("CAM"), binders, electronic conductive additives and, for GEN 3, liquid electrolyte components (solvents, salts, additives), as well as, for GEN 4, solid-state electrolyte either polymeric, inorganic or composite.

(15) The challenges regarding raw material for the R&D&I phase consist in developing new technologies meeting the specifications required to manufacture the battery advanced materials that are expected to be used for GEN 3 and GEN 4 cells, as well as meeting environmental sustainability objectives: lower CO_2 footprint than current supply, reduced energy consumption, reduced waste generated in their production, reduced impact on the environment, including in extraction, concentration and processing of ores.

(16) As regards the advanced materials, the challenges for the R&D&I phase consist in meeting a certain number of performance characteristics (in particular, energy and power density, material life, safety and costs); accepting possible variations of raw materials specifications so as to be able to accommodate different raw material sources; meeting environmental sustainability objectives: lower CO_2 footprint than current supply, reduced energy consumption and reduced waste generated in their production; and meeting certain CSR performance standards of the supply chain.

(17) As far as the challenges regarding the FID phase are concerned, these consist in introducing fundamentally innovative manufacturing processes meeting advanced materials' performance characteristics and meeting environmental sustainability objectives: lower CO_2 footprint than current supply, reduced energy consumption and reduced waste generated in their production; and meeting certain CSR performance standards of the supply chain.

2.2.3. WS#B - Cells, modules

(18) This WS aims at developing innovative GEN 3 and GEN 4 cells and modules meeting performance, safety and cost-targets. It will also develop new test methods to secure faster and more reliable measurements using different indicators (e.g. performance or durability) that are appropriate given the exposure of cells and modules to different charge or discharge current, different voltage levels and different temperature.

(19) In addition, this WS aims at implementing process innovation in order to reach the required volume, cost and performance targets for each generation (GEN 3 and GEN 4) of cells and modules. Specific and innovative processes regarding chemical assembly and formation sections should be developed and deployed for each generation.

(20) Further, this WS will develop new test methods for lithium cell and module for fast and reliable measurement. Such test methods will be developed for stand-alone batteries, as well as in their intended applications that can bring specific requirements on the cells.

(21) Finally, this WS will also develop cell and module housing produced from high pressure die casting ("HPDC") secondary aluminium alloys. This housing will be designed in a way that facilitates assembly and disassembly.

(22) Reduction of the CO_2 footprint of operations and the implementation of enhanced tracking of the CSR performance of the cells and modules supply chain will bring a significant contribution to the sustainability of the EU battery industry.

(23) The challenges for the R&D&I phase consist in these cells and modules being designed so as to fulfil the performance requirements (energy density, power density, cycling ability, life) needed for automotive applications, such as passenger cars ("PCs"), light commercial vehicles ("LCVs") and industrial electric vehicles ("IEVs"). The cells will also be suitable for non-automotive applications such as power tools, home and garden, material handling, and other consumer or industrial applications. Finally, they will also be suitable for marine applications. This requires optimized design of cell chemistry, electrode design, jelly roll/stack and overall cell, successful prototyping and final validation. Design objectives will encompass a reduced CO_2 footprint for the cells and modules, as well as extended battery reparability/recycling.

(24) Another challenge would consist in meeting environmental sustainability objectives: lower CO_2 footprint than current supply, reduced energy consumption and reduced waste generated in the production of the cells and modules; and meeting certain CSR performance standards of the supply chain.

(25) As far as the challenges regarding the FID phase are concerned, these consist in introducing fundamentally innovative manufacturing processes meeting consistently cells and modules performance, safety and environmental sustainability objectives.

2.2.4. WS#C - Battery systems

(26) This WS aims, building up on the innovations resulted from WS#A and WS#B, at developing innovative battery systems, including battery management software and algorithms, as well as innovative test methods for battery systems, that would go substantially beyond the state-of-the-art in terms of improved performance of the battery (e.g. energy density), easier dismantling, higher recyclability of the battery management system.

(27) The challenges for the R&D&I phase consist in developing management systems that can further enhance the performance requirements (energy density, power density, cycling ability, life) needed to serve automotive applications, such as PCs, LCVs and IEVs and for non-automotive applications such as ESS, power tool, home and garden, material handling, and other consumer or industrial applications; developing management systems capable of making batteries reach the theoretical useful lifespan in real-world applications; developing management systems that meet environmental sustainability objectives, in particular enable the easy dismantling and higher recyclability of the battery, enable the testing of the battery with recovering the energy still contained in the battery and further reduce the environmental footprint by the use of secondary materials.

(28) The challenges for the FID phase consist in introducing fundamentally innovative manufacturing processes meeting battery systems performance characteristics and meeting environmental sustainability objectives.

2.2.5. WS#D - Repurposing, recycling and refining

(29) This WS aims at designing safe, optimized, efficient and innovative processes to collect, dismantle, repurpose, recycle batteries and refine the recycled materials, in order to generate high purity secondary raw materials that fulfil the requirements of the developers and manufacturers of advanced materials. By achieving this, the WS will contribute to the diversification of raw materials' supplies and facilitate the development of electro-mobility, as well as non-automotive applications, the repurposing, recycling and refining operations for used batteries and other materials used for electro-mobility. It will also contribute to a reduction of primary raw materials extraction.

(30) In addition, this WS aims at bringing closer to the market the outputs of the R&D&I works by verifying at FID scale these R&D&I outputs.

(31) Finally, this WS aims at developing a closed loop as far as the housing of the battery is concerned by developing processes for easy dismantling of the housing and recycling of the aluminium to secondary alloy able to guarantee the same mechanical properties of primary alloys for the cell/module housing.

(32) The challenges for the R&D&I phase consist in designing safe, optimized and innovative processes for end of life Electric Vehicles ("EV") batteries; designing safe and efficient high-volume dismantling process for hybrid and electric vehicle ("xEV") batteries; designing innovative (i.e. higher throughput, higher tolerance for input variability, lower capital expenses ("CAPEX") and operating expenses ("OPEX"), lower environmental footprint) recycling processes for various EV battery waste streams; and designing innovative refining processes for the recovery of various battery materials in all forms that are considered appropriate by the downstream users.

(33) Particularly, for dismantling, the main innovation challenge will be to ensure safe reception of a wide range of inputs while increasing productivity at acceptable costs; for recycling, particular attention will be drawn on the efficient extraction of key valuable metals for the battery value chain, whilst ensuring that the environmental footprint is reduced (e.g. hazardous compounds, CO_2 emissions, flue dusts etc.); and for refining, a focus will be placed on the environmental footprint, purity, chemical form and costs of recovery of materials that are fit for re-use in the battery value chain. A final challenge of this WS will be to expand the lifespan of batteries and systems (repurposing) in order to support market demand for energy storage with competitive and environmental friendly solutions.

(34) The challenges for the FID phase consist in reaching the desired performance targets and environmental footprints of all processes designed in the course of the R&D&I phase; demonstrating a European closed-loop approach for batteries by connecting battery cells, modules and systems back to raw materials and advanced materials through the key step of repurposing, recycling and refining; introducing innovative recycling and/or refinancing processes concerning materials that are important for electro-mobility, meeting high recycling ratio and low emission targets; and, meeting environmental sustainability objectives: safety, lower CO_2 footprint than current supply, reduced energy consumption and reduced waste generated in their production.

2.2.6. Description of the companies involved in the IPCEI Batteries

(35) The table below summarises the companies involved in each WS of the IPCEI Batteries. The projects of each company under the different WS are described in more detail under section 2.4.1 below. Within each of the WS, the participating companies can conduct both R&D&I and FID activities.[7]

Table 1: Overall structure of the IPCEI Batteries

(36) The participating companies are briefly described below:

1. Automotive Cells Company ("ACC")

   ACC is a JV set up by Peugeot SA ("PSA"), Opel Automobile GmbH ("Opel") and Saft Groupe SA ("Saft"). Saft is a company of Total SA ("Total"), a global energy company, and a large player of the battery sector with strong expertise in electrochemistry. PSA is a global original equipment manufacturer ("OEM") with in-depth knowledge and expertise of automotive technical and costs targets. Opel is an OEM and a subsidiary of PSA.

2. BASF SE ("BASF")

   BASF is a chemical group operating in Germany, Belgium, France, Italy and Finland. BASF's Catalysts Division, which is the centre of the Battery Materials business, is a leading supplier of environmental and process catalysts. The division offers exceptional expertise in the development of technologies, which protects the air, powers the world and ensures efficient production, including production of advanced battery materials.

[7] Some participating companies (namely Solvay, Umicore and VARTA) will conduct more than one project within the same WS. In such cases, both eligible costs and funding gap calculations have been presented separately.

3. BMW AG ("BMW")

   BMW is the top-company of the BMW Group, a global OEM of cars and motorcycles. The BMW Group production network comprises 30 production and assembly facilities in 14 countries. The company is headquartered in Germany and has a global sales network in more than 140 countries.

4. Elemental Holding SA ("Elemental")

   Elemental is a Poland-based public holding company active in urban mining, collection and recycling of waste electronic and electric equipment, printed circuit boards, platinum group metals bearing materials, spent industrial and auto catalysts. It has developed a large collection network of the above-mentioned materials in the EU, consisting of professional sites holding necessary environmental permits, equipment, infrastructure, transportation fleet and sourcing personnel. Elemental is an interface between the location of waste origin and the location of its recycling. For the purposes of implementing its individual project, as part of the IPCEI Batteries, Elemental has created a special purpose vehicle ("SPV"), as a limited liability company incorporated in Poland.

5. Endurance SpA ("Endurance")

   Endurance is an Italy-based manufacturer of automotive components. It is a subsidiary of Endurance Overseas srl, which is a wholly-owned subsidiary of Endurance Technologies Limited, the top-company of the Endurance Group. The latter is an Indian market leader in aluminium casting and machining, suspension, transmission, braking systems for automotive applications.

6. Enel X srl ("Enel X")

   Enel X is an Italy-based subsidiary of the Enel Group. The latter is a global energy company and one of the world's leading integrated electricity and gas operators. Enel is active in 34 countries in the world, generating energy with a managed capacity of almost 90 GW (out of which 43 GW provided by renewable sources), selling gas and distributing electricity across a network spanning approximately 2.2 million km, with almost 73 million end users around the world.

7. Eneris Group ("Eneris")

   Eneris is a Poland-based company active in the production of technological innovations for environmental protection. It is involved in waste management, including a battery recycling pole, hazardous waste, waste-to-energy, and energy (cogeneration from renewable sources and distributed energy).

8. FAAM srl ("FAAM")

   FAAM is an Italy-based company active in the design, manufacturing and sales of lithium and lead-acid batteries for industrial, storage, military and special applications. FAAM is part of Seri Industrial SpA ("Seri"), a listed company in the Milan stock exchange market fully integrated along the supply chain of electric accumulators.

9. Fortum Waste Solutions Oy ("Fortum")

   Fortum is a Finland-based company, subsidiary of Fortum Oyj, active in recycling and waste solutions. Fortum Oyj is a leading clean-energy company that provides its customers with electricity, heating and cooling, as well as smart solutions to improve resource efficiency and recycling.

10. Kaitek srl ("Kaitek")

    Kaitek is an Italy-based company that offers customized industrial and special vehicle lithium battery systems.

11. Keliber Oy ("Keliber")

    Keliber is a Finland-based small and medium-sized enterprise ("SME") active in the production of battery grade lithium chemicals.

12. Nanocyl SA ("Nanocyl")

    Nanocyl is a Belgium-based SME active in the production of advanced & specialty chemicals, with a particular focus on multiwall carbon nanotubes ("MWCNT"). MWCNT are innovative specialty conductive additives used in various industrial applications including automotive and batteries.

13. SEEL AB ("SEEL")

    SEEL, a special purpose enterprise between the Research Institutes of Sweden ("RISE") and Chalmers University of Technology, is a Sweden-based research technology organization ("RTO") created in order to build, develop and operate a test center dedicated to testing services in different areas of electrified transport.

14. Solvay SA ("Solvay")

    Solvay is a Belgium-based advanced materials and specialty chemicals company, committed to developing chemistry that addresses key societal challenges. Its products are used among others in planes, cars, batteries, smart and medical devices.

15. Terrafame Oy ("Terrafame")

    Terrafame is a multi-metal mining Finland-based company active in the production of nickel, zinc and cobalt with an objective of producing battery grade nickel and cobalt sulphate. Its individual project will be coordinated by Suomen Malmijalostus Oy (Finnish Minerals Group, "FMG"), the parent company of Terrafame, a state-owned limited liability

company that is active in the development of the Finnish battery and mining ecosystem.

16. Umicore SA/NV ("Umicore)"

Umicore is a Belgium-based international group active in technology materials (cathode active materials and anode active materials) and battery recycling and refining for science, chemistry and metallurgy applications.

17. VARTA Microbattery GmbH and VARTA Micro Production GmbH (together "VARTA")

VARTA is a subsidiary of the Germany-based VARTA AG, the parent company of the VARTA Group, and is active in the business segments of Microbatteries and Power & Energy. The group's operating subsidiaries are currently active in more than 75 countries around the world, with five production and assembly facilities (e.g. energy storage systems for households and commercial applications as well as customized battery storage systems for OEM customers) in Europe and Asia, as well as distribution centres in Europe, Asia and the United States.

2.3. Governance of the IPCEI Batteries

(37) For the implementation and monitoring of the IPCEI Batteries a governance structure will be set up. This structure of the IPCEI Batteries is summarized in the table below:

IPCEI Supervisory Board ("SB")		
Public Authority Board ("PAB")	IPCEI Facilitation Group ("FG")	European Commission (guest status)
IPCEI General Assembly ("GA")		

Table 2: IPCEI on batteries governance structure

(38) The governance of the IPCEI Batteries will be performed by the Supervisory Board ("SB"), which consists of:

- The Public Authority Board ("PAB"), with representatives appointed by the Member States participating in the IPCEI Batteries, each having one vote;
- The IPCEI Batteries Facilitation Group ("FG"); and
- Three representatives of the Commission, as observers and advisers without voting rights, appointed by the Commission.

(39) The role of the SB will be to supervise, monitor and assure the implementation of the IPCEI Batteries at large. This especially concerns the monitoring of the progress of the participating companies, as well as the project as a whole. The focus of the implementation is on both, technological advances and the spillover activities to disseminate these advances, which the participating companies have committed to deliver.

(40) In principle, the SB will meet twice a year, by teleconferencing or videoconferencing. In addition, the SB may meet in extraordinary session to discuss any event relating to the Project, in particular regarding the entry of a new Direct Participant or the exit of an existing one.

(41) As regards the entry of a new Direct Participant into the project, this can be possible under conditions that will be decided and published (on the Project's website) on the first SB meeting (at unanimity). To this end, the applicant company will submit to the SB, via its Member State, a file demonstrating that its individual project is an addition to the IPCEI Batteries' work program; it fits into its scope and schedule; and it proposes at least two collaborations with at least two existing Direct Participants. Same rules will apply to additional individual projects of an existing Direct Participant funded by a Member State other than the current seven Member States.

(42) The Member State of the applying Direct Participant will provide evidence that:

- It has carried out the necessary steps to ascertain from the Commission that the individual project meets the eligibility criteria laid out in the IPCEI Communication, in particular, but not limited to the required innovation and R&D&I content, the contribution to spillover effects, and evidence that the proposed works go substantially beyond the state-of-the-art at the time of submission on the basis of public information; and
- It is willing to bridge the funding gap or a reasonable fraction thereof, thus rendering the individual project viable, with suitable aid instruments in compliance with IPCEI Communication.

(43) The effective admission of the new Direct Participant is conditional upon authorization of the State aid notification by the Commission.

(44) As regards the exit of an existing Direct Participant from the Project (i.e. for other reasons than the end of its individual project as described in its portfolio), the participating company will inform SB, via its respective Member State, of its withdrawal decision.

(45) To demonstrate the effectiveness of the Project's setting and functioning, key performance indicators ("KPIs") will be agreed upon at the first meeting of the SB and monitored accordingly in the course of the Project.

(46) As regards the FG, it is composed of the chair, the deputy of the Project, the coordinators of the WS and any additional company representatives or advisors assuming related duties. It will be in charge of the WS coordination, the annual reporting, the communication, the preparation of events, etc.). It will drive the overall progress of the WS on a non-confidential basis to establish a permanent interface between private and public stakeholders with the goal to highlight the Project's role and impact.

(47) The FG will also be responsible for organizing and fostering the collaboration and the communication within the Project and *vis-à-vis* third parties, which can benefit from results of the Project but are not Direct Participants. For this, the FG will implement two instruments: the annual IPCEI Batteries meeting batteries and the IPCEI website.

(48) The IPCEI Batteries meeting will take place once a year. The first meeting will take place at the latest one year following the Commission's approval decision. During the first part of this meeting, a restricted session will be dedicated only to the Member States, the Commission and the Direct Participants. During this first session, each WS coordinator will present the overall activities of its WS. Each Direct Participant will present in more detail the main results of its works, the collaborations achieved and relevant spillover activities.

(49) The second part of the meeting will be a public conference open to any interested party, not thus limited to the Direct Participants, during which they will present the main results of their works.

(50) The website will host public information about the Project and the Direct Participants. Moreover, the website will serve as the dissemination and interaction channel of the Project engaging thus entities other than the Direct Participants. For this, the website will list all spillover activities to which the Direct Participants have committed themselves (see below section 2.5). This information will be presented in form of an "Events Calendar" with the concrete dates and a brief description of the activity. The interested community will have the opportunity to register for participation at the activities directly with the Direct Participant who will be in charge of the specific activity. The website will thus also serve as a basis for the annual reporting on the delivery of the committed activities. The FG will collect qualitative and quantitative information for each activity. It may also foresee a restricted area for the Direct Participants to organise the implementation of the Project.

(51) The members of the FG will change over time to take into consideration the end of participation of the Direct Participants according to their respective individual portfolios.

(52) Lastly, the GA will be organised once a year, gathering all Direct Participants and the representatives of the Member States (and the Commission as observer). At its first meeting, within four months after the Commission's approval decision of the IPCEI Batteries, the GA will elect the members of the FG, and it will be responsible of adopting respective decisions on any changes of the FG's composition In particular, the GA elects the chair and the deputy of the Project and the coordinators (including their substitutes) of each WS, who will be members of the SB. It will also designate a Direct Participant, member of the FG, as key contact for the implementation of the spillover commitments. The GA will moreover take note of any exit decision from the Project either at the next ordinary GA meeting or by written consultation, teleconferencing or videoconferencing. The decisions will be taken by a 2/3 majority, with each Direct Participant having one vote. As from its second meeting onwards, the GA shall be organised alongside the annual public IPCEI conference.

(53) As regards national governance, the individual projects of the Direct Participants are governed by funding agreements between them and their relevant funding authority within each Member State. Such funding agreements impose requirements and obligations towards the administration of any individual project according to the rules set up by the funding authority. The national funding authorities are in possession of the commitments of all Direct Participants. As such, the PAB will be responsible to monitor the completeness of the listings and announcements of the committed spillover activities.

2.4. Integrated Project

(54) The Member States submit that the IPCEI Batteries is an integrated project within the meaning of point 13 of the IPCEI Communication. The WS are not only complementary but are mutually connected and depend on each other in order to meet the objectives of each WS separately and of the IPCEI Batteries as a whole.

(55) The sections below describe how the individual projects are necessary and complementary within each WS and across the different WS in order to achieve the respective goals of the IPCEI Batteries.

2.4.1. Necessity and complementarity of the individual projects within each WS for the achievement of the objective of the IPCEI

2.4.1.1. Necessity and complementarity of the individual projects for the achievement of the goals of WS#A

(56) The WS#A aims to develop highly sustainable processes for the generation of high-purity raw materials necessary to match the requirements of advanced materials developers and manufacturers, and produce them at large scale. It will also test, optimize, and bring to the market innovative advanced materials that will allow the advent of future generations of Li-ion cells, modules and batteries. Those new generations impose significant redesign needs of the material constitutive of a battery and particularly for electrodes and electrolytes.

(57) The success of innovations in the raw materials projects is needed by the engineered/advanced projects industry in two key areas:

- Securing supply of high purity/quality raw materials for further transformation into higher performance engineered/advanced materials;
- Enhancing the sustainability of raw materials (*inter alia* by diminishing their CO_2 footprint) which will in turn enhance the sustainability of engineered/advanced materials (*inter alia* by diminishing their CO_2 footprint).

(58) Furthermore, the engineered/advanced materials individual projects cover several key building blocks for cells and batteries, from cathode active materials and anode active materials, to components for electrolytes and separators, to agents, which enhance the interface properties between collectors and cathode or anode mixes. The innovations planned in those materials are indispensable to enable the innovations in the cells in the framework of WS#B.

(59) Within WS#A, both the R&D&I and FID phases will directly concern BASF, Eneris, Keliber, Nanocyl, Solvay, Terrafame and Umicore.

