

General Information	
Preliminary title of the European Partnerships	Towards a competitive European industrial battery value chain for stationary and mobile applications
Short description of the partnership	This partnership supports establishing a competitive European battery value chain to develop the batteries required to decarbonise the economy, in particular the power generation, transport, and industrial sectors.
Services directly involved	Cluster 5: RTD, ENER, CLIMA, MOVE. In addition to Cluster 5, which is the centre of gravity for this partnership, Clusters 4 and 6 will contribute. This implies involvement of GROW, CNECT and ENV.
Context and problem definition	<p>Europe is committed to deliver on the Paris Agreement. The objective to limit climate change to well below 2°C, and make efforts towards 1.5°C implies a fundamental change to our energy and transport systems. Electrification is an important technological pathway to decarbonise substantial parts of demand side sectors such as energy, transport, heating and industry. In a world that is increasingly electrified batteries become a key enabler. Electric vehicle and stationary batteries will facilitate the integration of high shares of intermittent renewable energy and provide (short-term) security of supply. Electric vehicle batteries represent the biggest battery market segment. Decarbonisation and competitiveness objectives require affordable, durable, fast-charging batteries with high capacities. They are an indispensable enabler for large-scale deployment of electric vehicles.</p> <p>Batteries research was supported in previous Framework Programmes. Since the launch of the European Green Cars Initiative PPP in 2008, EU research in this field has intensified. In Horizon 2020, the total budget in support of battery research will approximatively amount € 500 million.</p> <p>From a competitiveness perspective, batteries are becoming a crucial component with high added value, notably in the automotive sector, and major employment opportunities. The battery sector is growing exponentially and by 2030, 100 multi-GWh factories could be needed to meet global demand.<sup>1</sup> The growth of demand for batteries is also driven by new EU emission standards for cars and vans that are expected to lead to an increasing penetration of zero- and low-emission vehicles in the next decade (more than 20% zero- and low emission vehicles in new sales by 2030) as well an ambitious 2030 renewable energy target. In the Renewed Industry Strategy<sup>2</sup>, energy storage has been recognised as a value chain of strategic importance. However, in the quickly growing lithium battery segment, Europe does not yet have an established battery value chain that can compete on a global scale<sup>3</sup>. If this situation continues, Europe would be dependent on imports for this crucial technology. The European Commission created the European Batteries Alliance (EBA) to help mobilise European industry to play a major role in the strategic race to develop leading battery technologies. Europe already has a strong track record in research, as well as leading players in some parts of the battery value chain but lags behind in some key areas of strategic importance.</p>
Objectives and expected impacts	This partnership aims in the short- to medium-term to support the development of a world-class European R&I ecosystem on batteries, with a view towards industrial leadership by Europe in the design and production of batteries for both stationary and mobile applications. In the long-term,

<sup>1</sup> Fraunhofer ISI (2017) Energiespeicher-Roadmap

<sup>2</sup> COM (2017) 479 final, *Investing in a smart, innovative and sustainable industry: A renewed EU Industrial Policy Strategy*