Necessity of the individual projects

1. BASF

(60) BASF's R&D&I and FID will be key for the objective of WS#A to bring advanced CAM and their precursors[8] with higher performance, improved safety, low environmental impact and increased cost competitiveness on the European market. Responsible and secure sourcing of raw material and a low CO_2 production footprint are key elements of BASF's and WS#A's sustainability focus.

2. Eneris

(61) Eneris' participation in WS#A will contribute in the development of advanced and raw materials for battery cells production (anode, cathode and electrolyte and the development of new types of advanced materials (including new cathode materials and new materials for post-lithium energy storage cells) in line with the production of new battery cells technologies and safety systems.

3. Keliber

(62) Keliber will develop industrial processes to produce lithium hydroxide for CAM producers in a novel and more sustainable way using own ore resources as raw material. Keliber's individual R&D&I project will research, develop, test, demonstrate and validate the production of high purity battery grade lithium hydroxide using innovative on-line analysis and monitoring technologies to gain real-time process data and improve the purity grade of the lithium.

(63) Keliber will also use in the chemical plant novel and environmentally sound soda pressure leaching technique that has been developed in co-operation with Outotec. Soda leaching is a novel technology having no industrial references yet and requires hence additional R&D&I for its deployment.

4. Nanocyl

(64) Nanocyl's individual project aims to develop *[...]*.

5. Solvay

(65) Solvay plans to bring new, innovative electrolytes ingredients, formulations and new binders for both GEN 3 and GEN 4. Those materials should enable the use of higher voltage cathodes and higher capacity anodes.

[8] A precursor is a chemical substance that participates in a chemical reaction to produce another chemical substance, in this case CAM.

6. Terrafame

(66) Terrafame's research activities target the production of high purity chemicals (including nickel sulphate) needed in precursor manufacturing. The challenge stems partially from the fact that Terrafame will use both virgin and recycled raw materials for the production of the chemicals. This high purity is key to obtain battery grade chemicals used in advanced materials. Through development of production process with higher operational efficiency related to quality, emission, releases and CO_2 footprint, the individual project aims to reach the sustainability objective set for the IPCEI Batteries.

7. Umicore

(67) Umicore's objective is to produce advanced active materials (cathode precursor and cathode active material) through innovative production processes as well as developing an innovative active anode material while delivering on a much lower environmental footprint in their production.

Complementarity of the individual projects

(68) The participating Member States have explained that the individual projects of the companies participating in WS#A are interlinked, as the technologies used are related and based on a coherent systemic approach contributing to the same goals of the WS for developing highly sustainable advanced materials for GEN 3 and GEN 4 cells.

(69) In addition, the WS#A activity covers the development of highly sustainable (with reduced CO2 footprint) processes for concentration, refining and purification (in the mining/refining industry) of raw materials that are used for the manufacturing of new advanced/engineered materials.

(70) Finally, the different new advanced/engineered materials are to become building blocks for Li-ion cells and batteries.

(71) The Member States submit that for these reasons, works carried out within WS#A are highly complementary, both in sourcing and supply within WS#A and towards WS#B to provide solutions in the several areas needed to fulfil the expectations of cell developers/manufacturers (for complementarity with WS#B, see section 2.4.2.4).

(72) The complementary character of the individual projects is corroborated by a number of collaborations within the WS, as table 3 illustrates, and further explained in section 2.4.3.1.

2.4.1.2. Necessity and complementarity of the individual projects for the achievement of the goals of WS#B

(73) The goal of WS#B is to develop innovative GEN 3 and GEN 4 cells and modules meeting performance, safety and cost targets for various applications including (but not limited to) automotive. It also aims at implementing innovations in processes, as well as incorporate new test methods.

(74) Within WS#B, the R&D&I phase will concern ACC, BMW, Eneris, FAAM, SEEL and VARTA, while the FID phase will concern ACC, Endurance, Eneris, FAAM, SEEL and VARTA.

Necessity of the individual projects

1. ACC

(75) ACC will develop and produce *[...]*.

2. BMW

(76) BMW will develop *[...]*.

3. Endurance

(77) Endurance's goal is to develop an innovative secondary alloy housing for modules that also allows for easy assembly and dis-assembly for repurposing. In this context, it is necessary to share upfront features of this technological evolution and provide the necessary guidelines to cells and modules manufacturers.

4. Eneris

(78) Developing large lab-scale prototyping, new method of cells production and thin layer electrode are necessary for the manufacturing of innovative Li-ion cells. Eneris will contribute to the development (and production) of new types of cells using advanced materials in line with the development of new battery technologies, chemistries and safety systems. The development at Eneris depends upon the usage of advance materials, prototypes developed from other companies in the WS. Eneris will focus on cells and modules suitable for applicability in in naval/marine, heavy-duty machines and industrial energy storage.

5. FAAM

(79) As with, ACC, BMW and Eneris, FAAM will develop (and produce) cells and modules with higher performance, improved safety, low environmental impact and increased cost competitiveness, facing several technological and execution risks. FAAM targets the automotive applications in particular in terms of performance but expects that the cells could also be used for other applications..

6. SEEL

(80) SEEL is the only participating company within the IPCEI Batteries focusing solely on the area of test and method development. SEEL will contribute to the development of cells and enhance the competences and capabilities related to measurement technology and methods for the development of new battery technologies, chemistries and safety systems.

7. VARTA

(81) VARTA will focus on R&D&I and FID for battery cells that will exceed the performance currently available in terms of energy and power density. Furthermore, safety, sustainability and cost will be improved. VARTA targets automotive applications, as well as applications in the areas of the Internet of Things ("IoT") and wearable applications (e.g. medical technology).

Complementarity of the individual projects

(82) WS#B activity and goal is the successful development of innovative GEN 3 and GEN 4 cells and modules meeting safety, performance and cost competitiveness targets. In order to achieve these goals, joint work will be conducted within WS#B, in particular in terms of testing cell behaviour.

(83) Furthermore, the cell developers/manufacturers which are part of this Project address several different key segments of the Li-ion business, i.e. cells and modules for inter alia the PC/LCV segments, the non-automotive sector including but not limited to the industrial traction segment, the energy storage segment, the IoT segment, the medical technology segment, as well as other niche segments of the industrial battery business and naval/marine applications. In order to address this wide variety of segments, several chemistries and mechanical designs are contemplated, such as cylindrical, prismatic and pouch designs. The complementary character of the individual projects is corroborated by a number of collaborations within the WS, as table 3 illustrates, and further explained in section 2.4.3.1.

2.4.1.3. Necessity and complementarity of the individual projects for the achievement of the goals of WS#C

(84) The fast-growing technological evolution on battery cells and modules, their shapes and features requires strong networking to reach the innovative best possible solution. Each participating company of WS#C would not be able to start works in itself and effectively contribute to more efficient battery management systems without the Project.

(85) The WC#C activity focuses on battery systems and how their components can further increase their performance. These include innovations on BMS and related management software in the context of some specific uses, on predictive algorithms to facilitate a better fit between batteries and their use, on modules and pack designs to ensure easy assembly and disassembly so as to facilitate their reparability as well as their second life and their recycling, on testing of innovative assembly materials to improve mechanical sturdiness along with lower weight and increased recyclability.

(86) Within WS#C, the R&D&I phase will involve BMW, Endurance, Enel X, Eneris, Kaitek and SEEL, while the FID phase will involve Endurance, Enel X, Eneris and Kaitek.

Necessity of the individual projects

1. BMW

(87) BMW's individual project will be different from present state-of-the-art developments as it will allow for *[…]*.

2. Endurance

(88) Endurance's goal is to develop easy assembling and dis-assembling battery system solutions targeting for their repurposing, towards standardization of housings made out of HPDC secondary aluminium alloys. These innovative battery systems will include necessary components, such as new lightweight and low CO_2 footprint materials, innovative thermal management and efficient wiring and innovative flexible manufacturing units for assembling/dis-assembling batteries systems designed for first and second-use.

3. Enel X

(89) Enel X activities aim at deploying safer and higher performance batteries compared to current state-of-the-art by developing a predictive analysis tool for anomalies and fault detection of lithium battery systems, based on machine-learning techniques. The outcome of such activities will be applied in particular to stationary storage systems, thus facilitating the introduction of the new generation batteries in the sector.

(90) Software modelling can only be validated following close interaction with battery and battery management system manufacturers.

4. Eneris.

(91) Eneris' participation will contribute to the development of safe, innovative and cost-efficient Li-ion new battery packs and BMS. The development of Eneris however depends upon the usage of new types of battery cells and new prototypes developed by other participating companies of the WS.

5. Kaitek.

(92) Kaitek is the only developer and manufacturer of battery systems for industrial applications (large goods vehicles ("LGVs")/automatic guided vehicles ("AGVs "), cleaning machines, heavy machinery, etc.), special road vehicles and marine applications. Disruptive battery technologies are crucial for the electrification of such applications, which are composed of different requirements and each one typically needs a custom made large sized battery system in medium or low production volumes. Kaitek will develop an advanced BMS specifically designed for new cell technologies, in order to safely exploit their best performances and lifecycle. It will also develop technologies for new generation battery systems available to industrial applications and sectors.

6. SEEL

(93) SEEL will contribute to the development of battery modules and systems. It will provide all the competences related to measurement technology and methods for the development of new battery systems, control and safety systems and it will also develop fast and reliable characterization methods.

Complementarity of the individual projects

(94) Joint activity will be conducted between the Direct Participants of this WS in order to improve each of the domains of WS#C. Moreover, the battery designers/manufacturers will focus their works on integrating these innovations, along the GEN 3 and GEN 4 cells issued from the works conducted within WS#B, in order to make battery systems that meet the goals of the WS#C.

(95) The complementary character of the individual projects is corroborated by a number of collaborations within the WS, as table 3 illustrates, and further explained in section 2.4.3.1.

2.4.1.4. Necessity and complementarity of the individual projects for the achievement of the goals of WS#D

(96) The objective of this WS is to improve the recycling of batteries and the refining of the recovered materials to reduce the dependency of Europe on primary resources needed for the battery value chain and to improve the overall sustainability of e-mobility and storage applications in the EU.

(97) Within WS#D, the R&D&I phase will involve BASF, Elemental, Eneris, FAAM, Fortum, SEEL and Umicore, while the FID phase will involve *[...]*, Endurance, Elemental, Eneris, Fortum and Umicore.

Necessity of the individual projects

1. BASF

(98) BASF's individual project aims to treat the waste electrode active materials as one component of battery wastes in order to extract or improve the extraction of raw materials from this component *[...]*. These raw materials will then be re-introduced into the production of battery materials and the production of batteries as a result.

2. Endurance

(99) Endurance's individual project aims at designing, collecting, dismantling, repurposing, recycling and refining processes, which ensure intrinsic economic viability of batteries.

3. Elemental

(100) Elemental's individual project will have a holistic approach in recycling: from collection, storage through recycling of batteries and various materials important for e-mobility focusing on innovative methods allowing safe transportation. It will develop disruptive technologies of verification of used batteries allowing for increase of reuse. It will also develop technology for energy recovery from

spent batteries allowing to reduce CSR footprint and increase energy efficiency. Further, Elemental's project will develop innovative universal technology and equipment adjusted to changing batteries chemistry and wide range of inputs, thus increasing the chances of achieving net positive value from recycling.

4. Eneris

(101) Eneris' participation in this WS will contribute to the development of recycling technologies for batteries by means of developing new materials, chemistries and raw materials. The development of Eneris depends upon the usage of new prototypes developed by other participating companies of the WS.

5. FAAM

(102) To FAAM's knowledge, there are currently no recycling plants in Europe able to recover more than 50% in mass of the materials used in a Li-ion cell. FAAM's individual project will target 85% recovering efficiency by producing battery grade materials that could be used to synthesize new active materials for Li-ion batteries.

6. Fortum

(103) The objective of Fortum's individual project is the deployment of an ecosystem supplying battery chemicals from secondary raw-material resources, such as spent Li-ion batteries, industrial side-streams and battery production waste materials. Fortum's individual project integrates three development projects: (i) sourcing and pre-treatment of secondary raw materials; (ii) recovery of battery metals from the secondary raw materials and (iii) introduction of battery chemicals back to the battery material value chain. In order to meet the increasing demand of battery metals in a sustainable way, reducing thus greenhouse gas ("GHG") emission from battery production, secondary raw material sources need to be introduced into battery value chain in parallel with primary sources. In addition to the opportunity to produce high value products the process decreases the environmental impact of the materials.

7. SEEL

(104) SEEL will provide all the competences related to measurement technology and methods for the development of re-use and remanufacturing technologies, safe handling methods, control and safety systems. It will also develop fast and reliable characterization methods for safe transport and offer abuse tests that are relevant across the entire battery life cycle. SEEL is the only participating company focusing solely on the area of test and method development.

8. Umicore

(105) Without the innovations to be developed by Umicore, the collection, dismantling, recycling and refining of battery waste cannot be improved in such a way as to ensure a sufficient flow of battery raw materials (in their most appropriate forms) back to the producers of battery active materials, for the purpose of remaking battery cells for e-mobility and stationary energy storage applications.

Complementarity of the individual projects

(106) Within WS#D work will be conducted on each of these several stages through which, used batteries have to flow in sequence in order to meet the recycling requirements imposed by EU law and generate valuable materials in order to offset process costs with secondary raw materials revenue (dismantling, pre-treatment, recycling and refining processes).

(107) Some Direct Participants will focus of the front end of the process (dismantling and pre-treatment, as well as the first steps of recycling) whilst larger operations with a strong presence in metallurgical processes will focus of the back end of the process (the later steps of recycling and the refining step). The complementarity within this WS to ensure the different successive recycling steps is further corroborated by a number of collaborations within the WS.

(108) Furthermore, as the used battery flow stems from the nature of the new batteries placed earlier on the market, i.e. both a very large volume of a limited number of standardized PC/LCV battery systems complemented by a much smaller volume of packs with a very large variety of models designed for the high diversity of industrial applications, this creates different expectations on the recyclers abilities, performance and ultimately on their processes. The individual projects of recycling operators will focus on one or another segment, hence bringing innovations to the several corners of the market.

(109) The complementary character of the individual projects is corroborated by a number of collaborations within the WS, as table 3 illustrates, and further explained in section 2.4.3.1.

2.4.2. Necessity and complementarity between the WS for the achievement of the objective of the IPCEI

(110) The Member States involved in the IPCEI Batteries submit that each of the four WS is necessary and complementary with each other to meet the objectives of the project.

2.4.2.1. Necessity of WS#A and complementarity with other WS

(111) WS#A is necessary for the completion of the other WS:

a. As already described under section 2.4.1.1, raw and advanced materials shall be used as building blocks for the development and FID of cells and modules under WS#B to meet performance, cost and sustainability targets of customers, manufacturers, investors, regulators and the society at large.

b. For WS#C: the materials from WS#A also have an impact on the design of the safe, high performance, cost competitive and environmentally friendly battery systems.

c. For WS#D: the work under WS#A will determine the quality of secondary material that needs to be obtained from recycling and refining to close the loop. Under WS#A efforts will be made to use recycled materials as far as possible and thus close the loop.

(112) Concerning the complementarity to other WS, WS#A is complementary to WS#B for the following reasons:

a. As demonstrated in the individual project portfolios, advanced materials for CAM and AAM formulation and advanced materials in electrolyte composition and additives are key drivers for increased cell performance. Therefore, the output in WS#A will be used by the participating companies in WS#B; and

b. Individual projects conducted in the area of WS#A require proper input from cell developers operating within WS#B, both in understanding their needs and targets and in receiving feed-back from testing thorough campaigns (of materials embedded within cells) on the benefits (or lack thereof) of the several advanced materials they are developing.

(113) This complementarity is evidenced in particular by the many collaborations between WS#A and WS#B, as displayed in table 3 and further explained in section 2.4.3.2.

(114) WS#A is also complementary to WS#D, since WS#A depends on a sustainable and reliable source of raw materials, which need to be increasingly provided by recycling processes in WS#D. In addition, recyclers and refiners need to be aware of the purity requirements to ensure a recycling quality that allows for a re-use of the recovered material in the battery value chain. The complementarity is further illustrated by a number of collaborations, also shown in table 3 and further explained in section 2.4.3.2.

2.4.2.2. Necessity of WS#B and complementarity with other WS

(115) The goal of WS#B is to develop innovative GEN 3 and GEN 4 cells and modules meeting performance, safety and cost targets, for various applications including (but not limited to) automotive. It also aims at implementing innovations in processes and incorporate new test methods.

(116) The necessity of WS#B across the battery value chain is shown by the following:

a. The innovative cell designs of WS#B will be based on innovative and sustainable advanced materials developed and processed in WS#A and the results from the R&D&I phase of WS#B will be fed back to WS#A. In addition, a high quality supply of performant and sustainable advanced materials resulting from highly innovative R&D&I and FID of WS#A will ensure effective conduct of the FID activities of WS#B. Innovative cells and modules within WS#B will be designed so as to ensure that their FID meet operational, financial and sustainability targets of customers, manufacturers, investors, regulators and the society at large;

b. Further, WS#C will feed back results to WS#B regarding the proper fulfilment of the required characteristics. The innovative cells and modules resulting from WS#B will represent the main content of innovative battery systems of WS#C and will have a significant impact on the design of those systems; and

c. Innovative cells and modules of WS#B will also contribute to ensuring that the battery recycling and refining processes of WS#D are adapted to incoming battery cells and modules containing advanced materials generating the best recovery of battery materials in the most appropriate forms. The design of modules will allow for easy disassembly and for cost effective logistics and recycling.

(117) Concerning the complementarity to other WS, WS#B is complementary to WS#A for the following reasons:

a. As demonstrated in the individual project portfolios, advanced materials for CAM and AAM formulation and advanced materials in electrolyte composition and additives are key drivers for increased cell performance. Therefore, the participating companies in WS#B (cells R&D&I) and their individual projects rely on the quality of the output of the participating companies in WS#A (raw and advanced materials R&D&I) and their individual projects; and

b. As above mentioned in recital (112), individual projects conducted in the area of WS#A require proper input from cell developers operating within WS#B, both in understanding their needs and targets and in receiving feed-back from testing thorough campaigns (of materials embedded within cells) on the benefits (or lack thereof) of the several advanced materials they are developing.

(118) This complementarity is evidenced in particular by the many collaborations between WS#A and WS#B, as displayed below in table 3 and further explained in section 2.4.3.2.

(119) WS#B also is complementary to WS#C for the following reasons:

a. To a very large extent, the individual projects within WS#C rely on the performance of cell innovations achieved within WS#B to bring innovative fully functional batteries to the market;

b. Specifically, designing high performing battery management systems and the related algorithms in WS#C is closely linked to the expected hardware performance and behaviour of the new generation cells developed in WS#B;

c. Selecting and making good use of embedded state-of-health ("SoH") measurement sensors and gauges in WS#C requires the same level of consideration as for the expected outputs of WS#B; and

d. For the production of innovative cells and modules in WS#B a good understanding of the markets and services that battery designers are targeting in WS#C is needed. For example, cell developers, which wish to explore the opportunities offered by innovative “ready-to-reuse” mechanical and electronic battery designs (with R&D&I in WS#C) need to incorporate (in WS#B) the constraints faced by the said designs.

(120) This complementarity is in particular illustrated by a number of collaborations shown in table 3 and further explained in section 2.4.3.2.

(121) WS#B further complements with WS#D for the following reasons:

a. The cell manufacturers of WS#B will benefit from the expected success of WS#D and the high-quality of secondary raw material to be provided, and as a result reduce the carbon content of their products, which is one the main objectives of WS#B; and

b. Cells and modules of WS#B will eventually need to be recycled and/or repurposed in WS#D. The latter thus aims to extract the most valuable components of WS#B to be reused by the industry. However, to reach a higher recycling rate, the constraints of disassembly and recycling should be taken into account already during the designing of the cells and modules.

(122) This complementarity is in particular illustrated by a number of collaborations shown in table 3 and further explained in section 2.4.3.2.

2.4.2.3. Necessity of WS#C and complementarity with other WS

(123) WS#C is necessary to connect the different WS through knowledge sharing across the different systems, from coin to industrial size cells, modules and complete systems. Furthermore, WS#C will gain knowledge from the end user applications that will benefit the development in the different WS and thereby the whole Project.

(124) Concerning complementarity with other WS, WS#C is complementary to WS#A. The synergies are indirect as they stem from synergies with WS#B. A high quality supply of performant, innovative and sustainable advanced materials resulting from highly innovative R&D&I and FID will ensure effective conduct of the FID activities of WS#C.

(125) WS#C is also complementary to WS#B. The innovative battery systems resulting from WS#C will be based on innovative cells and modules developed and processed in WS#B and the results from the R&D&I phase of WS#C will be fed back to WS#B. In addition, the innovative cells and modules designed and resulting from their FID in WS#B will ensure that the battery systems FID in WS#C can be conducted in a manner, which will meet performance and sustainability characteristics, and operational, financial and sustainability targets of customers, manufacturers, investors, regulators and the society at large.