<sup>3</sup> JRC (2017) EU Competitiveness in Advanced Li-ion Batteries

	<p>the goal is to support the development of future battery technologies beyond 2030.</p> <p>The partnership should take into account shorter-term needs, and longer-term opportunities. Thus, the partnership should both aim at reaching high TRLs for the most advanced Li-ion technologies currently being worked on, as well as driving forward new promising and longer-term lower TRL technological solutions such as solid-state lithium batteries, Li-air, Li-sulphur or Na-ion batteries. The longer-term research should involve ICT-based batteries (Battery2030+ initiative started under FET heading of H2020).</p> <p>Technologies suited for stationary application such as flow batteries and molten salt batteries should also be further developed, to decrease demand for critical raw materials, ensure maximum sustainability and lowest cost.</p> <p>This partnership addresses several programme objectives stated in the proposed framework programme (Article 3) of Horizon Europe:</p> <p><i>Advance scientific excellence; Article 3(2a)</i></p> <ul style="list-style-type: none"> <li>• Improve the safety, performance and lifetime of electrochemical energy storage;</li> <li>• Industrial investments along the entire battery value chain in Europe from materials, electrochemistry, cells to re-use and recycling.</li> <li>• Contribute to the R&amp;I pillar of the EBA, which since recently is coordinated by European Technology and Innovation platform BATTERIES EUROPE.</li> </ul> <p>The expected impact is to establish EU research excellence in state of the art of battery technology in terms of cost, performance, convenience and environmental (and carbon-) footprints.</p> <p><i>Support Union policies, including addressing climate change; Article 3(2b)</i></p> <ul style="list-style-type: none"> <li>• Cost-effective achievement of future CO<sub>2</sub> performance standards<sup>4</sup> as well as decarbonisation of other transport modes.</li> <li>• Enhanced flexibility in the power system to enable cost-effective integration of renewable electricity necessary for meeting the targets established under the new Renewable Energy Directive<sup>5</sup>.</li> <li>• Reduce dependence on imports of both raw materials and intermediate products for battery production.</li> <li>• Improve the environmental footprint of battery production/use/recycling and ensure sustainability.</li> </ul> <p>The expected impact is to achieve Union targets and at the same time to enhance the competitiveness of current and emerging European industries along the battery value chain.</p> <p><i>Foster innovation; Article 3(2c)</i></p> <ul style="list-style-type: none"> <li>• Advance lithium and successor battery technologies to make applications such as electric vehicles more cost-competitive and attractive to end users.</li> <li>• Advance stationary battery technologies.</li> </ul>
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<sup>4</sup> The commission proposal for post-2020 CO<sub>2</sub> targets for cars and vans as well as heavy duty vehicles has been adopted by both the European Parliament and the Council of the EU. On the basis of the Impact Assessment, it is estimated that the Commission's proposal for post-2020 CO<sub>2</sub> targets for cars would trigger a battery demand amounting to at least 66 GWh in 2025 and at least 140 GWh in 2030.

<sup>5</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L2001&from=EN>

	<ul style="list-style-type: none"> <li>• Increase the capacity of the European battery technology stakeholders to bring technologies to the market.</li> </ul> <p>The expected impact is to reduce the time required to bring battery technology improvement to the market by establishing a innovation environment across the entire value chain from materials to recycling and cover both for mobile and stationary (e.g. redox flow) applications.</p>
Necessity test: rationale for a European Partnership	<p>At this stage, there is sufficient indication that traditional calls for Horizon Europe cannot achieve the ambitious objectives described above since they would not provide the necessary directionality of research efforts and ensure additionality of partners' contribution. In order to achieve the objectives, it is necessary to establish a close collaboration of all relevant actors in the value chain of battery manufacturing, use and recycling. It requires also a clear commitment of partners to provide additional resources and investments within the framework of the European Partnership, and potentially also beyond.</p> <p>Through a partnership, it will be possible to create the much-needed interdisciplinary cooperation and research. For example, if a promising battery chemistry is developed, advanced manufacturing technologies are to be developed for reliable, cheap large scale production. A partnership would also allow to create a critical mass in R&amp;I, and to realise and exploit cost-improvements along the value chain. For example, a new recycling technology could provide cheaper and more secure secondary materials than primary production.</p> <p>This partnership will bring together all Horizon Europe R&amp;I activities in this area under one roof so as to develop a coherent and strategic programme, in cooperation with industrial players, the research community and other relevant stakeholders. A result of a better directionality of research efforts and interdisciplinary collaboration would be an increased impact of research and innovation efforts.</p>
Relevant for the following parts of Horizon Europe	<p>Pillar II 'Global Challenges and European Industrial Competitiveness'</p> <p><input checked="" type="checkbox"/> Cluster Digital, Industry and Space</p> <p><input checked="" type="checkbox"/> Cluster Climate, Energy and Mobility</p>
Currently identified links with other partnership candidates / Union programmes	<p>This goal of this partnership is to develop leading battery technologies in Europe that can be applied in a variety of areas, for example in electric vehicles (partnership 2ZERO), aviation (Clean Aviation), shipping (Horizon Europe collaborative research), or in buildings (partnership on the built environment). The batteries partnership would focus the development of batteries, whereas the other partnerships and programmes could focus on their implementation and deployment in land transport, aviation, waterborne transport, or buildings. Other research areas in Horizon Europe such as innovative materials, advanced manufacturing, and circular economy should be integrated in the partnership. Furthermore, depending on the scope of the mission in the area of 'Climate-Neutral and Smart Cities' this partnership might be able to contribute.</p>
Does the proposed partnership build on currently active ones?	<p>There are no existing partnerships in the field, but the proposed Battery Partnership within Horizon Europe can build on existing initiatives that were announced in the Strategic Action Plan on Batteries. These initiatives could form the nucleus for one partnership that brings together all stakeholders (industrial and scientific community) so as to develop both industrial R&amp;I as well as frontier research in view of long-term battery solutions:</p> <ul style="list-style-type: none"> <li>▪ ETIP BATTERIES EUROPE: definition of long term vision and R&amp;I roadmaps as well as facilitation of joint and coordinated R&amp;I actions across the entire value chain. It brings together different</li> </ul>