(126) The complementarity between WS#C and WS#B is further demonstrated by a number of collaborations shown in table 3 and further explained in section 2.4.3.2.

(127) WS#C is further complementary to WS#D. The innovative batteries systems resulting from WS#C will contribute to ensuring that the battery recycling and refining processes are adapted to incoming battery systems containing cells and modules, themselves containing advanced materials, generating as a result the best recovery of battery materials in the most appropriate forms. The design of battery systems will allow for easy disassembly and for cost effective logistics and recycling. These systems will contribute to ensuring that the cost of battery recycling and refining processes is compensated by the revenues generated through the recovery of battery materials.

(128) The complementarity between WS#C and WS#D is further demonstrated by a number of collaborations shown in table 3 and further explained in section 2.4.3.2.

2.4.2.4. Necessity of WS#D and complementarity with other WS

(129) WS#D is necessary to achieve the goals of each WS and of the IPCEI Batteries as a whole:

a. For WS#A: considering the anticipated shortage in raw materials and the environmental footprint of sourcing raw materials, the recycling activities within WS#D appear indispensable for an economic and ecological European value chain for batteries including the processing of recycled materials to advanced materials;

b. For WS#B: recycled battery materials will be needed for a sustainable production of battery cells. The design of battery cells should also consider the future recyclability; and

c. For WS#C: cells from recycled batteries will be needed for a sustainable production of battery systems.

(130) As regards complementarity with other WS, WS#D is complementary to all other WS in that it brings together companies that are operating in different areas in the battery value chain.

(131) WS#D is complementary to WS#A: the CAM development in WS#A on the one hand, and the recycling and refining innovation in WS#D on the other hand, will require cooperation along the execution of the project. It is important to ensure that developed CAM do not impact negatively the recycling and refining processes, and the latter need to demonstrate that they are fit to deliver the battery materials in their most appropriate forms for further re-use into the production of active materials.

(132) The complementarity between WS#D and WS#A is in particular demonstrated by a number of collaborations shown in table 3 and further explained in section 2.4.3.2.

(133) WS#D is further complementary to WS#B and WS#C: the design of modules and battery systems has to allow for easy disassembly and for cost effective logistics and recycling. In addition, repurposing, recycling and refining processes will need to accommodate for development and deployment of WS#B regarding cells and modules. They will also need to accommodate for development and deployment of WS#C regarding battery systems, which are of particular importance for the first step of recycling (dismantling of batteries).

(134) The complementarity between WS#D, WS#B and WS#C is in particular demonstrated by a number of collaborations shown in table 3 and further explained in the section 2.4.3.2.

2.4.3. Collaboration within the IPCEI Batteries with respect to the relevant WS

(135) In addition to the necessity and complementarity of the individual projects within each WS, s+trong collaboration of the participating companies within and across the WS will exist, which, according to the Member States would not occur to this extent without the project.

(136) The table below shows all the collaborations envisaged within the IPCEI Batteries:

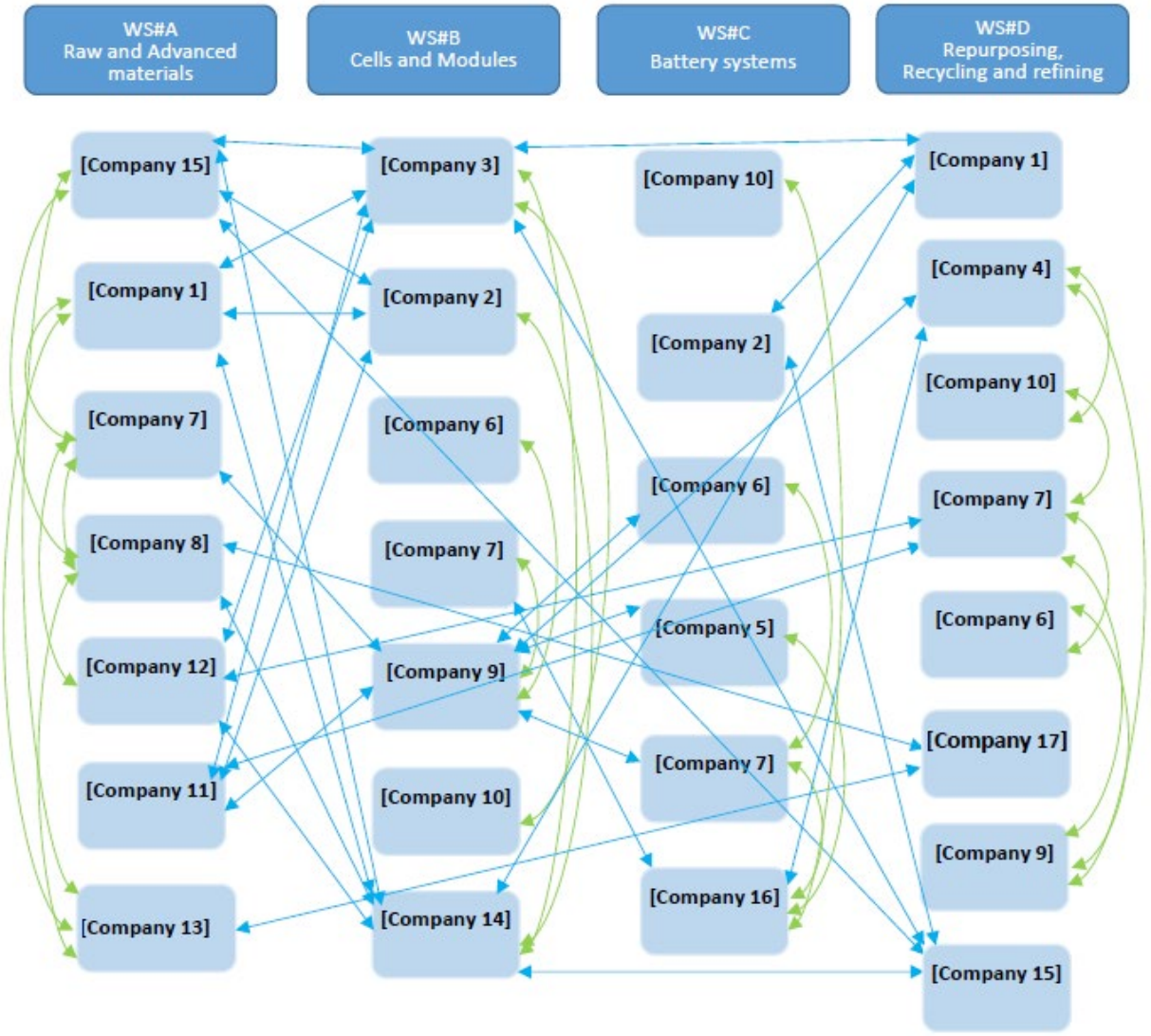

Table 3: All collaborations envisaged in the IPCEI Batteries

2.4.3.1. Examples of collaborations intra WS

(137) In WS#A, *[…]*.

(138) *[…]*.

(139) *[…]*.

(140) Endurance and FAAM will collaborate in the course of the FID phase to orientate cells and modules design towards feasibility for easy assembling and dis-assembling of secondary aluminum housings containing them. This collaboration will help orientate aluminum housings design and assembling towards the best compromise for receiving cells and modules developed by FAAM. The two companies further will collaborate to share and define target setting for the design of re-purposing options, from automotive battery systems application to second use in several different fields (i.e. e-bike, e-motorcycle, e-gardening tools and energy storage) and for prototyping re-purposing options. The collaboration will extent to the manufacturing of new products suitable for the automotive industry with innovative material for battery module and pack assembly easily recyclable.

(141) In WS#C, SEEL, will collaborate with Kaitek for the testing and development of battery packs adopting advanced materials. Such advanced materials will be adopted to improve the battery system overall performance, safety and recyclability. This collaboration aims at designing and developing solutions, which will improve the battery performance specifically addressing industrial domain. Kaitek will contribute to design and material selection and will be in charge of the development of prototypes according to the different applications' specific requirements. SEEL will contribute through validation of safety performance of the new battery system concepts and compare to existing solutions. In addition, within WS#C, Kaitek will test, in the course of the R&D&I phase, the early version of the BMS and distributed architecture of Eneris assembling these cell/modules in a battery system and provide early validation data. In return, Eneris will provide the early new cells/modules batch together with the verified datasheet. Kaitek will also perform the test for the new battery system. Eneris will establish new tests to be included in the validation of the battery system that takes in account the specificity of the datasheet of the cells.

(142) In WS#D, Elemental will collaborate with SEEL, for tests concerning mechanical, physical and chemical characteristics of used batteries with regard to transportation, storage and mechanical treatment. They intend to exchange information on best practices to mitigate health and safety related risks connected to handling of used or damaged batteries. Elemental and SEEL will focus on developing methods for judging the safety status for a used battery and to develop safe handling methods for damaged batteries. Also within WS#D, Eneris will collaborate with FAAM, which will use Eneris' test facilities to observe materials and cells behaviour and investigate the repurposing and/or recycling conditions and costs for its materials, cells and modules. Eneris will collaborate with FAAM in the utilization of secondary raw materials in battery materials.

2.4.3.2. Examples of collaborations inter WS

(143) *[...]*.

(144) *[...]*.

(145) Keliber that is active in WS#A will collaborate with Fortum that is active in WS#D. Both projects are complementary because Fortum is developing

production of secondary lithium raw materials from recycled materials that can be used as feed for Keliber's primary lithium chemicals production.

(146) FAAM that is active in WS#B will collaborate with Endurance that is active in WS#C. The two companies will collaborate in developing feasibility analysis for easy assembling and dis-assembling of cells and modules to be re-used. Endurance will provide FAAM with information and feedback to design cells and modules to be easily integrated into such battery systems. The two companies will co-design and prototype representative and feasible demo cases for each of repurposing viable options.

(147) Kaitek that is active in WS#C will collaborate with Elemental that is active in WS#D. This collaboration will allow Kaitek to gain access to proprietary knowledge of Elemental on recycling and safety related characteristics of battery systems and cells, which are crucial for the improvement of safety, design and composition of systems and cells.

(148) *[...]*.

(149) Enel X that is active in WS#C will collaborate with FAAM that is active in WS#B. This collaboration will enable a faster and safer deployment of the new batteries, and expand their usage in the sector of stationary storage. Enel X will also provide testing lines for batteries, which will be also available for joint testing with the partners and several players of the battery value chain, with special reference to universities and research institutes.

(150) Fortum that is active in WS#D will collaborate and Terrafame that is active in WS#A). This collaboration refers to the utilization of secondary raw materials in battery materials. It aims at ensuring that industrial deployment performance is in line with the specifications reached and agreed in the course of both WS#A and WS#D. Feedback from the whole value chain is needed to enable the introduction of secondary raw materials into the battery production on a large scale.

2.5. Positive spillover effects generated by the Project

(151) The Member States submit that the Project will generate important dissemination and spillover effects within the EU. This dissemination will be made possible through:

a. The dissemination and spillover of knowledge that is not protected by intellectual property ("IP") rights;

b. The dissemination and spillover of IP protected results ; and

c. The dissemination and spillover during the FID.

(152) Each Direct Participant has committed to and will participate to the dissemination activities up until the end year of its individual project, whereas a member of the FG will be designated as key contact for the implementation of the dissemination and spillover commitments.

2.5.1. Dissemination and spillover of knowledge that is not protected by IP rights

2.5.1.1. Overview of the dissemination and spillover strategy of non-protected results

(153) The Direct Participants to the Project will disseminate knowledge that is not protected by IP rights to the scientific community and the industry.

(154) The table below displays the mapping of the dissemination actions of the non-protected IP rights of the Project within the EU:

Targeted audience	Purpose	Dissemination material vehicles
General public	Communicating upcoming activities; objectives of the Project, benefits of spillover effects, timelines and expected outputs in the view of: • Creating a public awareness *vis-à-vis* the Project; • Foster public support of the Integrated Project.	• Press releases and newsletters; • Interviews; • Companies websites; • Project-specific website; • Social media (e.g. Facebook, Twitter, LinkedIn, etc.).
Employees and stakeholders	Communicating objectives, of the Project, timelines, expected outputs and results.	• Internal conferences and newsletters (published on the companies intranet).
Other Direct Participants/indirect partners	Ensuring a common awareness regarding the Project for all the relevant people at each Direct Participant/indirectly involved partners (for e.g. regarding the current state-of-the-art) Ensuring that each Direct Participant/indirectly involved partner uses the reference models of the Project for all delivered materials (e.g. presentations at workshops or seminars, deliverables, training activities, etc.)	• Private project (secured) document exchange platform for Direct Participants/indirectly involved partners; • Dedicated personnel to communicate and share information related to the Project; • Newsletters; • Project templates for presentations and reports; • Internal workshops with Direct Participants/indirectly involved partners.
Scientific community	Exchanging with other scientists in the battery field (inside and outside the Project) Coordinating with ongoing and future programme to maximize impact and create synergies	• Presentations on relevant congresses and conferences; • Presentation of the Project at the Commission and relevant funding agencies and schools (PhD thesis defence); • Publication in scientific

Targeted audience	Purpose	Dissemination material vehicles
		journals[9]; • Ensuring the availability of students internships; • Sponsoring PhDs; • Fostering university/academic chairs and post-doc positions; • Organizing student contests.
SMEs/Start-ups	Looking for new suppliers and potential clients. Sharing the knowledge about the results and expected outcomes of the Project. Seeking for new ideas and most promising technologies/solutions	• Invitations after market recognition; • Specialized-industry magazines; • Start-up contests

Table 4: Matrix of dissemination and spillover strategy of non-IP protected results

(155) The table below details in a quantitative manner the dissemination actions envisaged by the Direct Participants:

KPIs	Expected dissemination in the course of the Project (estimates)	Difference with "business as usual" (estimates)
Publication in peer-reviewed journals	170	+ 100
Workshop organization/exhibition	178 to 186	+ 100
Participation in conferences	around 275[10]	+170
Sponsorship of PhDs/MScs	178 to 190	+140
Internal conferences and newsletters	142	+80

[9] Such as in the Journal of Power Sources, Electrochemica Acta; ChemSusChem; Hydrometallurgy; Waste Management; Journal of Cleaner Production; Resources Conservation and Recycling; Waste Management & Research; Separation and Purification Technology, Industrial Electronomic Magazine, Nature Energy and the Journal of the Electrochemical Society.

[10] This is calculated on the basis of the participations of each Direct Participant. Several Direct Participants may participate to the same conference.

KPIs	Expected dissemination in the course of the Project (estimates)	Difference with "business as usual" (estimates)
Media coverage and social media	around 5 400	+600
Site visits	150	+140

Table 5: KPIs for dissemination and spillover knowledge

2.5.1.2. Participation to events

(156) The Direct Participants will further participate in conferences and public presentations in the framework of established international events listed in the table below.

(157) These events cover a number of Member States including but not limited to: Belgium, Finland, France, Germany, Italy, Spain, Sweden, Poland, etc. They relate to a number of different sectors beyond the sector(s) where each Direct Participant operates, such as mining, metal extraction, hydrometallurgy, electrochemical, automotive, e-mobility, energy storage, telecommunications, etc. They are open to participants from all Member States of the EU and ensure wide geographic coverage, beyond the participating Member States.

Name of event/ conference **Frequency and locations** **Main topics addressed**	**Connected mainly to Direct Participants**
Advanced Automotive & Industrial Battery (AABC Europe)[11] Conference (annual) • Battery technology, material, chemistry	ACC; BASF; Umicore; FAAM; Fortum; VARTA; Terrafame; Solvay.
BATCircle seminars, Pori, Finland • Circular economy • Recycling technologies • Manufacturing processes of battery chemicals	Fortum
Batteries Europe coordinating several initiatives such as: • European Battery Alliance (EBA) • European Technology and Innovation Platform (ETIP)[12]	ACC; Solvay; Umicore Fortum;
Batteries Event, chaired by Avicenne, Nice, France (annual) • Circular economy • Raw materials • Safety • Recycling	ACC; Fortum; Solvay; Terrafame; Umicore; VARTA
Battery Show Europe (annual) • Battery technology	ACC; Nanocyl; Solvay;

[11] https://www.advancedautobat.com/

[12] The Direct Participants will further assess the development of a relationship with the secretariat of ETIP.

Name of event/ conference Frequency and locations Main topics addressed	Connected mainly to Direct Participants
	Terrafame; Umicore
Commission, Horizon 2020 and Horizon Europe related-events	ACC; Solvay; Umicore
EGVIA-ERTRAC conferences	Kaitek
Electric vehicle symposium (annual)[13] • Test and verification methods • Test system development	ACC; SEEL
Electrochemical Conference on Energy and the Environment (ECEE) (annual)	ENEL X
Electrochemical Society (ECS) meeting (biannual)	FAAM
EMIRI (Energy Materials Industrial Research Initiative) events on Advanced Materials (frequently during the year) r • Battery technology, material, chemistry	Umicore; Solvay
Energy Storage World Forum	ENEL X
EU Industry Days Conference (annual)	Umicore; Solvay
EU Raw Materials Week • Hydrometallurgy • Battery metals extraction • Circular economy • Raw materials	Keliber, Terrafame, Umicore
European Strategic Energy Technology Plan (SET Plan) Conference, (annual)	ACC; Solvay; Umicore
FEM, Levi, Finland Conference (biannual) • Raw materials	Fortum; Keliber, Terrafame
IMPACT, innovation conference in Krakow, Poland (annual) • Circular economy • E-mobility • Innovation	Elemental
Impact Mobility Revolution' 19	Eneris
International Battery Association (IBA) Conference (annual) • Electrochemical energy storage	BASF; Umicore; Elemental; Terrafame; Solvay
International Conference on Electronics Engineering and Technology (ICEET) (annual)	ENEL X
International Congress for Battery Recycling ICBR (annual)	BASF; Umicore; Elemental, FAAM; Fortum; Terrafame;

[13] https://www.evs32.org/

Name of event/ conference Frequency and locations Main topics addressed	Connected mainly to Direct Participants
• Recycling value chain • Collection • Recycling technologies • Circular economy	Solvay
International Meeting on Lithium Batteries IMLB (biennial, when in EU) • Li-ion, Solid State, Li/S	ACC; FAAM
Intersolar Europe, Munich, Germany (annual)	ENEL X
Lithium Battery discussion, Arcachon, France (annual) • Li-ion, Solid State, Li/S…	ACC
Lithium Supply and Markets, Santiago, Chile (annual) • Hydrometallurgy • Production technology	Keliber; Terrafame
Meeting European Materials Research (E-MRS) Society (biannual)	BASF
Mines & Money, London, UK (annual) • Hydrometallurgy • Battery metals extraction • Real-time process monitoring technology	Keliber; Terrafame
Mines & Technology, Helsinki, Finland (frequently during the year) • Hydrometallurgy • Battery metals extraction • Real-time process monitoring technology	Keliber; Terrafame
Smart Production Solutions (SPS), Parma, Italy (annual)	Kaitek
The European Mineral Processing and Recycling Congress (EMPRC) (annual)	FAAM
The Minerals, Metals & Materials Society (TMS) conference (annual)	FAAM
Vehicle Electronics and Connected Services (VECS), Sweden (annual)	SEEL
WasteCon Conference (annual)	FAAM

Table 6: Event/conferences where at least one Direct Participant will participate

(158) As far as SEEL is particularly concerned, being a RTO, it will organise lunch seminars five times a year where SEEL's users and customers (companies and RTOs), as well as all Direct Participants can meet and share results and knowledge. SEEL will also organise researchers' days once a year. The researchers' days will start during the first quarter of 2022, when SEEL centre is expected to be operational. SEEL's intention is to form an ecosystem for cooperation and networking (an open innovation arena) and to serve as a forum for researchers, experts and practitioners to explore and discuss recent research results, challenges and opportunities in the area of batteries and e-mobility.

2.5.1.3. Dissemination and spillovers through the European collaborative R&D&I ecosystem

(159) The Direct Participants commit to disseminate the IP non-protected results acquired in the framework of the Project to the scientific community. In particular, the Direct Participants will collaborate with the scientific community and with indirect partners.

(160) The Direct Participants will in particular finance and/or contribute, through among others participation in excellence networks, such as RS2E, Alistore and ITS (Istituti Tecnici Superiori), to the creation/development of university/school chairs related to new materials, cells and system design with a view to train future European scientists, experts, engineers, technicians and operators.

(161) In addition, it is expected that the following indicative RTOs, will benefit from the dissemination of the results of the Project:

Name of RTOs	Country
Agenzia Nazionale per le Nuove tecnologie, l'Energia e lo Sviluppo economico sostenibile (ENEA)	Italy
Austrian Institute of Technology	Austria
Bi-REX at Università di Bologna	Italy
CEA	France
Centre interuniversitaire de recherche et d'ingénierie des matériaux (CIRIMAT), Unité mixte de recherche (UMR) du CNRS 5085, Toulouse	France
Chalmers University of Technology Gothenburg	Sweden
CiCEnergigune	Spain
CNRS	France
DLR Institute, Stuttgart	Germany
Doctoral School of engineering and science of the Aalborg University	Denmark
École Polytechnique Fédérale de Lausanne (EPFL)	Switzerland
Fraunhofer Institute (ISC)	Germany
Gent University (UGENT)	Belgium
Helmholtz-Institut Ulm	Germany
InnoEnergy PhD School	-
Institut Charles Gerhardt Montpellier	France
Institut de microélectronique et composant (IMEC)	Belgium
Institut des Matériaux Jean Rouxel, Nantes	France

Name of RTOs	Country
Institut für Technische Chemie und Umweltchemie, of the Friedrich-Schiller-Universität Jena	Germany
Kent University	UK
Laboratoire de Réactivité et Chimie des Solides, Amiens	France
Laboratoire MADIREL, Marseille	France
ŁUKASIEWICZ Research Network	Poland
Mons University (UMONS)	Belgium
Münster Electrochemical Energy Technology (MEET) at University of Münster.	Germany
Nanolab CIDETEC	Spain
Politecnico di Milano	Italy
Politecnico di Torino	Italy
Reggio Emilia Innovazione	Italy
Rheinisch-Westfälische Technische Hochschule Aachen	Germany
Smart Chemistry Park (SCP)	Finland
Solid State Electrochemistry Group (USTAN), St Andrews, Scotland	UK
Studi di Modena e Reggio Emilia	Italy
Swedish Electromobility Center	Sweden
Technical University of Freiberg	Germany
Technical University of Münich	Germany
Università di Parma	Italy
Université Catholique de Louvain (UCL)	Belgium
Université Libre de Bruxelles (ULB)	Belgium
University of Bath	UK
University of Cambridge	UK
University of Catania	Italy
University of Graz	Austria
University of Limerick	Ireland
University of Urbino 'Carlo Bo', Department of Pure and Applied Sciences	Italy

Name of RTOs	Country
University of Sheffield	UK
Uppsala University	Sweden
Vrije Universiteit Brussel (VUB)	Belgium
Zentrum für Sonnenenergie und Wasserstoff, Ulm	Germany

Table 7: RTOs benefitting from spillover effects

2.5.1.4. Dissemination and spillovers through the participation of Direct Participants to clusters

(162) The results of the Project will be disseminated through the clusters to which the Direct Participants are members. These include:

- The European Battery Alliance bringing together over 100 stakeholders sharing similar interest in the furthering the development of a battery industry within the EU. Several groups have been set up with the task to enhancing coordination amongst industry, academia, public and private research centres and recommend policies to the EU bodies, as well as to national governments;

- The Smart Chemistry Park ("SCP") in Raisio, Finland, which is an innovation platform and cluster for start-ups and SMEs delivering solutions to bio and circular economies and clean-tech. It offers laboratory and office spaces, as well as a broad network involving industry, the public sector and RTOs. The SCP offers excellent opportunities for start-ups and SMEs to form industrial symbioses with large industry and also to develop industrial symbioses, joint circular economy solutions (e.g. CO2 recovery, wastewater processing) and co-creation between industrial plants. Fortum will use the R&D&I facilities located in the SCP.

(163) Other clusters may be described by each Direct Participant in its respective individual project portfolio.

2.5.1.5. Dissemination and spillovers through the participation of Direct Participants to professional associations and research coordination and facilitation bodies.

(164) Professional associations and research coordination and facilitation bodies will also constitute a network for dissemination. They include notably:

- Agoria;
- AENAS (Association for European NanoElectronics Activities);
- ALICE (Alliance for Logistic through Collaboration in Europe);
- AMBP (International Partnership on advanced battery materials);
- CEFIC (European Chemical Industry Council);
- EARPA (European Automotive Research Partner Association);

- EARTO (European Association of Research and Technology Organizations);
- EGVIA (European Green Vehicle Initiative Association);
- EIT KIC InnoEnergy;
- EIT KIC on Raw Materials;
- EMIRI (Energy Materials Industrial Research Initiative);
- ERTRAC (European Road Transport Research Advisory Council);
- EUROBAT;
- RECHARGE (the Rechargeable Batteries Association);
- The Swedish ship owners' association; and
- SusChem (European Technology Platform for Sustainable Chemistry).

2.5.1.6. Other dissemination

(165) Direct Participants will cooperate with firefighters in the EU to help them gain knowledge and methodology on safety issues relating to the GEN 3 and GEN 4 cells and modules.

2.5.2. Dissemination and spillover by IP-protected results diffusion

(166) The Direct Participants have committed to the dissemination of the IP-protected results.

(167) BASF, for example, commits to develop and protect IP through patenting. It will also provide non-exclusive licensing to SMEs at fair, reasonable and non-discriminatory ("FRAND") conditions:

- For the tutoring of SMEs willing to introduce next generation batteries in their products; and
- For non-automotive applications, such as stationary energy storage and some specific portable electronic segments.

(168) BASF will further contribute to establishing leading industrial hygiene/environmental health and safety ("EHS") measures.

(169) Endurance commits to ensure that the Project will generate significant dissemination effects at all levels of the battery value chain. Such dissemination effects will concern more specifically:

- The results of the innovation regarding smart battery housings and systems designed for re-purposing in various fields of application; and
- New materials for the secondary aluminium alloys shelf, for low carbon footprint foundry HPDC processes.

(170) FAAM aims to generate, during the Project, at least 25 unique patents regarding process and products. These patents will be offered at FRAND conditions.

(171) SEEL will take measures to improve the dissemination of IP rights. Within the Project, SEEL will work to actively spread new results and facilitate cooperation

around new scientific findings and processes. Where possible SEEL will work in order to get the results of the research published in a way that it is easily accessible to all interested parties. If SEEL will hold rights to IP-protected results, these will be licensed to other European actors at FRAND conditions. When the IP rights are owned by a business partner, SEEL will encourage the dissemination of information of the research conducted, as well as encourage the dissemination of as much of the results as possible. SEEL will cooperate with RISE and Chalmers in order to spread information to SMEs and academia in the EU. SEEL will also participate in outreach events for other parties and sectors, either itself or through its owners that are already investing in such events.

(172) Solvay will grant licenses at FRAND terms, following negotiation. Companies that Solvay may grant licenses are European-based battery companies and electrolyte companies.

2.5.3. Dissemination and spillover effects in FID

(173) The Direct Participants will use several ways for disseminating results during the FID. Some examples are provided below, whereas additional details are mentioned in each individual project portfolio.

(174) ACC will allow SMEs from different Member States to conduct development within its premises at fair site costs. In addition, it will open its testing lines to SMEs in neighbouring fields of activity. Access to the testing lines will be at FRAND conditions. Details and conditions are provided in ACC's individual portfolio.

(175) Endurance will disseminate the results of the intermediate testing phases in a timely manner also to European SMEs already active in the field (both foundries and OEM Tier 1 and 2 system Suppliers) as well as to companies potentially contributing to the involved supply chain.

(176) Nanocyl foresees that when the purification is transited from pilot unit to FID unit and then mass production, the pilot-prototype purification unit (at R&D&I scale) will have a lower use rate. This free time can be open to RTOs and partners under normal commercial services conditions.[14]

(177) Solvay commits to open access to the units installed in the frame of its individual project, to SMEs needing for developing new materials, if the units are compatible with the type of process needed to develop such materials and available (i.e. not fully occupied) under a normal lease or toll manufacturing agreement.

2.5.4. Dissemination and spillover effects to other undertakings and sectors

(178) The Project envisages producing dissemination and spillover effects to other undertakings and sectors outside the Project through the involvement of its Direct Participants in numerous collaborations with over 70 indirect partners. In addition to the RTOs already listed above, the Direct Participants commit to collaborate with several undertakings (including SMEs) from the same Member

[14] This assumes that products are safe to handle.

States participating in the Project, as well as, in the case of one company, from a Member State outside the Project, namely Austria.

(179) Particularly as regards the collaboration with a partner from a Member State outside the Project, in WS#B, WS#C and WS#D, Endurance will collaborate with AVL, an Austrian-based automotive undertaking developing powertrain and test systems, in providing design guidelines for the conception of innovative repurposing battery systems. The Direct Participants will also collaborate with equipment manufacturers, so that the IPCEI Batteries provides positive spillovers in those sectors, developing new know-how and skills given that part of the equipment will be first-of-its kind. *[...]*.

(180) In addition, the development of more performing cells and modules and battery systems will make it possible to develop new applications that so far could not have been envisaged, in particular commercial and industrial applications in the areas of among others IoT, medical technology, automotive, military, aerospace, marine technology (including submarine), mining, household electronics, energy consumption optimization or heavy machinery. VARTA, Eneris and FAAM will develop cells that can be used for applications outside the automotive sector. This will make it possible for the developer of applications *[...]*, to enhance the properties of these applications as a result of introducing the better performing cells and modules, or even to develop new applications. For instance, in WS#C, Kaitek will collaborate with Elettric80 S.p.A., an Italian-based automation undertaking, in order to develop a predictive maintenance algorithm system specifically addressed for industrial applications.

(181) In addition, as the participating companies to the IPCEI Batteries will use novel processes and technologies, their projects will also have a demonstration value for the novel technologies. The technology could then, also be exported to other sectors. For instance, Keliber believes that besides of options for monitoring of different hydrometallurgical industrial processes the real-time monitoring technology used in the project could potentially be used for autonomous monitoring of raw water quality in waterworks as well as autonomous environmental monitoring of wastewaters in different fields of the society.

(182) It is also expected that the innovations delivered by the IPCEI Batteries will spur further innovations in the development of electric boats and planes.

2.6. Description of the aid measures

2.6.1. Selection of the participating companies in the IPCEI Batteries

(183) The notifying Member States have submitted information about the following national procedures that have taken place for the selection of IPCEI Batteries participants:

- Belgium has published an open and transparent call for projects on 20 February 2019.

- In Finland there is a continuous open call principle complemented by specific programs and campaigns on emerging topics, such as a national state-of–the-art battery ecosystem organised by the Finish governmental organization "Business Finland" under an open non-discrimination

campaign in 2018, "Batteries from Finland". The specific IPCEI Batteries has been communicated to interested participants in an open and non-discriminatory manner in the context of various meetings organised by Business Finland (on 26 March 2019, 15 May 2019 and 25 May 2019), where more than 100 companies in total participated;

- France has launched an open and transparent call for projects on 9 January 2019;

- Germany has launched an open and transparent call for projects on 22 February 2019;

- In Italy, the IPCEI application process is based on a continuous open call principle complemented by specific information campaigns. For the IPCEI Batteries a publication of a request for expression of interest was launched on 25 January 2019. In addition, seven meetings were held over the period February to May 2019 with the aim of informing all interested parties of the IPCEI process. An average of 50 companies participated in each of these meetings.

- Poland has launched an open and transparent call for projects on 16 April 2019;

- Sweden has given RISE the task to build and operate an open test centre to support electrified transportation. SEEL has been designated to achieve this goal, through cooperation with academia and the industry.

2.6.2. Total investment in the IPCEI Batteries

(184) The notifying Member States authorities indicate that the activities performed during the project qualify as R&D&I and FID[15] in the meaning of points 21 and 22 of the IPCEI Communication.

(185) They also submit that the total IPCEI Batteries eligible costs[16] are nearly EUR 4.3 billion, out of which EUR 2.4 billion for FID and EUR 1.8 billion for R&D&I (see table 8):

[15] The Member States have explained that the FID activities are different at each stage of the value chain. For each individual project, they have presented in each participating company's project portfolio: a) the cut-off point (and the criteria used) between the FID and the mass production from an industrial point of view. Those cut-off criteria correspond to measurable and controllable KPIs and include in general KPIs linked to: quality, safety, environment, level of scrap, costs, service-ranking and productivity. In addition, for each company, the Member States have separately described and quantified the R&D&I effort that would still be taking place during the FID stage. Finally, the Member States have described the testing, sampling and qualification process implemented by each participating company and described the liability and return conditions applying to feedback sales and sales during ramp-up and explained how they differed from mass production and normal commercial activities. They explained further that during the FID phase, the production process will not yet be stable with contaminants of various sources generally still disturbing it. Thus, the scope of the FID activities will be among others to stabilise the process and remove all sources of contamination through various improvements of the production process. Products resulted from the FID phase that will not meet the customers' requirement shall be returned. In addition, customers also have the right to return those products even if they satisfy ex ante requirements as long as they are not suitable for their needs.

WS	R&D&I							Sum
	Belgium	Finland	France	Italy	Germany	Poland	Sweden	
Raw and advanced materials	[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]
Cells and modules	[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]
Battery systems	[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]
Repurposing, recycling & Refining	[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]
Sum	[…]	[…]	[…]	[…]	[…]	[…]	[…]	**1 833**
WS	**FID**							**Sum**
	Belgium	**Finland**	**France**	**Italy**	**Germany**	**Poland**	**Sweden**	
Raw and advanced materials	[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]
Cells and modules	[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]
Battery systems	[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]
Repurposing, recycling & Refining	[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]
Sum	[…]	[…]	[…]	[…]	[…]	[…]	-	**2 449**
Sum total	**[209-490]**	**[230-420]**	**[1 100-2100]**	**[320-750]**	**[1025-1925]**	**[237-412]**	**[32-73]**	**4 282**

Table 8: Estimated total costs per WS, per type of activity, per Member State, in million EUR

2.6.3. Aid amounts per aid beneficiary and chronology of funding per Member State

(186) The Member States submit amounts of the State aid under the measures that will be provided to the beneficiaries, together with the individual eligible costs and funding gaps:

	Eligible costs			Funding Gap	State aid nominal amount
	RDI	FID	Total		
Nanocyl	[…]	[…]	*[5 000 – 8 000]*	*[6 000 – 10 000]*	*[4 000 – 6 000]*
Umicore[17]	[…]	[…]	*[292 000 - 500 000]*	*[100 000-200 000]*	*[40 000 – 70 000]*
Solvay[18]	[…]	[…]	*[30 000 - 60 000]*	*[-20 000 / -40 000]*	*[12 000 – 20 000]*
Sum	[…]	[…]	**413 784**	***[-100 000 / -200 000]***	***[50 000 – 100 000]***

Table 9: Belgium – State aid per company in 1000 €, maximum

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[16] Eligible costs are only those costs of the individual projects, which comply with the requirements of the Annex to the IPCEI Communication. They, however, do not represent all costs required to conduct the R&D&I and FID activities concerned. The remaining portion of the costs required to conduct those activities, which are not considered eligible for public financing, will be absorbed by the Direct Participants.

[17] The number indicated as "State aid nominal amount" is not a commitment of the Government of Flanders for public financing but represents a maximum level that will not be exceeded when providing State aid.

[18] The indicated State aid nominal amount is not a commitment for public financing but represents a maximum level that will not be exceeded when providing State aid.

	Eligible costs			Funding Gap	State aid nominal amount
	R&D&I	FID	Total		
BASF	*[…]*	*[…]*	*[150 000 - 200 000]*	*[25 000 - 50 000]*	*[10 000 - 20 000]*
Fortum	*[…]*	*[…]*	*[20 000 - 70 000]*	*[5 000 - 25 000]*	*[1 000 - 10 000]*
Keliber	*[…]*	*[…]*	*[20 000 - 40 000]*	*[10 000 - 20 000]*	*[1 000 - 10 000]*
Terrafame	*[…]*	*[…]*	*[20 000 - 50 000]*	*[10 000 - 30 000]*	*[5 000 - 15 000]*
Sum	*[…]*	*[…]*	**271 404**	***[50 000 - 125 000]***	***[17 000 - 55 000]***

Table 10: Finland – State aid per company in 1000 €, maximum

	Eligible costs			Funding Gap	State aid nominal amount	State aid NPV
	R&D&I	FID	Total			
ACC	*[…]*	*[…]*	*[500 000 – 1 000 000]*	*[-1 000 000 / -1 500 000]*	*[500 000 – 1 000 000]*	*NA*
Solvay	*[…]*	*[…]*	*[300 000 – 400 000]*	*[-50 000 / -100 000]*	*[100 000 – 200 000]*	*[50 000 – 100 000]*
Sum	*[…]*	*[…]*	**1 197 523**	***[-1 000 000 / -1 500 000]***	***[500 000 – 1 000 000]***	***[50 000 – 100 000]***

Table 11: France – State aid per company in 1000 €, maximum

	Eligible costs			Funding Gap	State aid nominal amount	State aid NPV
	R&D&I	FID	Total			
Endurance	*[…]*	*[…]*	*[13 000 – 20 000]*	*[-5 000 / -10 000]*	*[10 000 – 15 000]*	*[5 000 – 10 000]*
Enel X	*[…]*	*[…]*	*[2 000 – 5 000]*	*[-1 000 / -3 500]*	*[2 000 – 5 000]*	*[1 000 – 3 500]*
FAAM	*[…]*	*[…]*	*[350 000 – 700 000]*	*[-300 000 / -500 000]*	*[350 000 – 700 000]*	*[300 000 – 500 000]*
Kaitek	*[…]*	*[…]*	*[5 000 – 8 000]*	*[-4 000 / -7 000]*	*[5 000 – 8 000]*	*[4 000 – 7 000]*
Solvay	*[…]*	*[…]*	*[40 000 – 70 000]*	*[-20 000 / -25 000]*	*[35 000 – 50 000]*	*[20 000 – 25 000]*
Sum	*[…]*	*[…]*	**594 826**	***[-300 000 / -700 000]***	***[500 000 – 900 000]***	***[300 000 – 700 000]***

Table 12: Italy – State aid per company in 1000 €, maximum

	Eligible costs			Funding Gap	State aid nominal amount	State aid NPV
	R&D&I	FID	Total			
ACC	*[…]*	*[…]*	*[350 000 – 510 000]*	*[-1 100 000 – -1 700 000]**	*[350 000 – 510 000]*	*NA*
BASF	*[…]*	*[…]*	*[356 000 – 487 000]*	*[-231 000 – -347 000]*	*[228 000 – 362 000]*	*NA*
BMW	*[…]*	*[…]*	*[108 000 – 162 000]*	*[-71 300 – -114 600]*	*[73 300 – 121 700]*	*NA*
Umicore	*[…]*	*[…]*	*[7 200 – 9 300]*	*[-6 900 - -9 100]*	*[7 600 – 9 400]*	*NA*
VARTA	*[…]*	*[…]*	*[323 000 – 489 000]*	*[-345 000 - -533 000]*	*[341 000 – 460 000]*	*NA*
Sum	*[…]*	*[…]*	**1 477 595**	***[-1 139 000 - -1 563 000]***	***[929 000 – 1 357 000]***	***NA***

Table 13: Germany – State aid per company in 1000 €, maximum

Company name	Eligible costs			Funding Gap	State aid nominal amount	State aid NPV
	RDI	FID	Total			
Elemental	*[…]*	*[…]*	[50 000 – 100 000]	[-50 000 / - 100 000]	[50 000 – 100 000]	[50 000 – 100 000]
Eneris	*[…]*	*[…]*	[100 000 – 200 000]	[-100 000 / - 200 000]	[100 000 – 200 000]	[100 000 – 200 000]
Umicore	*[…]*	*[…]*	[0 – 50 000]	[0 / -50 000]	[0 – 10 000]	[0 – 10 000]
Sum	*[…]*	*[…]*	**273 023**	**[-100 000 / - 200 000]**	**[200 000 – 300 000]**	**[-100 000 / - 200 000]**

Table 14: Poland – State aid per company in 1000 €, maximum

	Eligible costs			Funding Gap	State aid nominal amount	State aid NPV
	R&D&I	FID	Total			
SEEL	589 000	0	589 000	-490 000	575 000	490 000
Sum	**589 000**	**0**	**589 000**	**-490 000**	**575 000**	**490 000**

Table 15: Sweden – State aid per company in 1000 SEK, maximum

(187) The Member States submit that the durations of the individual projects of the participating companies differ. The funding period (i.e. the period during which the costs, which the companies can claim to be eligible, should be incurred) is the following, per WS:

WS	Starting date	End date
WS#A	This WS will start in 2019 as soon as the Commission issues its clearance decision.	Collaborations within this WS and/or with other WS are expected to terminate at the latest in *[…]*.
WS#B	This WS will start in 2019 as soon as the Commission issues its clearance decision.	Collaborations within this WS and/or with other WS are expected to terminate at the latest in *[…]*.
WS#C	This WS will start in 2019 as soon as the Commission issues its clearance decision.	Collaborations within this WS and/or with other WS are expected to terminate at the latest in *[…]*.
WS#D	This WS will start in 2019 as soon as the Commission issues its clearance decision.	Collaborations within this WS and/or with other WS are expected to terminate at the latest in *[…]*.