	<p>battery research streams, including two streams mentioned below.</p> <ul style="list-style-type: none"> <li>▪ Battery 2030+ initiative started under Future and Emerging Technologies heading of H2020: large-scale ICT-based research initiative on future battery technologies bringing together the research community to follow a joint research agenda. It targets low TRL research.</li> <li>▪ Interregional partnership on advanced battery materials, launched on 8 October 2018.</li> </ul>
Expected type and composition of partners	<p>In order to achieve the above described objectives it is necessary to establish a close collaboration of all relevant actors in the value chain of battery materials, manufacturing, use and recycling. These actors include companies, research institutes and other stakeholders that are involved in the EBA along the whole value chain, dealing with raw materials, active materials, battery cells, battery packs, applications, and recycling. Openness of the Partnership will be ensured by the dynamic composition of the Partnership over time. At any time, new Members will be allowed to join the Partnership provided they are active in the electric batteries field in the EU.</p> <p>Participation of end users (including OEM's) will ensure an application-driven focus.</p> <p>Wide membership base of BATTERIES EUROPE across the whole value chain should serve as a good basis for identifying companies and other entities interested to participate in the future partnership.</p>
Contributions and commitments expected from partners	<p>Major contributions from the partners will be to provide inputs and advice to the Commission to achieve the objectives of the Partnership, in particular on research and innovation activities in Horizon Europe Work Programmes. In addition, they will undertake additional investments in deploying and transferring of successful projects outcomes into industrial product thus committing to a certain level of leverage effect. They will also contribute to technology transfer, demonstration activities, project clustering, support to standardisation and identification of new business models (e.g. recycling and second life).</p>
Currently envisaged implementation mode(s).	<p><input checked="" type="checkbox"/> Co-programmed European Partnership</p> <p><input type="checkbox"/> Co-funded European Partnership</p> <p><input type="checkbox"/> Institutionalised European Partnership</p> <p><input type="checkbox"/> Article 185</p> <p><input type="checkbox"/> Article 187</p> <p><input type="checkbox"/> EIT-KIC</p>
Justification of the implementation mode	<p>The battery partnership is targeted at a core of industrial partners and the implementation of choice is therefore the co-programmed partnership that allows to make contractual arrangements with industry on their contributions and commitments outside the scope of the funded projects, while allowing them to define the strategic R&amp;I agenda. A co-funded partnerships is not suitable for industry partners, and the institutionalised approach (Article 187) has been assessed and discarded as not necessary and appropriate, since objectives are expected to be better achievable in the flexible form of the co-programmed approach.</p>
Proposed starting year	2021