Table 16: IPCEI Batteries timeline

2.6.4. The aid instruments

(188) The aid to be granted by all the participating Member States will predominantly take the form of direct grants. In the case of Nanocyl, Belgium has decided to provide direct grants for the R&D&I activities of the company and repayable advances for the FID activities.

2.7. Granting of the aid under the notified measures

(189) All the participating Member States have subjected the effective implementation of State aid to the prior approval of the Commission.

(190) The participating Member States have committed to suspend the award and/or payment of the notified aid if the beneficiary still has at its disposal earlier unlawful aid that was declared incompatible by a Commission Decision (either as individual aid or aid under an aid scheme being declared incompatible), until that beneficiary has reimbursed or paid into a blocked account the total amount of unlawful and incompatible aid and the corresponding recovery interest.

(191) They have further confirmed that the aid beneficiaries are not undertakings in difficulty.

(192) Some Member States (France, Italy and Poland) have indicated that no cumulation with other aid, de minimis aid, or EU funding will be allowed to cover the same eligible costs whereas the remaining Member States have put in place mechanisms ensuring that the total funding will not exceed the aid approved by the Commission under this Decision.

2.8. Transparency

(193) The Member States have in their notification committed to respect the transparency and publication requirements of points 45 and 46 of the IPCEI Communication.

2.9. Claw-back mechanism

(194) In order to further ensure that the aid is kept to the minimum necessary, the Member States have in their notification committed to introduce a claw-back mechanism. The basis for the claw-back mechanism will be ex post figures, which have been subject to annual approval by an independent auditor. For this purpose, separate analytical accounting will be required from the aid beneficiaries in the relevant Member State. The detailed conditions of the claw-back mechanism are explained in Annex I.

(195) The claw-back mechanism for the individual projects of the Direct participants only applies in case of a 'Surplus' including the actual State aid disbursements, as defined in Annex I. To ensure, however, that the beneficiaries have an incentive in delivering their project in an efficient manner, a share of any potential 'Surplus' will remain with the Direct participants.

(196) The claw-back mechanism will apply at minimum to aid beneficiaries having a notified aid amount, per Member State, above EUR 50 million19.

(197) The Member States are required to report to the Commission the implementation of the claw-back mechanism one month after each application.

3. ASSESSMENT OF THE MEASURES

3.1. Presence of State aid pursuant to Article 107(1) TFEUI

(198) According to Article 107(1) TFEU, "any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the internal market".

(199) In order to qualify as State aid under Article 107(1) TFEU, the following cumulative conditions must be met: (i) the measure must be imputable to the State and financed through State resources; (ii) it must confer an advantage on its recipient; (iii) that advantage must be selective; and (iv) the measure must distort or threaten to distort competition and affect trade between Member States.

(200) The public support measures of Belgium, Finland, France, Germany, Italy Poland and Sweden will be financed with funds stemming from the respective State budgets. The measures therefore involve State resources and are imputable to the relevant States.

(201) The Member States only grant support to the beneficiaries listed section 2.2.6 and the funding is not available to all undertakings in a comparable situation. By contributing to the financing of the R&D&I and FID activities of the selected firms with funds that would not have been available under normal market

[19] This threshold ensures that all the larger and more complex projects will be subjected to the mechanism and avoids imposing burdensome administrative requirements on the relatively smaller and less complex projects. Member States are free to introduce stricter conditions.

conditions, the measures confer to the aid beneficiaries a selective economic advantage.

(202) The aid beneficiaries involved in the relevant WS described above in section 2.2, operate in different sectors along the battery value chain, namely, mining, refining, chemical, cell manufacturing, automotive, battery management system development, energy storage, energy and recycling. These are economic sectors open to intra-EU trade (both in terms of supply and demand). Therefore, the measures may affect trade between Member States.

(203) By reinforcing the aid beneficiaries' position in their respective sectors, the measures are therefore liable to distort competition by putting the beneficiaries at a competitive advantage as compared to their competitors.

(204) In the light of the foregoing, the Commission considers that the public resources granted to the aid beneficiaries in the form of direct grants (and repayable advances in the case of Nanocyl) for the R&D&I and FID activities as described within the framework of this IPCEI Batteries project qualify as State aid within the meaning of Article 107(1) TFEU.

3.2. Legality of the aid measures

(205) By notifying the measures before putting them into effect, the Belgian, Finish, French, German, Italian, Polish and the Swedish authorities have fulfilled their obligations under Article 108(3) TFEU.

3.3. Assessment of the aid measures

3.3.1. Applicable legal basis for assessment

(206) In derogation from the general prohibition of State aid laid down in Article 107(1) TFEU, aid may be declared compatible by the Commission if it can benefit from one of the derogations enumerated in Article 107(2) and (3) TFEU.

(207) According to Article 107(3)(b) TFEU, aid to promote the execution of an important project of common European interest may be considered to be compatible with the internal market.

(208) In the IPCEI Communication, the Commission has provided guidance on the analysis of the compatibility with the internal market of State aid to promote the execution of important projects of common European interest. The criteria set out in the IPCEI Communication are applicable to this case.

(209) As Article 107(3)(b) TFEU allows the Commission to consider as compatible with the internal market aid to promote the execution of an important project of common European interest, it is appropriate to consider first whether the notified measures relate to such a project. These general eligibility criteria are assessed in section 3.3.2. Second, it needs to be considered whether the criteria for declaring the aid compatible with the internal market are met. The compatibility criteria are assessed in section 3.3.3.

3.3.2. Eligibility criteria

(210) In order to be eligible for aid under Article 107(3)(b) TFEU, the notified measures must involve a project, the project must be of common European interest, and the project must be important. These three criteria are considered below.

3.3.2.1. Definition of a project

(211) According to point 13 of the IPCEI Communication, the Commission may consider eligible an "integrated project", that is to say, a group of single projects inserted in a common structure, roadmap or programme aiming at the same objective and based on a coherent systemic approach. The individual components of the integrated project may relate to separate levels of the supply chain but must be complementary and necessary for the achievement of the important European objective.

(212) The participating Member States, as explained above in section 2.4, consider the notified IPCEI Batteries to constitute an integrated project. The Commission shares this analysis for the reasons explained below.

(213) The Commission finds that the IPCEI Batteries is designed in such a way as to contribute to a common objective, formulated by the participating Member States and companies, as described in section 2.1. As mentioned therein, the main aim of the Project is to develop an innovative and sustainable battery value chain in the EU that goes substantially beyond the state-of-the-art and which brings together companies operating at different levels of the battery value chain. This aim is planned to be achieved by combining in a coherent systemic approach R&D&I and FID activities in four WS, which constitute the individual but interlinked components of the IPCEI Batteries. As described in section 2.4 above, each individual project is necessary and complementary to the other projects for the achievement of the overall IPCEI Batteries' objectives. In particular, the Commission notes that:

- The different projects in WS#A constitute the building blocks of the battery value chain supplying new generation of cathode and anode active materials, binders, electrolytes and performance enhancers. They are necessary for WS#B. In addition, WS#A encompasses both advanced materials and precursors and raw materials, so that one part of the projects within WS#A constitutes input for the other part;

- The different projects in WS#B will deliver next generations of cells satisfying performance needs for automotive applications, as well as other types of applications. They are complementary with each other in providing cells in different formats and specifications. They set the level of ambition for WS#A, constitute an input to both WS#C and WS#D, given that the improved recyclability and improved life cycle of the batteries require interaction and collaboration between WS#B, WS#C and WS#D;

- WS#D is key to deliver on the sustainability objective of the IPCEI. However, introducing a circular economy logic into the battery value chain is only possible if there is close interaction between WS#A and

WS#D. This cooperation is needed to recover materials, refine them to battery grade and reintroduce them in the production of advanced materials. Cooperation and interaction between WS#B, WS#C and WS#D is further needed to develop cells and modules that can more easily be recycled and recycled with a higher efficiency. Within WS#D, the different participants are also complementary to each other as together they cover the full recovery chain (safe transport, dismantling, pre-treatment, recycling, refining).

(214) Further, the Commission takes account of the following benefits of the Project that, as submitted by the Member States, would not have materialised otherwise and which corroborate to the consideration of this Project as being integrated in nature:

- Aggregation/cross-fertilization effect: the elevated number of participating companies with differing backgrounds in the industry brings together a wide pool of expertise along the Li-ion value chain. This scope and diversity of knowledge and know-how, which will be directly and indirectly pooled together, will accelerate the speed and deepen the quality of the progress achieved within the various collaborations envisaged; this phenomenon can be illustrated for instance by the cooperation between advanced material manufacturers and cell/module manufacturers described in recital (143), as the testing by the different partners of the advanced material improves the quality of the feedback and the testing, accelerates the qualification of the product and pulls also the expectations in terms of quality of the deliverables.

- The assistance of a framework: the necessary duration of some of the collaborations is such that a framework is needed in addition to the aid to help Direct Participants make the required long-term commitments;

- Widening the pool of potential partners: through this Project, several participating companies discovered the existence and activities of some partners with potential they were unaware of, and created relevant collaborations;

- Developing the EU ecosystem: this Project will provide the opportunity to create links and synergies with EU players of different size and geographic footprint, which would otherwise not have been created;

- Better focus: this Project will give Direct Participants the opportunity to jointly identify necessary areas of progress in the advanced materials and recycling industries, hence conferring a coordinated message to the related R&D&I teams on where efforts should focus.

(215) In view of this, and as described in detail in section 2.4 above, the Commission observes that the individual projects of the Direct Participants and the four WS are inserted in a common structure and programme aiming at the same objective and based on a coherent systemic approach, aiming at an innovative and sustainable battery value chain in the EU that goes substantially beyond the state-of-the-art and which brings together companies operating at different

levels of the battery value chain. In addition, the various WS have common objectives, as well as tasks and deliverables for the R&D&I and the FID phases.

(216) Further, in order to ensure the coherent implementation of the IPCEI Batteries, the participating Member States will establish a common governance structure, as described in section 2.3, under a SB, which will have the task to review the progress and the results of the project and propose changes if necessary, giving specific attention to the benefit for the European society. The Commission will be represented in the SB with three delegates.

(217) Therefore, in view of the above, the Commission concludes that the notified IPCEI Batteries qualifies as an integrated project in the meaning of the IPCEI Communication, as its individual projects and WS are inserted in a common structure and roadmap, and aim at the same objective, being necessary and complementary for the achievement of the important common European objective.

3.3.2.2. Common European Interest

(218) In order to establish that a project qualifies as being of common European interest, the IPCEI Communication sets out general cumulative criteria (section (a) below), as well as general positive indicators (section (b) below). In addition, the IPCEI Communication specifies certain criteria depending on the type of the project (section (c) below).

a) General cumulative criteria

Important contribution to the Union's objectives

(219) According to point 14 of the IPCEI Communication, the project must contribute in a concrete, clear and identifiable manner to one or more Union objectives and must have a significant impact on the competitiveness of the Union, sustainable growth, addressing societal challenges or value creation across the Union.

(220) According to point 15 of the IPCEI Communication, the project must represent an important contribution to the Union's objectives, for instance by being of major importance for one of the strategies or policies listed, which explicitly include, the Union's flagship initiatives such as the Innovation Union European strategy, the 2030 framework for climate and energy policies, the Energy Strategy for Europe and the Integrated Industrial Policy for the Globalisation Era.

(221) The Commission notes the important role that the battery industry has to play in reaching the decarbonisation targets of the EU. The 2030 climate and energy framework[20] includes EU-wide targets and policy objectives for the period from 2020 to 2030. One of the key targets is a reduction of at least 40% in greenhouse gas emissions (from 1990 levels).

[20] Communication from the Commission, to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A policy framework for climate and energy in the period from 2020 to 2030, COM(2014) 15 final/2, 28.1.2014.

(222) Further, the Commission has proposed a communication presenting its long-term vision for a climate-neutral economy by 2050.[21] Electrification of the economy, associated with the deployment of renewable sources of electricity and including the deployment of e-mobility, is set to be one of the main technological pathways to reach carbon neutrality.

(223) In the same context, the IPCEI Batteries will contribute to the EU objective on Sustainable Mobility for Europe. In its Communication, the Commission states: "Batteries production and development is a strategic imperative for Europe in the context of the clean energy transition".[22] The report on the implementation of the Strategic Action Plan on Batteries ("the 2019 SAPB Report") states that "Europe is forecast to develop a capacity of 207 GWh by 2023, while European demand for electric vehicle batteries alone would be around 400 GWh by 2028"[23].

(224) The IPCEI Batteries also makes an important contribution to the Energy Strategy for Europe given that it will also further develop stationary batteries needed to balance the grid against the background of an increasing share of electricity from variable renewable energy sources.

(225) In the 2019 SAPB Report, which was adopted following consultation of and close cooperation with the "European Battery Alliance"[24] launched in October 2017 with key industrial stakeholders, interested EU Member States and the European Investment Bank, the Commission observes that batteries will be one of the key enablers for a transition to a low carbon economy given the important role they play in stabilizing the power grid and in the roll-out of clean mobility"[25].

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[21] Communication from the Commission, to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, A Clean Planet for all – A European strategic long-term vision for prosperous, modern, competitive and climate neutral economy, COM(2018) 773 final, 28.11.2018.

[22] Communication from the Commission, "Europe on the move – Sustainable mobility for Europe: safe, connected and clean", COM(2018)293 final, 17 May 2018.

[23] Report from the Commission to the to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, on the Implementation of the Strategic Action Plan on Batteries: Building a Strategic Battery Value Chain in Europe, COM(2019) 176 final, 9.4.2019.

[24] https://ec.europa.eu/growth/industry/policy/european-battery-alliance_en

[25] Report from the Commission to the to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, on the Implementation of the Strategic Action Plan on Batteries: Building a Strategic Battery Value Chain in Europe, COM(2019) 176 final, 9.4.2019.

The Commission also stresses that Europe shall move fast in reaping the benefits of its technological and industrial excellence and seize the opportunities arising along the entire batteries value chain. The Commission therefore, shall work together with the Member States and key European companies "[…] to build a competitive, sustainable and innovative battery ecosystem in Europe, covering the entire value chain".[26]

(226) The Commission considers that the IPCEI Batteries will contribute to fulfilling the objectives laid down in the 2019 SAPB Report, the "Europe on the move" Communication, and the "Clean Planet for All" Communication. First, the Project will help developing battery cells, modules and systems within the EU. aiming to serve the needs of the automotive (PCs/LCVs) sector, as well as other forms of e-mobility, such as e-scooters, e-motorcycles and e-bikes contributing thus to a successful decarbonisation of the economy. Second, the information submitted shows that the Project will develop significant R&D&I on battery cells, modules and battery systems and on their deployment process for the automotive and other important sectors of the economy, in particular energy storage. Third, the Project is set to support sustainability of the battery cells, modules and battery systems industry with the lowest environmental footprint possible, ensuring at the same time cost effective and efficient repurposing and recycling targets.

(227) The IPCEI Batteries will in addition support Action 7 of the Integrated Strategic Energy Technology ("SET") Plan, which is the central pillar of the EU's energy and climate policy.[27] The SET Plan was revised in 2015 to help realise the research and innovation priorities of the Energy Union, particularly in relation to the development of low-carbon technologies. The Project, through the setting up of an entire value chain for cells, modules and battery systems, will contribute to the development of e-mobility and stationary storage and will allow EU to advance on the agreed priorities.

(228) The Commission further notes that the IPCEI Batteries also contributes to the Innovation Union European Strategy. Indeed, it significantly contributes to the EU Renewed Agenda for Research and Innovation[28] and the Europe 2020 Flagship initiative[29]. The two communications proposed by the Commission in the context of these initiatives aim, among other at fostering R&D&I, especially through substantial investments needed for addressing societal challenges of the EU; at ensuring R&D&I cooperation across the EU; and at facilitating the cooperation between the industry and the academics. The Commission notes that

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[26] Report from the Commission to the to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, on the Implementation of the Strategic Action Plan on Batteries: Building a Strategic Battery Value Chain in Europe, COM(2019) 176 final, 9.4.2019.

[27] Communication from the Commission, "Towards an Integrated Strategic Energy Technology (SET) Plan: Accelerating the European Energy System Transformation", COM(2015)6317 final, 15 September 2015.

[28] Communication from the Commission, "A Renewed Agenda for Research and Innovation – Europe's chance to shape its future, COM(2018)306 final, 15 May 2018.

[29] Communication from the Commission, "Europe 2020 Flagship Initiative - Innovation Union", COM(2010) 546 final, 6 October 2010.

the IPCEI Batteries will contribute to R&D&I investments of up to around 2,465 million euros.

(229) As regards the contribution of this Project to the renewed EU Industrial Policy Strategy[30], the Commission acknowledges the importance of the IPCEI Batteries for supporting significant investments in the EU's battery value chain and that the Project will contribute to job creation by creating around 12,000 direct jobs.

(230) Lastly, the Commission notes that the IPCEI Batteries will contribute to the Europe 2020 objectives as detailed by the Commission's Communication on a Strategy for smart, sustainable and inclusive growth, which includes a reduction of GHG emissions, an increase of the share of renewable energy sources in the EU's final energy consumption and an increase in energy efficiency.[31] In this communication, the Commission indicated that three priorities should be the heart of Europe 2020: smart growth, developing an economy based on knowledge and innovation; sustainable growth, promoting a more resource-efficient, greener and more competitive economy; and inclusive growth, fostering a high-employment economy delivering economic, social and territorial cohesion. The Commission considers that the IPCEI Batteries will fulfil the above priorities by creating a value chain with sustainable battery cells, modules and systems at its core, by offering alternative sources of supply, thus reinforcing competition, and by capitalizing on the job, growth and investment potential of batteries. Specifically, the Commission notes that, depending on the different activities carried out, the reduction of CO_2-eq footprint is estimated up to 20 to 30% compared to existing processes.

(231) Based on the foregoing, the Commission concludes that the IPCEI Batteries contributes in a concrete, clear and identifiable manner to one or more Union objectives and has in particular a significant impact on sustainable growth and addresses societal challenges and value creation across the Union.

Member States involved

(232) The IPCEI Communication, point 16, further requires that more than one Member State is involved. The notified IPCEI Batteries involves seven Member States: Belgium, Germany, Finland, France, Italy, Poland and Sweden.

Positive spillover effects generated by the Project

(233) As required by points 16 and 17 of the IPCEI Communication, an IPCEI must benefit the European economy or society via positive spillover effects. According to the IPCEI Communication, "the benefits of the project must be clearly defined in a concrete and identifiable manner" and "the benefits of the project must not be limited to the undertakings or to the sector concerned but must be of wider relevance and application to the European economy or society through positive spillover effects (such as having systemic effects on multiple levels of the value chain, or up- or downstream markets, or having alternative

[30] Communication from the Commission, "Investing in a smart, innovative and sustainable industry – A renewed EU Industrial Policy Strategy", COM(2017)479 final, 13 September 2017.

[31] Communication from the Commission, "Europe 2020, A strategy for smart, sustainable and inclusive growth", COM(2010) 2020 final, 3 March 2010.

uses in other sectors or modal shift) which are clearly defined in a concrete and identifiable manner."

(234) The IPCEI Communication requires for spillover effects to be identified at all the following levels: beyond the participating Member States ("European economy or society"); beyond the aid beneficiaries ("not be limited to the undertakings"); beyond the sector(s) in which the aid beneficiaries are active ("… or to the sector concerned").

(235) In view of the information submitted by the Member States, the Commission observes that different dissemination levels, ranging from awareness to exploitation, are proposed to ensure the translation of developments and outputs into new findings and market opportunities. The objective is to reach a wide range of potential users and uses amongst research, social, investment and policy makers.

(236) As regards spillover effects for non-IP protected results of R&D&I, the Member States have provided an extensive list of activities (described in section 2.5.1). illustrating that the effects of the Project are not limited to the Direct Participants but will be disseminated to the whole scientific community and be of wider relevance and application to different economic sectors. For example, the Commission recognises that involvement in conferences and events as speaker, contributor, or participant will contribute to the dissemination of the knowledge and skills in the sense that attendance to these events is typical of all key actors (undertakings, RTOs, universities, etc.) of the battery value chain as they provide an excellent opportunity to exchange on the latest updates in the battery industry. Moreover, a close communication and connection to clusters, professional trade associations, research facilitation bodies, chambers of commerce and other intermediary bodies will enhance the dissemination effort.

(237) The Commission notes also the significant effort made by the Direct Participants in spreading and sharing knowledge by publications in peer-reviewed journals and in increasing links with the academic world, including through direct collaborations for the implementation of the Project but also through a significant sponsorship of PhD and MSc degrees. This is particularly important to ensure that the knowledge is also transmitted to the next generations and that the future workforce can acquire the skills and knowledge that will be needed in the future.

(238) Particularly, the Commission notes that, regarding advanced materials, the active and non-active materials developed within the Project could be used for applications not covered by the IPCEI (applications other than PCs, LCVs and industrial electric vehicles), for stationary energy storage manufacturers other than the Direct Participants and for applications not targeted by the IPCEI Batteries.

(239) Regarding cells, modules and systems, the Member States provided information showing how the availability of higher performing cells, modules and systems could also enable the development of new applications for instance in the power tool sector. Within the project timeframe, FID activities in IPCEI Batteries will lead to significant spillover effects in upstream or downstream markets, among IPCEI partners but also beyond them. In general, downstream markets parties will benefit in many ways from the R&D&I and FID phases. IPCEI Batteries

will enable them to develop new product applications and designs and acquire specific skills as well as knowhow, which again can be used in cooperation with third parties (inside or outside IPCEI Batteries).

(240) Further, battery recycling and refining processes developed in framework of the Project will be able to treat a broad range of Li-ion batteries used in automotive and non-automotive applications and not just the cells, modules and batteries produced by Direct Participants. The innovations in recycling will thus improve the recycling of all Li-ion batteries in the EU.

(241) As regards spillover effects for IP protected results of R&D&I, the Commission considers that the Member States have shown adequately the dissemination activities and the commitments undertaken by the Direct Participants to spread those results as widely as possibly to the scientific community and across economic sectors (e.g. cells and modules manufacturers for non-automotive applications, such as energy storage, hobby tools, e-bike, e-motorcycles and niche automotive producers), without jeopardising the objectives of the Project. As described in section 2.5.2, interested parties, e.g. SMEs or RTOs, will be granted access to those results from some aid beneficiaries at FRAND conditions and the licenses will be non-exclusive. This dissemination will provide interested parties the possibility to reap the benefits of the R&D&I and FID activities undertaken by the IPCEI Batteries. Interested parties will exploit the results in different applications, in up- or downstream markets, increasing therefore their technological expertise and their own research activities, improving their own equipment, materials and processes and having the opportunity to develop new products or establish new collaborations, contributing, as a result to the overall objectives of the Project.

(242) As far as spillover effects of FID activities are concerned, the Commission considers that, on the basis of the information provided by the Member States (described in section 2.5.3), the FID activities will lead to significant spillover effects in downstream markets amongst the Direct Participants, but also beyond those markets. The Project will enable the participating companies to develop new product applications and designs and acquire specific skills and know-how, which can be used in cooperation with third parties within or outside the Project. The Project will also provide access to next generation batteries, as well as to new technologies issued from the FID phase to all interested parties that would be willing to develop new knowledge and applications considering the entire lifecycle of high-performance batteries. These parties should benefit of an early access to the latest technologies available and may thus be able to reduce their development time.

(243) The FID activities will also generate spillover effects across economic sectors to other industrial parties, such as equipment manufacturers, high-tech industries or RTOs, which they will benefit from their own feedback regarding R&D&I in order to improve their own equipment, materials and processes.

(244) In addition, the FID projects will test novel techniques, which could – upon demonstration that they are effective - be implemented in other areas. For instance, the optical monitoring technology that will be tested in the production of lithium hydroxide could be used for quality monitoring of raw water resources and for environmental monitoring of wastewaters.

(245) It stems from the above that the benefits of the Project are not limited to the Direct Participants but benefit the EU economy and society at large, The IPCEI Batteries will benefit various other sectors in up- and downstream markets compared to the activities covered by the IPCEI Batteries. The Commission considers that these benefits are clearly defined in a concrete and identifiable manner and the Member States have adequately shown how this Project benefits interested parties beyond those directly involved in the Project and beyond the sectors concerned. Therefore, this eligibility condition is satisfied, in accordance with point 17 of the IPCEI Communication.

Co-financing by the aid beneficiaries

(246) As required by point 18 of the IPCEI Communication, co-financing of the beneficiaries is present, as evidenced by the fact that aid to individual beneficiaries does not cover 100% of the individual projects' costs.

Environmental harmful subsidies

(247) The public financing of the IPCEI Batteries does not relate to environmentally harmful subsidies, therefore it is not in conflict with the principle of phasing out such subsidies recalled by the Resource Efficiency Roadmap as well as several Council conclusions, as required by point 19 of the IPCEI Communication. On the contrary, the sustainability is one of the core objectives of the Project and is one of the drivers of the innovations concerned; each participant is committed to reduce its own footprint on the environment and reduce the environmental footprint of the developed products once they are in use notably through:

- Increasing the energy efficiency through the use of industry 4.0, compact plants, energy efficient equipment, cogeneration and energy efficient production processes;
- Generating own electricity based on renewable energy or supply electricity from renewable energy;
- Improving air quality and avoiding water contamination by introducing solvent free processes;
- Reducing waste;
- Producing tailings that can be reused for other industries instead of being discarded;
- Proactive actions to minimize the impact of mining towards protected species;
- Replacing liquid acid treatment by more environmentally friendly processes causing less water pollution and less health and safety hazards to workers;
- Designing cells, modules and batteries having an extended lifetime allowing for second use and being easier to dismantle and recycle;
- Designing cells and modules having a higher efficiency, reducing the energy needed to charge them;
- Developing processes that allow for a higher degree of recyclability of the battery; and

- Where possible, using secondary materials instead of raw materials.

(248) Based on all the above considerations, the Commission considers the general cumulative criteria for eligibility of the notified IPCEI Batteries to be met.

b) General positive indicators

Open procedure for Member States

(249) All Member States were made aware in the first months of 2019 of the creation of the IPCEI Batteries at the onset of the project.

(250) In addition, this open procedure is illustrated by the fact that different types of individual projects with a different amount of public financing have been selected by the Member States, whereas the entry of new Direct Participants is possible and can be decided under specific conditions that will be fixed on the first SB meeting.

Involvement of the Commission in the design of the project

(251) The Commission facilitated the emergence of the Project and contributed to having enhanced the coordination of Member States in such a project by having organised technical meetings with open invitation for all Member States and companies interested to participate.

Governance

(252) As described in detail above under section 2.3, the governance structure of the Project involves the Commission through participation into the SB.

Collaboration within the IPCEI Batteries

(253) The Member States have provided detailed information (see section 2.4.3) describing how each individual project creates important collaborative interactions in terms of number of partners, involvement of companies participating in the same and different WS and the involvement of companies of different sizes.

(254) The Commission takes note of the number of collaborations within each and across the different WS, as the table below illustrates:

WS	Number of collaborations	Collaborations intra WS	Collaborations inter WS	
			WS	Number of collaborations
WS#A	20	7	**WS#B**	12
			WS#D	1
WS#B	24	5	**WS#A**	11
			WS#C	3
			WS#D	5
WS#C	9	4	**WS#B**	2
			WS#D	3
WS#D	16	5	**WS#A**	4
			WS#B	4
			WS#C	3
Total	69	21		48

Table 17: Summary of the different inter and intra WS collaborations

Co-financing by a Union fund

(255) The Commission takes note of the fact that some Member States (at least, Poland and France) are considering seeking co-financing from the European Regional Development Fund, while several individual projects build on previous R&D&I funded by the Union fund "Horizon 2020".

(256) In view of all the foregoing, the Commission considers that on grounds of section 3.2.2 of the IPCEI Communication, five general positive indicators, in accordance with point 20 of the IPCEI Communication are met.

c) Specific criteria

(257) Point 21 of the IPCEI Communication provides that R&D&I projects must be of a major innovative nature or constitute an important added value in terms of R&D&I in the light of the state of the art in the sector concerned. According to point 22 of the IPCEI Communication, projects comprising of industrial deployment must allow for the development of a new product or service with high research and innovation content and/or the deployment of a fundamentally innovative production process. Regular upgrades without an innovative dimension of existing facilities and the development of newer versions of existing products do not qualify as IPCEI.

(258) The Commission has verified at the level of individual aid beneficiaries and per project that each aid beneficiary has a well-defined and documented research roadmap; the Commission has further compared all product and process innovation of each participant against the state of the art on the market. It has verified that those innovations were fundamental innovations due to the many challenges that they aimed at solving and verified that they did not constitute mere incremental improvements of existing products or processes. Also, if the research roadmap of a specific aid beneficiary included several products or applications, the Commission has verified that each of those products or applications contained fundamental product or process innovations not only

compared to the state of the art on the market but also compared to each other. It verified that the products/applications would not constitute mere incremental innovations of each other (see also section 3.3.3.1 below).

(259) Based on the information provided by the notifying Member States the Commission's assessment confirms that the R&D&I and FID activities carried out in each WS clearly aim to result in outcomes that will bring the technology substantially beyond the state-of-the art. The innovations identified by the Commission are described below.

Major innovative nature and expected results

(260) The Commission considers that the Member States have demonstrated the innovativeness of the project in all areas of the battery value chain including both R&D&I and FID activities.

(261) In WS#A (raw and advanced materials), the focus will be on raw materials, active materials and processes.

(262) Regarding raw materials, the innovation consists in particular in:

- Developing new very high purity battery chemical products;
- Using both virgin raw materials from the mining process and raw materials from recycled material sources, also favouring sources compliant with high environmental and social standards; and
- Developing hydrometallurgical lithium extraction by using the novel soda pressure leaching process, which is itself beyond the state-of-the-art technology.

(263) Regarding active materials, the innovation consists in particular in:

- Synthesizing CAMs and AAMs with energy densities that are significantly higher than the state-of-the-art *[...]*;
- Re-designing the electrode binders and developing new components for liquid electrolyte to achieve higher energy densities;
- Investigating new polymeric structures to increase fast charge capabilities;
- Using cobalt-free technologies to lower costs and to mitigate the EU's dependence on this critical raw material; and
- As far as solid-state battery cells are concerned:
  - Identifying new inorganic materials, as well as new binders and new associations of those inorganic materials and binders;
  - Developing hybrid oxide/sulphide -polymer solid-state electrolyte and allowing to achieve an energy density of 450Wh/kg to 500Wh/kg at cell level; and
  - Developing wet-precipitation method for Lithium-titanium oxide ("LTO") material synthesis allowing to obtain a powder of unusual electrochemical properties.

(264) Regarding processes, their innovation consist in:

- High throughput production technology with innovative material treatment steps for precursor CAM ("PCAM"), AAM and CAM which will be more cost competitive, more performant and better from a sustainability point of view;
- Introducing novel, carbon-neutral, processing and upscaling technologies, also as far as possible using existing European infrastructure; and
- Introducing processes with internal circulations, thus aiming for a near-zero-waste-process.

(265) The Key expected results of the WS#A R&D&I activities are:

- New highly sustainable processes which allow extraction, concentration, refining and purification of ores stemming from newly operated mines or refining facilities so as to generate high-purity raw materials fulfilling the requirements of advanced materials developers and manufacturers; and
- New active/non active materials to be utilized in highly innovative cells of GEN 3 and GEN 4 cells. These include AAM and CAM, binders, electronic conductive additives and, for GEN 3, liquid electrolyte components (solvents, salts, additives) as well as, for GEN 4, solid-state electrolyte, either polymer, inorganic or composite. These will need to meet a certain number of performance characteristics (in particular, energy and power density, material life, safety and costs), and will be sourced, as far as possible, in a sustainable way in the EU.

(266) The key expected results of the WS#A FID activities are:

- Near-zero waste industrial facilities for refined raw materials; and
- Industrial deployment of sustainable and cost-competitive production processes of innovative, advanced active and non active materials for GEN 3 and GEN 4 cells.

(267) In WS#B (cells and modules), the focus will be on battery components, battery cells, modules and innovative test methods.

(268) The above-mentioned innovations in the WS for raw and advanced materials and processes apply also in this WS leading to technologically upscale battery cells and modules generations.

(269) In the area of battery cell components, innovative solutions for the solid-state technology will be developed, such as utilizing solid-state electrolytes in combination with novel, high energy AAMs. Fully solvent free electrode processes, cathode in particular, will equally be part of the innovation as the cobalt-free cathodes. Both will have a significant contribution to a far more sustainable battery cell production and improve the CO_2 footprint.

(270) The innovative nature for the battery cells itself lies in the increase in energy density and power density taking into account economic and ecological aspects. It combines innovations from the material and process area with novel cell designs developed as part of the individual projects. Particular focus on cells and modules will be on a green manufacturing footprint, aiming to eliminate toxic

solvents, reduce the CO_2-eq equivalent during production and provide more efficient processes (e.g. reversible formation or water based coating). They will also contribute to the sustainability objective as, by using secondary aluminium low carbon footprint housings, they will develop a flexible assemble and disassemble design.

(271) The Commission acknowledges that cells and modules available nowadays have reached the maximum performance that can be obtained based on their current design. Trying to increase the silicon content of the current batteries has a negative impact on irreversible loss of capacity following formation process and requires a fundamentally different design and composition to obtain the higher performances needed for automotive applications, in particular to allow for driving long distances.

(272) The Key expected results of the WS#B R&D&I activities are:

- Several types of advanced Li-ion GEN 3 cells, with increased energy density both on a specific and volumetric level, faster charging performance, increased cycling ability. These GEN 3 cells will incorporate nickel-rich CAM and new graphite-based anode materials;
- Several innovative GEN 3 cell manufacturing processes in the following key areas: faster mixing, improved coating and more efficient formation;
- Several types of solid-state Li-ion GEN 4 cells, with further enhancements in energy density, charging performance and cycling ability. These GEN 4 cells will be based on silicon rich - followed by LiM - anodes materials and will be devoid of liquid electrolytes; and
- Several innovative GEN 4 manufacturing processes ensuring 0% porosity electrodes, implementing high-speed assembly processes and guaranteeing high quality interfaces between the several solid layers of the cells.

(273) The Key expected results of the WS#B FID activities are:

- Industrial lines for the several GEN 3 and GEN 4 cells described above will be deployed for the first time. These deployments will incorporate the several process innovations which will need to be further refined and adjusted to meet the quality and throughput requirements which must be complied with;
- Successfully transitioning into FID will require advanced digitalization, enhanced automation, process data capture and Big Data analytical tools to ensure competitiveness, increase quality and reduce non-compliance rates in production; and
- These innovative designs and associated manufacturing processes will ensure a reduction in the CO_2 footprint of batteries built with these cells and associated modules. This will further contribute to the reduction of the CO_2 footprint of mobility.

(274) In WS#C (battery systems), the focus will be on battery systems, including battery management software and algorithms, as well as innovative test methods for battery systems. The innovations in the field of raw and advanced materials and processes and cells and modules apply also in this WS leading to technologically upscale battery systems.

(275) The main innovations in the area of battery systems that would go substantially beyond the state-of-the-art in terms of performance (e.g. energy density), CO_2 footprint and sustainability, in particular regarding recycling and reuse of valuable materials, consist notably of:

- Innovative battery system architecture with increased useable space for cells, reduced number of inactive parts, sub-components and material mix as well as fully automated assembly and disassembly capability in order to allow for most efficient reuse/re-purposing and recycling;
- Innovative battery system architecture and production process to reduce CO_2-eq. footprint by using all potentials along the integration levels from material to battery system;
- New lightweight and low CO_2-eq. footprint components, e.g. near 100% secondary aluminium battery housing;
- Innovative thermal management, efficient wiring, advanced power electronics, innovative battery management system using innovative new sensors for SoH estimation and cell tracking;
- Fast predictive software providing new functionalities such as predictive analysis, advanced remote monitoring, real-time control systems using intelligent control algorithms, self-diagnosis with communication of SoH to effectively model battery degradation, improve reliability and facilitate repurposing; and
- Innovative measurement methods and most suited measurement set up for battery performance test, as well as safety test for accurate and relevant measurement, collection and analysis of data for battery systems incorporating advanced materials and cells.

(276) The Key expected results of WS#C R&D&I activities are:

- Innovative battery system architecture with increased useable space for cells, reduced number of inactive parts, sub-components and material mix as well as fully automated assembly and disassembly capability in order to allow for most efficient recycling;
- Innovative battery system architecture and production process to reduce C_{O2} footprint by utilizing all potentials along the integration levels from material to battery system;
- New lightweight and low CO_2 footprint components as high-vacuum assisted high-pressure casting thin wall, near net shape, large components with secondary aluminum alloys, to be developed in order to fit battery housings re-purposing solutions. The near net shape features of the casting have to accommodate easy re-usable battery cell/modules fittings/joining systems and guarantee dimensional tolerances repeatability adopting new generation of in-process control tools (i.e. thermal camera, 3D scanning);
- Innovative thermal management, efficient wiring, advanced power electronics, innovative battery management system using innovative new sensors for SoH estimation and cell tracking;
- Fast predictive software providing new functionalities such as predictive analysis, advanced remote monitoring, real-time control systems using intelligent control algorithms, self-diagnosis with communication of SoH

to effectively model battery degradation, improve reliability and facilitate repurposing; and

- Innovative measurement methods and most suited measurement set up for battery performance test as well as safety test for accurate and relevant measurement, collection and analysis of data for battery systems incorporating advanced materials and cells.

(277) The key expected results of the WS#C FID activities are:

- The definition and deployment of a new modular manufacturing process (covering the complete supply chain) and related industrial lines for battery components, dedicated to *inter alia* innovative, low CO_2 impact, easy to assemble and disassemble housings for cells, modules and external casings for batteries; as well as to new BMS incorporating distributed architecture;
- The upgrade, from pilot unit to the full scale, of the industrial process, in a step by step mode, in order to accommodate innovative products defined in RDI; and
- The coding, testing and implementation of predictive software and algorithms for more efficient battery use and monitoring.

(278) In WS#D (repurposing, recycling and refining), the focus will be on products, materials and processes.

(279) Regarding products, the innovative character of the process and the expected results consist in developing innovative battery modules housing for automotive applications designed for easy dis-assembling, for lower environmental impact and for better components and materials management, re-use and recycling.

(280) Regarding materials, the innovative character of the process and the expected results consist in using, for battery housing, secondary aluminium alloys with ten times lower carbon footprint versus primary aluminium alloys. In addition, secondary raw materials will be turned into products and reinjected into the battery value chain.

(281) Lastly, regarding processes, innovation will consist in:

- Development of integrated reverse logistics and treatment systems for large scale flows of end-of-life Li-ion batteries,
- More efficient dismantling, sorting and recovery / refining technologies for components and compounds from end-of-life battery flows allowing the achievement of highest recovery at the highest purity and added value, aiming at secondary materials with battery grade quality;
- Development of characterization methods for used batteries, as well as of a methodology for checking safety on used and damaged batteries for handling and transport;
- Flexibility regarding the type of waste (substrate) and products (e.g. metals or salts of metals); and

- Aluminium casting technologies combined with automatic machining & assembling and disassembling unit for repurposing and finally recycling (HPDC).

(282) The Commission acknowledges that today's technologies for exhausted batteries treatment are mainly based on crushing, automatic material selection, burning and melting with a high energy consuming process. In addition, the recycled materials generally do not have the required purity to be reintroduced in the battery value chain but can only be used in sectors with lower purity requirements.

(283) The key expected results of the WS#D R&D&I activities are:

- New (semi)automatized dismantling technologies to dismantle with high throughput, high efficiency, high quality and high safety battery systems into fractions fit for recycling processes;
- New pre-treatment/recycling approaches and systems to process in the most efficient, sustainable, safe and cost-competitive way all kinds of valuable waste generated by the battery value chain (simple to complex battery production scrap and end-of-life batteries); and
- New refining technologies to process in the most efficient, sustainable, safe and cost-competitive way the output of recycling processes to ensure an optimized recovery of key battery metals in their most appropriate forms for their re-use in the battery value chain.

(284) The key expected results of the WS#D FID activities are:

- The deployment of an efficient battery recycling service across Europe, implementing the new features developed in the course of this WS and previous with a view to facilitate recycling operations;
- The first transitioning into industrial stage of processes which facilitate the closing of the raw material loop, ensuring used batteries become a high-quality source of secondary materials for new batteries; and
- The industrial starting and ramping-up of new cost-optimized processes, which will ensure used Li-ion waste process costs can be kept below their embedded material costs. This will ensure that the intrinsic value of the waste is positive, hence eliminating incentives for all actors to select inappropriate end of life disposal routes, and in so doing greatly facilitating the collection and recycling of such waste.

(285) Based on the above, the Commission considers that the specific criteria established by the IPCEI Communication in points 21 and 22, as regards the R&D&I content of the research projects and FID projects that will be performed within the framework of the WS of the IPCEI Batteries are fulfilled.

3.3.2.3. Importance of the project

(286) According to section 3.3 of the IPCEI Communication, in order to qualify as an IPCEI, a project must be important quantitatively or qualitatively. It should either be particularly large in size or scope and/or imply a very considerable level of technological or financial risk.

(287) As evidenced by the number of participating companies (17 Direct Participants and over 70 indirect companies and RTOs) covering the entire battery value chain, the amount of total eligible costs (nearly EUR 4.3 billion), the amounts of State aid envisaged for the Project (see section 2.6.3), and the innovative character of the WS involved (as described in recitals (260) to (285)), the Commission considers the IPCEI Batteries an important project meeting the quantitative requirements of the IPCEI Communication.

(288) In addition, the Commission takes note of the considerable level of technological and financial risks for both R&D&I and FID activities entailed in the IPCEI Batteries.

(289) Regarding the technological risks, the IPCEI Batteries will be confronted to a number of technological hazards that could lead to an unacceptable failure in performance, cost and sustainability. Dealing with those risks would require unforeseen additional work (studies, modifications, tests, etc.), hence leading to significant delays and additional costs. This could be in particular the case for cells, modules and systems manufacturers, which, for instance, could not meet the power requirements nor the necessary safety level.

(290) As far as the raw materials producers are concerned, the technological risks are related to the introduction of new technologies, such as the novel soda leaching technology, especially for the ramp-up required, the high product quality requirements and the long qualification time required by the clients. Concerning the key ingredients for electrolytes, the risks stem from the fact that the technologies associated with the project are disruptive and have never scaled-up to an industrial level. For the advanced materials producers, the challenge to design materials with the required purity to fulfil the requirements of commercial batteries and match an acceptable cost is still to be demonstrated, and will require an outstanding effort of R&D&I and process development, with a significant risk of delay and additional costs. The technological risks for AAM and CAM reside in not reaching the performance, cost and reduced environmental footprint profiles deemed important for battery cell makers and their customers both at R&D&I but most importantly at FID level. Regarding recycling and refining, the technological risks reside in not developing a cost-competitive, versatile and scalable process able to generate battery materials with best recovery in the most appropriate forms for further use in the battery value chain.

(291) The IPCEI Batteries will moreover be confronted to strategic and organisational risks. The sales of cells, modules and systems, as well as of the active materials needed for these cells, modules and systems will depend on customers' requirements in terms of timing (e.g. as far as the automotive business is concerned or as regards the capacity to deliver on time the next generations of cells), costs and performance of the cells, modules and systems. In addition, the different contributors to the Project will have to align their development schedules to reach the same level of maturity at the same time, in order to fit with the customers' demand requirements. Any delay therefore would jeopardize the effective implementation of the Project.

3.3.2.4. Conclusion on the eligibility of the project

(292) In view of the above, the Commission concludes that the general eligibility criteria of the IPCEI Communication are met by the IPCEI Batteries.

3.3.3. Compatibility criteria

(293) When assessing the compatibility with the internal market of aid to promote the execution of an IPCEI on the basis of Article 107(3)(b) TFEU, the IPCEI Communication (point 25) requires the Commission to take into account a number of criteria, as elaborated below. Moreover, it requires also that the Commission carry out a balancing test to assess whether the expected positive effects outweigh the possible negative effects (point 26).

(294) Having regard to the conclusion that the general eligibility criteria are fulfilled by the IPCEI Batteries, as stated in section 3.3.2 above, and the nature of the IPCEI Batteries, the Commission considers that the presence of a market failure or important systemic failure can be presumed in line with point 27 of the IPCEI Communication.

(295) The analysis of the compatibility criteria has been performed by the Commission at the level of individual aid beneficiaries and per project.[32]

3.3.3.1. Necessity and proportionality of aid

Necessity of aid

(296) According to point 28 of the IPCEI Communication, the aid must not subsidise the costs of a project that an undertaking would anyhow incur and must not compensate for the normal business risk of an economic activity. Without the aid, the project's realisation should be impossible, or it should be realised in a smaller size or scope or in a different manner that would significantly restrict its expected benefits. Footnote 24 thereto requires that the aid application must precede the starts of the works, which is either the start of construction works on the investment or the first firm commitment to order equipment or other commitment that makes the investment irreversible, whichever is the first in time. According to point 29 of the IPCEI Communication, the Member State should provide the Commission with adequate information concerning the aided project, as well as a comprehensive description of the counterfactual scenario, which corresponds to the situation where no aid is awarded by any Member State.

(297) The Commission has verified that all companies have submitted their aid applications to the Member States before the start of their work on their individual projects included in the IPCEI Batteries, therefore the formal incentive criterion, as required by the IPCEI Communication (footnote 24) is met.

[32] Such individual projects can be composed of an R&D&I part and a FID part. Some aid beneficiaries have presented more than one project, either because they will be active in different WS or because they have separate projects within the same WS. .

(298) The Member States have submitted information demonstrating that the aid has an incentive effect for all aid beneficiaries, i.e. that the aid will induce a change of the behaviour of the beneficiaries by means of allowing them to engage in their IPCEI-covered individual projects in their full ambitious scope and in the time span of the project as notified. More specifically, this information is revealed in the counterfactual scenarios for the aid beneficiaries.

(299) Two aid beneficiaries, namely Terrafame and Keliber, specify a counterfactual project that they would implement as an alternative to the IPCEI Batteries. Terrafame would invest in the production of a more generic product instead of a high-purity one, whereas Keliber would have developed a less ambitious project (lower purity and less sustainable project) and would have supplied the lithium for chemicals with lower requirements and lower qualification standards. Both companies claim that the IPCEI Batteries entails additional technological challenges and higher costs.

(300) The remaining beneficiaries affirm that, absent the IPCEI Batteries public financing, they would not undertake their individual projects, or, if they would, they would not undertake them rapidly enough, or they would carry out activities with a significantly lower level of ambition. The aid beneficiaries would instead either not develop the new products under the IPCEI Batteries (in particular none of the participants would enter the cell market segment for automotive applications) or they would not conduct the R&D&I to introduce the different fundamental innovations under the IPCEI Batteries. In fact, when already present on the relevant market segment, they would limit their R&D&I activities to incremental improvements and would renounce to sustainability innovations. Some aid beneficiaries also indicated that they would postpone their decision to invest in the Project by several years potentially jeopardizing its implementation (given that they would have lost the first mover advantage and the Project would then also yield lower returns).

(301) The Member States have underlined that absent the aid, the development of a competitive, innovative and sustainable ecosystem would not take place. The innovations both in terms of performance and sustainability, would not be made available to European consumers, as each participant would have focussed on its own roadmap.

(302) The Commission observes that in all instances where the counterfactual scenario consisted in the absence of a project in the same segment or of mere incremental improvements or in delaying the projects, jeopardising thus the materialisation of the project, there is no appropriate evidence showing that the companies had clearly considered these alternatives in their internal decision-making at the time of taking the decision to apply for the public support. Moreover, it was not further substantiated by any financial calculations of the costs, revenues and profitability of such alternatives to be compared with the scenarios of the aided project.

(303) From the foregoing, the Commission concludes that, for all but two aid beneficiaries, there is no counterfactual scenario within the meaning of point 29 of the IPCEI Communication, which defines the counterfactual scenario as “a clearly defined and sufficiently predictable alternative project considered by the beneficiary in its internal decision making”.

(304) The Commission further verified that the aid was necessary to induce a change of behaviour by the aid beneficiaries. For the companies with no counterfactual scenario within the meaning of the IPCEI Communication, this change of behaviour is assumed to occur when the individual IPCEI-related projects achieve a sufficient degree of profitability. The sufficient degree of profitability corresponds to the company's weighted average cost of capital ("WACC"), as commonly applied by them as minimum internal benchmark for selection of projects. As represented by the funding gap analyses, submitted by the Member States for all aid beneficiaries, the aid is needed in order to cover the funding gap of the individual projects (the net present value of all these projects, calculated by using the respective WACCs as a discounting factor, is negative).

(305) For the companies with a clearly defined and sufficiently predictable counterfactual scenario (see recital (299) above), the Commission compared the net present values of the aided and alternative projects, in line with point 32 of the IPCEI Communication. Furthermore, the Commission verified that the aid is kept to the minimum necessary to ensure the implementation of the Project.

(306) The Member States also submit (also where the aid would not cover the full funding gap (see recital (186)) that the aid helps to induce the change of the behaviour of the aided companies due to further strategic long-term considerations (such as to offer innovative and differentiating products, to preserve the EU-based technological, research and technical capabilities, strategic KETs importance, strategic security considerations, etc.).

(307) In view of the above, the Commission considers that the Member States have sufficiently demonstrated that the aid measures do not subsidize the costs of the projects that the Direct Participants would anyhow incur and do not compensate for their normal business risks.

(308) Considering the fact that the aid measures enable the Direct Participants to pursue ambitious projects, which would not have been pursued in the absence of the IPCEI Batteries, the Commission concludes therefore that the notified aid measures are necessary to induce the change of the behaviour of the aid beneficiaries.

Proportionality of the aid

(309) According to point 30 of the IPCEI Communication, in the absence of an alternative project, the Commission will verify that the aid amount does not exceed the minimum necessary for the aided project to be sufficiently profitable, e.g. by making it possible to achieve an internal rate of return ("IRR") corresponding to the sector or firm specific benchmark or hurdle rate. According to point 31 of the IPCEI Communication, the maximum aid level should be determined with regard to the identified funding gap and to the eligible costs. The aid could reach up to 100% of the eligible costs, provided that the aid amount does not exceed the funding gap.

(310) The Member States have submitted, for all Direct Participants, detailed calculations of the eligible costs for their IPCEI specific R&D&I and FID projects and funding gap calculations. In the individual project descriptions, the contents of the companies' individual R&D&I and FID projects falling into the scope of IPCEI Batteries are detailed. In particular, the R&D&I activities to be

performed, technology risks and challenges, the state-of-the art in the sector concerned are detailed and it is explained how their R&D&I activities bring about important added value in going substantially beyond the state of the art, are of major innovative nature, how the FID allows for the development of new products with high R&D&I content and/or fundamentally innovative production processes and contains a very important R&D&I component. They also detail the eligible costs for the R&D&I and FID projects.

(311) In its assessment of the eligibility of the costs, for the individual R&D&I projects, the Commission verified individually for all aid beneficiaries, that their projects contain R&D&I activities of major innovative nature, going substantially beyond the state-of-the art in the sector concerned. This verification was based on the nature of the activities to be performed, the technology challenges and risks to be overcome within each WS and the duration of each activity, as demonstrated by each company (see section 3.3.2 above).

(312) The Commission consistently verified for all WS and individual projects that a high innovation level is to be reached, and that the activities do not merely allow for an incremental evolution of the technologies existing and embedded in battery products already existing on the market. Moreover, through this exercise, the Member States have verified and confirmed that the related R&D&I costs of each aid beneficiary comply with the Annex on eligible costs to the IPCEI Communication. The Commission has checked these costs and considers that they fulfil the conditions set out in the Annex to the IPCEI Communication. In addition, if instruments and equipment are not to be used during the full life for the Project, the Commission has verified that only the depreciation costs corresponding to the life of the Project are considered for the calculation of the eligible costs. The Commission has also required the aid beneficiaries to demonstrate that the depreciation periods used corresponded to good accounting practice.

(313) For the individual FID projects, the Commission verified, in order to determine whether they qualify as FID under the IPCEI Communication, that the FID activities:

a. Concern "the development of a new product or service with high research and innovation content and/or the deployment of a fundamentally innovative production process"[33];

b. Do not relate to "regular upgrades without an innovative dimension of existing facilities and the development of newer versions of existing products"[34];

c. Consist in "the upscaling of pilot facilities, or [to] the first-in-kind equipment and facilities which cover the steps subsequent to the pilot line including the testing phase,

d. Do not correspond to neither mass production nor commercial activities"[35];

[33] Point 22 of the IPCEI Communication, first sentence.

[34] Point 22 of the IPCEI Communication, second sentence.

e. "Follows on from an R&D&I activity and [themselves] contain a very important R&D&I component which constitutes an integral and necessary element for the successful implementation of the project"[36].

(314) In relation to the costs, the Commission has assessed, in particular, that they relate to "the capital and operating expenditures (CAPEX and OPEX), as long as the industrial deployment follows on from an R&D&I activity and itself contains a very important R&D&I component[37], which constitutes an integral and necessary element for the successful implementation of the project"[38].

(315) Having regard to the specificities of the battery sector concerned and the participating companies' individual FID projects contained in this Project, the Commission has assessed the eligibility of FID costs for each aid beneficiary according to the above criteria, in the following manner.

(316) The Commission finds for all aid beneficiaries, for each FID project, that it concerns either a new product with high R&D&I content or a fundamentally innovative production process or even both (see also recitals (260) to (285) above).

(317) The Commission further finds for all aid beneficiaries, for each FID project, that the industrial deployment concerns technologies with high R&D&I content or fundamentally innovative nature, and these highly innovative technologies are a result from a preceding R&D&I activity but yet they still require very important R&D&I to be carried out even after the R&D&I phase, i.e. to put these technologies into FID requires very important R&D&I; as such, the FID of these specific technologies contains a very important R&D&I component on its own (quantitatively or qualitatively), and this R&D&I in the FID phase is indispensable for the successful FID of the technologies.

(318) In relation to the very important R&D&I component, the Commission finds that for all beneficiaries an adequate demonstration of the very important (in quantitative and/or qualitative terms) R&D&I activities in their FID, which constitutes an integral and necessary element for the successful implementation of their individual projects, is provided. In particular, the Commission verified for each FID project that the planned important R&D&I during the FID, necessary to solve outstanding technological roadblocks, among others in terms of process integration, design stability, testing, packaging of components and/or security and safety of components, in the context of the complex technologies and large number of processes involved, is demonstrated. Mere engineering work accompanying normal activities of FID does not constitute the required R&D&I in FID. In particular, the assessment of the very important R&D&I component in the FID of each aid beneficiary took into account the following issues.

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35 Footnote (1) in the Annex to the IPCEI Communication.

36 Point (g) in the Annex to the IPCEI Communication.

37 The wording of the IPCEI Communication implies that the very important R&D&I component that needs to be embedded in the FID costs in order for these to be eligible constitutes a limit both in scope and time ("as long as") on the eligible FID costs.

38 Point (g) in the Annex to the IPCEI Communication.

(319) The assessment took into account, for each FID project specifically, the integration of processes in the industrial environment, the necessity of process, equipment and/or component redesign in relation with the complexity of the line, the technological complexity and progress going substantially beyond the state-of-the-art of the targeted components and systems, the applications addressed and their specific constraints in particular in terms of safety and security in relation to the components it embarks. When assessing the setting up of processes, activities are only considered eligible where they relate to the introduction of processes that transfer the R&D&I performed before FID and are critical for the functionality of the resulting product. These activities were assessed against the most up-to-date publicly available information related to the different IPCEI Batteries components (including scientific and technical literature journals, corporate technical scientific publications, corporate and news, patents).

(320) In its assessment, the Commission verified that the FID is not a mere regular upgrade, without an innovative dimension, of existing facilities, or a development of newer versions of existing products or technologies.

(321) In its assessment, the Commission further considered that where FID costs and the embedded R&D&I do not relate to the highly/fundamentally innovative technologies the beneficiary is developing, these are not eligible. Where the R&D&I in FID does not take place before the end of FID (end date in line with the IPCEI Communication), the FID costs are not eligible. The Commission has verified that such R&D&I costs are excluded from the eligible costs represented in tables 9 to 15 above.

(322) The Commission moreover verified that the FID as described by the Member States for the different aid beneficiaries does not cover mass production or commercial activities.

(323) In this connection, the Commission first examined whether the different beneficiaries established key performance indicators (e.g. quality of product, throughput, level of scrap, energy consumption, etc.) for identifying the moment in time that they reach a stabilised production process and mass production. Any costs relating to production occurring after the key performance indicators have met cannot be included in eligible FID costs. The Commission verified that they were not included in the eligible costs represented in tables 9 to 15 above.

(324) Further, the Commission verified that the activities taking place during the FID phases notified by the Member States for the different aid beneficiaries correspond indeed to FID activities and do not point at mass production or commercial activities. Thus, in addition to verifying that the FID phases are accompanied by a significant R&D&I effort until the end of FID, the Commission also verified that the activities undertaken during these periods do not correspond to commercial activities both in quantitative and qualitative terms.

(325) A FID phase corresponds to a phase in which the undertaking starts to test the production of its new product or the new production method outside the lab and the pilot line. Undertakings provide samples to potential customers to verify the quality of the product and how it can be integrated in the potential customers' activities. Typically, at that moment, new issues will appear and the product

might need to be changed or the production process might need to be modified. During the FID, numerous trial runs and a critical number of testing scenarios will be performed at different days and shifts to validate the production process with many idle moments in between.

(326) Concerning the samples, during FID, companies develop the so-called "C-sample", which could result from either the pilot line or already the production line it is planned to be made in. This sample is extensively tested by downstream partners and potential customers, which provide feedback on the performance parameters and is adjusted accordingly if not found satisfactory. With an approved C-sample, the product is then transferred to the production line it is planned to be made in, and a production line sample is provided. In this sample, referred to as "D-sample", all settings must be defined and frozen, with regard to process parameters and raw materials. The production line then needs to qualify as well. Moreover, after feedback by the customers, further development adjustments may still be necessary. D-samples are produced in large volumes, i.e. in volumes that are sufficient to allow for the detection of systemic flaws. Once the testing of samples is done, the production can be progressively ramped-up. The ramp-up phase is characterised by a low output rate, high scrap rates and high inefficiencies.

(327) In addition, as the activities supported under the IPCEI Batteries involve substantial innovations, the ramp-up phase of the FID activities continues to involve an important R&D&I effort until the end of FID, which the Commission has verified, as indicated under recital (318). During ramp-up, given that the production processes are implemented for the first time complications are expected and adjustments will in any event be needed to remedy the situation, potentially requiring that part of the production process is redesigned.

(328) Even during the ramp-up phase, customers expect the delivery of products of a high quality level despite the high inefficiencies and reject rates that undertakings face during FID. In the FID phase, this can only be achieved with the supply of products under abnormal commercial conditions: extraordinary quality assurance and extended return policies. Customers will be particularly keen to require extensive liabilities from new entrants. Those quality assurances imply for the companies additional quality control, screening and sorting processes, which are not needed anymore when the production process is stabilised and would also not be sustainable under normal commercial conditions (because they are too costly). During the FID phase, customers reserve the right to reject or return shipments not only in the event of a quality issue but also in cases that customer applications show technical problems or the market introduction is postponed, in particular from new entrants.

(329) The Commission verified that the planned FID activities included by Member States in the eligible costs calculations presented in tables 9 to 15 above: a) correspond only to the testing, sampling and ramp-up activities described in recitals (325) to (328) above, b) include only activities that still require significant R&D&I effort, c) correspond only to a limited output volume, and d) when a small volume of sales is planned, those sales occur under extended liability conditions. Conversely, the Commission verified that sales occurring after product qualification and years for which high volumes of sales were already planned were not included in the FID anymore and excluded from

eligible cost calculations summarised in tables 9 to 15 above, given that such sales would point to mass production and commercial activities.

(330) The Commission's assessment confirms that the notified FID phases of all aid beneficiaries comply with the requirement of the IPCEI Communication not to cover neither mass production nor commercial activities and that the costs summarised in tables 9 to 15 for the FID phase of each beneficiary relate to FID within the meaning of the IPCEI Communication.

(331) With regard to the eligible FID costs, the Commission also verified that for cost items that are depreciated during several years, only depreciation costs until the end of FID are included in the eligible costs.[39] The Commission further required the aid beneficiaries to demonstrate that the depreciation periods used correspond to good accounting practice.

(332) With regard to the operating costs, which should be limited both in scope and in time to the R&D&I that the FID entails according to the Annex to the IPCEI Communication, the Commission examined thoroughly the costs information provided by the Member States and considers the requirement fulfilled.

(333) The Commission moreover checked the FID cost information provided by the Member States and summarised in tables 9 to 15 above and considers that they fulfil the conditions set out in the Annex to the IPCEI Communication.

(334) Based on the above, the Commission finds that the costs notified by the Member States in relation to all aid beneficiaries constitute eligible costs for the IPCEI Batteries and fulfil the requirements of the Annex to the IPCEI Communication.

(335) The Commission reviewed in detail the funding gap calculations provided by the aid beneficiaries and verified the main assumptions in those calculations against publicly available data.

(336) The funding gap refers to the net present value of the difference between the future cash in- and out-flows projected over the lifetime of the investment, i.e. including the financial streams related to the mass production following from the IPCEI Batteries. In line with the IPCEI Communication, the Commission assessed the funding gap of each project at the level of each beneficiary.

(337) The Commission verified two main assumptions underpinning the calculation of the funding gap. First, the Commission checked that the participating company's internal WACC, which is the rate used to discount the cash flows determining the funding gap, corresponds to the company's internal WACC and is calculated in line with the best practices in finance. The Commission also constructed a company-specific benchmark WACC based on publicly available data, with the aim of assessing the plausibility of the company internal WACC.

[39] While verifying the funding gap calculations, for buildings or equipment used for the IPCEI Batteries, which still have a value at the end of the project, the Commission verified that this terminal/residual value is added to the revenues in the last year of project's financial projection to determine the project's specific funding gap.

(338) Second, the Commission made sure that companies consider all the revenues that can be reasonably expected from the investments and costs included in their business plan. To this end, the Commission verified that the length of the revenue streams is in line with the expected life cycle of the product. The Commission also checked that companies include a terminal value among their revenues. This value refers either to the residual value of capital investments (equipment and buildings) at the end of the planning period or the terminal value of the project resulting from the additional profits the company might expect to earn at a future horizon beyond the planning period.[40]

(339) Finally, the claw-back mechanism described above in section 2.9 provides further reassurance on compliance with the proportionality requirement.

(340) Taking into account the foregoing, the Commission considers that the aid to all Direct Participants does not exceed the individually identified funding gap of each beneficiary neither does it exceed the eligible costs displayed in the tables presented in section 2.6.3 .

(341) In addition, Member States have put in place mechanisms to make sure that irrespective of the source of the funding (local, regional federal, EU), the total support will not exceed the notified and approved aid amount under this decision.

(342) Therefore, the Commission considers that the aid to be granted by the notifying Member States is proportionate.

3.3.3.2. Prevention of undue distortions of competition and balancing test

Appropriateness

(343) According to point 40 of the IPCEI Communication, the Member State should provide evidence that the proposed aid measure constitutes the appropriate policy instrument to address the objective of the project.

(344) The Member States submit that State aid is the appropriate policy instrument to support the IPCEI Batteries. In their view, due to the exceptional size of the Project and the synergies it requires from the various partners, it could not be achieved and such technological breakthroughs could not be created without the support of the Member States involved in the financing of this Project. Alternatively, the participating companies would have focused on their own roadmaps to the detriment of innovations whose spillover effects will largely benefit the EU ecosystem.

(345) Further, the French, Italian and Belgian authorities submit additional considerations as to why other policy instruments would be inappropriate alternatives to State aid. They consider that the use of regulation to implement the objectives of the IPCEI Batteries would not be realistic and would not lead to the same outcome as the proposed measure. Regulation would also have little practical consistency, as in view of the many technological uncertainties and

[40] The terminal value of the project is calculated assuming cash flows in the last year of the business plan will grow at a constant rate in the future.

new processes and products, it would be more efficient to trust the choices of companies to decide on their own R&D&I and FID activities. The national authorities further argue that this is especially true for projects like the IPCEI Batteries with a great proportion of R&D&I activities being carried out in the participating companies themselves, which have the essential role to ensure the development of new technologies, as well as their industrial and commercial deployment.

(346) The French, Italian and Belgian authorities also argue that the payment of direct grants constitutes the appropriate instrument in view of the high risk of the Project and the low expected profitability induced by the relevant spillovers. Further, it is considered that direct grants will reduce the participating companies' incentives to opportunistically use contractual incompleteness to their advantage and will also address the coordination problems. The Belgian authorities further submit that for one of their projects, the FID phase will be financed through a repayable advance measure.

(347) The Commission shares the views of the Member States that given the level of ambition pursued by the IPCEI Batteries, its size and the numerous collaborative interactions induced, the public support through the notified State aid measures constitutes the appropriate policy instrument to address the objectives of the IPCEI Batteries. Given the level of risk and uncertainty, the Commission considers appropriate the use of direct grants for the R&D&I phase. The Commission also considers that the FID phase will equally entail a relatively high level of risk and uncertainty and therefore finds appropriate the use of direct grants or repayable advances (for one specific individual project). The Commission further notes that all larger aided projects will be subject to a claw back mechanism that will further ensure the appropriateness of the aid measure.

Identification of the potential risks of distortions of competition

(348) According to point 41 of the IPCEI Communication, aid can be declared compatible if the negative effects of the aid in terms of distortions of competition and impact on trade between Member States are limited and outweighed by the positive effects in terms of contribution to the objective of the common European interest. The assessment of the potential negative effects of the aid under the IPCEI Communication needs to consider, in particular, the effects on competition between undertakings in the product markets concerned, as well as risks of market foreclosure and dominance (points 42 and 43 of the IPCEI Communication).

(349) The Commission notes that each Member State provided detailed information and reasoning on the absence of undue distortions to competition in relation to each specific measure under the IPCEI Batteries. In particular the Member States argue that the European markets affected by the IPCEI Batteries are either non-existent (yet to be developed) or in their infancy. This is reflected in the fact that most of the aid beneficiaries are not currently active in the markets in which they intend to develop their production, as a result of the proposed measures. In the few cases where aid beneficiaries are already active in such markets, the Member States argue that these firms have either their production plants mainly outside Europe and, for those where there is presence in Europe, they are not materially active in the Li-ion type of batteries value chain that constitute the subject of IPCEI Batteries. The Member States also argue that the market shares

of the firms already active in markets affected by this Project are not material and will be even less material once the potential future developments and growth in these markets are taken into account. Finally, the Member States argue that the aid beneficiaries will continue facing intense competition from established competitors that are currently already active in the entire value chain targeted by this Project and that entry of potential competitors is expected and not hindered by the envisaged measures. The Member States also indicate that there will be no risk of foreclosure and overcapacity as a consequence of the IPCEI Batteries.

(350) The Commission's analysis of undue distortions to competition is always case specific. According to the IPCEI Communication, the assessment of the potential negative effects of the aid shall consider, in particular, the effects on competition between undertakings in the concerned product markets, as well as the risks of market foreclosure and dominance.

(351) The IPCEI Batteries involves an unusually large number of companies, each with several products present in various product markets. Key Enabling Technologies by nature diffuse to several applications along the value chain, which further increases the number of markets potentially affected by the aid measures. For this reason, in this particular case, the Commission adopts a two-step approach, as described below, in order to identify potential significant competition distortions, which might result from the aid measures. The purpose of the two-step approach is to determine whether there is a risk that one or more Direct Participants could exert market power and foreclose the market thereof. This verification was conducted, at the level of each aid beneficiary and at each level of the value chain concerned by the projects aided under the IPCEI Batteries (i.e. raw materials, advanced materials, Li-ion cells and modules, aluminium casting, battery management systems, recycling, refining and repurposing).

(352) First, the Commission screened companies using a uniformly available metric based on European production. Second, the Commission reviewed the detailed market information related to each beneficiary and carried an overall assessment of competition distortions based on that information.

(353) As for the first step (filtering companies), the Commission requested and received data on the aid beneficiaries' past production values by 8-digit PRODCOM classification for the products categories that each aid beneficiary intend to produce as a result of the Project.[41] This first screening identified only two cases in which the distortion of competition could be more significant. Particularly, this first screening showed that the majority of the aid beneficiaries have no current production in the PRODCOM categories of the products they intend to produce as a result of this Project. Further, in some cases the beneficiaries only have production outside the EEA (meaning that the

[41] According to the PRODCOM statistics on the production of manufactured goods. Note that PRODCOM sectoral data has been used in State aid control for example in the ETS Guidelines (Communication from the Commission — Guidelines on certain State aid measures in the context of the greenhouse gas emission allowance trading scheme post-2012, OJ C 158, 5.6.2012) and the Environmental and Energy Aid Guidelines (Communication from the Commission — Guidelines on State aid for environmental protection and energy 2014-2020, OJ C 200, 28.6.2014).

appropriate comparison would not be the European production level as captured by the PRODCOM data). In addition, the PRODCOM categories, in some cases, do not define appropriately the relevant product markets in which the beneficiaries intend to be active following this Project. Finally, PRODCOM data would not capture the competitive conditions of the service markets that are part of the IPCEI Batteries.

(354) Given the above concerns related to this first screening, the Commission also scrutinized the detailed market information requested to the Member States for each specific aid beneficiary and project. The data requested encompass a description of the current and future market conditions with information on expected production and demand levels and expected competition from other market players not part of this Project. Further, the Commission collected independently other market information as part of its assessment.

(355) The additional information on the competitive conditions of the markets provided for each individual project confirm the preliminary finding of the PRODCOM screening. This evidence confirms that most of the undertakings are new entrants in the battery value chain. The few undertakings that are already active in the value chain have a limited market share and face competition from other established players that are not part of this Project. In addition, the Commission considers that the concerned markets will significantly expand in the next years, as they result from the forecasted increased European demand (see recital (223)). Because of this expected market expansion, the relative size of the concerned undertaking would likely be even more limited. Taking into account the expected growth of these markets, the Commission also considers that the risk that the additional production levels induced by this IPCEI would lead to increased market power or dominance are low. Furthermore, on an overall basis, the projects resulting from the IPCEI Batteries will help meeting this increased European demand but will not suffice to fully cover it, which also indicates that the risk of overcapacity is unlikely.

(356) Concerning the two cases that the PRODCOM screening identified as potentially problematic, the detailed analysis of the available market information (in terms of actual and potential competitors and actual and expected market shares) indicates that there is no risk of undue distortion of competition. In particular, in both cases the used PRODCOM category was too narrow, not reflecting the relevant product market definition that should be considered in a competition assessment. A more refined analysis of the market shares in the appropriate product market shows that the aid beneficiaries have a limited market share and face several competitors that are likely to be still present in the future together with possible new entrants so that the risk of dominance is also low for those two cases.

(357) Based on the above, the Commission concludes that the negative effect on competition due to possible dominance or increase in market power are limited. The Commission also investigated whether the aid measures could lead to possible distortions of competition due to foreclosure. However, given that none of the aid beneficiaries has, or will have as a result of the aid measures concerned, a significant degree of market power, at any level of the battery value chain, the Commission concludes that the possible negative impact on competition due to foreclosure will also remain limited.

(358) The Commission also considered whether the IPCEI Batteries could have some undue effect on competition due to a joint foreclosure of undertakings not receiving aid under the Project. The Commission considers that the risks of this type of foreclosure are also limited for the following reasons. First, the aid beneficiaries of IPCEI Batteries are independent companies, often competitors at the different stages of the value chain. Therefore, these independent companies will compete for demand downstream and for the procurement of inputs upstream reducing possible risks of foreclosure. Second, several Direct Participants have already concluded or are planning to conclude collaboration agreements with undertakings outside the IPCEI Batteries, again indicating a low risk for possible foreclosure of non-aid beneficiaries.

(359) The Commission considers that the limited risk of undue distortions on competition is in any event outweighed by the following positive effects brought by the IPCEI Batteries.

(360) First, the IPCEI Batteries will deliver a key technology to allow the markets to grow. In particular, the necessity to develop cells making it possible to drive a vehicle over longer ranges and allow fast charges will help the deployment of e-mobility to an extent that would match the decarbonisation objectives of the EU.

(361) Second, the IPCEI Batteries is committed to a very large and pro-active dissemination of the results of the research, making it possible for other undertakings to enter the market (see sections 2.5.1 and 2.5.2). This dissemination of the research results further decreases the risk of foreclosure. The Commission further notes that as far as the automotive cell segment is concerned, one of the Direct Participants in WS#B plans to transfer the knowledge resulting from the supported research to a cell producer outside the Project, facilitating therefore the entry of an additional player on the cell manufacturing market (see recital (76)).

(362) Third, the IPCEI Batteries has numerous spillovers beyond the sectors concerned, the participating Member States and the Direct Participants. The innovations developed under the Project have the potential to lead to the development of entirely new applications, as well as to process innovations being transferred to other industries, increasing further efficiencies and environmental benefits.

(363) The analysis of the detailed information available to the Commission leads to the conclusion that the risks of foreclosure, dominance and overcapacity are limited and that any negative impact on competition is outweighed by the positive effects of the IPCEI Batteries in terms of contribution to the objective of the common European interest that will result in particular from the dissemination of the R&D&I results produced.

3.3.3.3. Transparency

(364) The transparency requirement, specified in section 4.3 of the IPCEI Communication, is fulfilled (see recital (193) above).

3.3.4. Reporting obligation

(365) According to point 49 of the IPCEI Communication the execution of the project must be subject to regular reporting.

(366) As notified by the Member States, the annual execution of the IPCEI Batteries activities as regards the technical advancements and individually committed spillovers, will be subject to reporting by the participating companies (to their national funding authorities), to annual reports on the progress and results of each of the WS and to annual report on the progress of the IPCEI Batteries as a whole (including through key performance indicators).

(367) The Member States must provide the Commission with an annual report, containing the progress and results of the IPCEI Batteries, the WS and the companies. These reports will include detailed reporting on the actions undertaken (e.g. number of SMEs pro-actively approached in which Member States) and results achieved by the companies in relation to the spillover actions that the companies have committed themselves to. The Member States have confirmed they will provide this reporting.

(368) Further, the Member States have agreed to report to the Commission every five years the application of the claw back mechanism.

(369) The Commission therefore considers that the reporting obligation on the execution of the IPCEI Batteries is fulfilled.

3.3.5. Conclusion on compatibility

(370) Based on the assessment under the IPCEI Communication, the Commission concludes that the notified aid measures are compatible with the internal market pursuant to Article 107(3)(b) TFEU.

4. CONCLUSION

(371) In view of the above and in light of the notifications of the Member States, the Commission has decided:

- not to raise objections to the aid on the grounds that it is compatible with the internal market pursuant to Article 107(3)(b) TFEU.

If this letter contains confidential information which should not be disclosed to third parties, please inform the Commission within fifteen working days of the date of receipt. If the Commission does not receive a reasoned request by that deadline, you will be deemed to agree to the disclosure to third parties and to the publication of the full text of the letter in the authentic language on the Internet site: http://ec.europa.eu/competition/elojade/isef/index.cfm.

Your request should be sent electronically to the following address:

European Commission,
Directorate-General Competition
State Aid Greffe
B-1049 Brussels
Stateaidgreffe@ec.europa.eu

Yours faithfully,

For the Commission

Margrethe VESTAGER
Executive Vice-President

ANNEX I

CLAW-BACK MECHANISM

The aid is capped in nominal terms by the notified and actual eligible costs. Member States will also ensure that the discounted value in 2019 terms of the aid (using the notified WACC as a discount factor) will not exceed the notified funding gap.

The claw-back mechanism will apply to those aid beneficiaries having a notified aid amount, per Member State, above EUR 50 million[42] in total (in case of subprojects[43], for all subprojects together) in that Member State[44].

The basis for the claw-back mechanism (whether at subproject level, if any, or otherwise at project level) will be ex *post* figures, which have been subject to annual approval by an independent auditor. For this purpose, separate analytical accounting (in case of different subprojects, at the level of each subproject) will be required from the aid beneficiaries in the relevant Member State.

Letter of credit

Starting as from 30 June 2026 and then, every five years, until an "End date"[45] to be determined depending on the durations of the projects/subprojects a test will be run ("the test-run") and the following $Surplus_i$ for year i (i=2025, 2030…) will be computed as the sum (positive or negative) of:

(a) the net present value discounted in year "i" (using the notified WACC as a discounting factor[46]) of the actual ex-post audited post-tax cash flows (including Capex, excluding State aid payments and financing cash flows) from 2019 to year "i"; and

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[42] This threshold of EUR 50 million of aid amount is to be understood in discounted terms in 2019 value terms when notified by the relevant Member State or in nominal terms in the absence of the former. If the aid eventually disbursed to the aid beneficiary is lower than the notified aid amount and lower than €50 million (in discounted terms, in 2019 value terms), the Project will be relieved from this claw-back mechanism. In such case, the Member State disbursing the aid commits to inform the Commission of the occurrence of a lower than notified aid amount and of the inapplicability of the claw-back mechanism within 2 months after final disbursement of the aid.

[43] A subproject is defined as each project for which a separate funding gap calculation has been notified. If that is the case, the claw-back mechanism will be applied at the level of each notified subproject.

[44] Clearly identifiable beneficiary projects/subprojects which are determined as unsuccessful by both the company and the Member State (i.e. commercially non-viable) and are terminated before the End date, will not be subject to the claw-back clause.

[45] The End date (only for the purposes of this claw-back mechanism) is set at the year corresponding to the end of FID + 5 years, or of RDI + 5 years for those projects and subprojects with no FID. In the case of multiple FID stages within the same subproject, 5 years should be added from the end of the latest of those FID stages. In case of delays in implementing the project compared to the timeline forecasted in the notification, the relevant end of FID will be the actual one, as verified by the relevant Member State.

[46] This means that for instance, for the test-run in 2026, a cash flow in 2019 will be multiplied by (1+WACC)^(6).

(b) the net present value discounted in year "i" (using the notified WACC as a discounting factor) of the actual aid disbursements from 2019 to year "i".

The $Surplus_i$, if it is positive, will be multiplied by an allocation ratio "$Share_{State}$", equal to the lesser between 60% or the net disbursed State aid from 2019 to year "i" divided by the verified eligible costs from 2019 to year "i" (both expressed in nominal terms and relating to the applicable project/subproject, if there are several subprojects).

This claw-back mechanism only applies in case of positive net present values of cash flows after taking into account the actual State aid disbursements. No surplus can be generated by projects with negative net present value after State aid.

A letter of credit (by a reputable financial institution having investment grade rating from a first-rank rating agency) should cover the repayment obligation at the End Date by the aid beneficiary, from the first test-run (that is, mid-2026).

The secured amount guaranteed by the above-mentioned letter of credit should be at least equal to an amount ensuring that the two following principles are fulfilled:

1) The secured amount must never be negative (initial balance equal to zero);

2) The secured amount must, after each test-run, correspond to the lower of the following, if positive:
   - $Surplus_i$, multiplied by $Share_{State}$ (computed at that test-run) and
   - The sum of the actual State aid disbursements between 2019 and that test-run expressed in terms of the year "i" of the test-period. For all the disbursements before that test-run, the discount factor will be the EU reference rate applicable to the Member State concerned according to the Commission's communication on setting the reference and discount rates[47] applicable at year "i", increased by 100 basis points between the corresponding disbursement and year "i".[48]

An amount equal to the final secured Amount, after the last application at the End date, will be transferred to the Member State.

The application of the claw-back mechanism will be reported by the relevant Member State to the Commission within 1 month following completion of each test-run and after the End date (e.g. first reporting on application of the claw-back mechanism in July 2026).

Account with annual transfers

Alternatively, the Member State, instead of the "letter of credit" system described above, may opt for an account-based system. This system will apply exclusively if the two following conditions are both met: a) the account to be used for the purpose of applying

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47 OJ C 14, 19.01.2008, p.6.

48 NB: Written in the form of a formula, this means that after each test run, a transfer from the company to the Account (respectively from the Account to the company) takes place so that the overall balance of the Account reaches the following:

$MAX(0; MIN(Surplus_i;$ State Aidsubproject (in NPV 2019 terms, multiplied by [1+$BaseRate_j$ + 1.0%]^(i-2019)))

the claw-back mechanism is not under the control of the aid beneficiary; b) computations and transfers to/from the account by the aid beneficiary must take place once every year[49] until the End date.

The balance of that account should never be negative and no transfer by the Member State to the account shall take place at any time.

This account-based system must not be more favourable from the aid beneficiary perspective than the letter of credit system[50] and should ensure comparable results[51].

The annual application of the claw-back mechanism will be reported by the relevant Member State to the Commission within 1 month following completion of each test-run (e.g. for projects staring in 2020, first reporting on application of the claw-back mechanism in July 2021 and thereafter every July until the final application after the End date).

[49] Not later than in the first six months of the year following the year of implementation the project (e.g. for a project starting in 2020, by end June 2021 at the latest).

[50] Excluding the specific administrative costs of a letter of credit, as well as fees and deposit interests related to an account.

[51] The competent services of the Commission will provide to the participating Member States a template in Excel format to assist them in the implementation of this claw-back mechanism, including in the form of an account-based system. This template should allow for comparable results of the account-based system with the "letter of credit" system when discounting both the final payment in the "letter of credit" system and the annual transfers to/from the account with the WACC.

ANNEX II

LIST OF ABBREVIATIONS

AAM:	Anode active material
ACC:	Automotive Cells Company
BMS:	Battery management system
CAM:	Cathode active material
CAPEX	Capital expenses
CSR:	Corporate social responsibility
EHS:	Hygiene/environmental health and safety
EV:	Electric vehicle
FG:	Facilitation Group
FID:	First industrial deployment
FMG	Finnish Minerals Group
GHG:	Greenhouse gas
GWh:	Giga Watt Hour, an energy unit (of the SI: International System of Units)
HPDC:	High pressure die casting
IEV:	Industrial electric vehicle
IoT:	Internet of Things
IP:	Intellectual property
KPI:	Key Performance Indicator
LCV:	Light commercial vehicle
LGV:	Large goods vehicle
Li-ion:	Lithium-ion
LiM:	Lithium metal
LTO:	Lithium-titanium oxide
MWCNT:	Multiwall carbon nanotubes
OEM:	Original equipment manufacturer (in the context of this document: car manufacturers)
OPEX:	Operating expenses
PAB:	Public Authority Board
PC:	Passenger car
R&D&I:	Research, development and innovation
RTO:	Research Technology Organization
SB:	Supervisory Board
SME:	Small or medium sized enterprise

SoC:	State-of-charge
SoP:	State-of-power
SoH:	State-of-health
xEV:	Hybrid and electric vehicles
WS:	Work stream(s)