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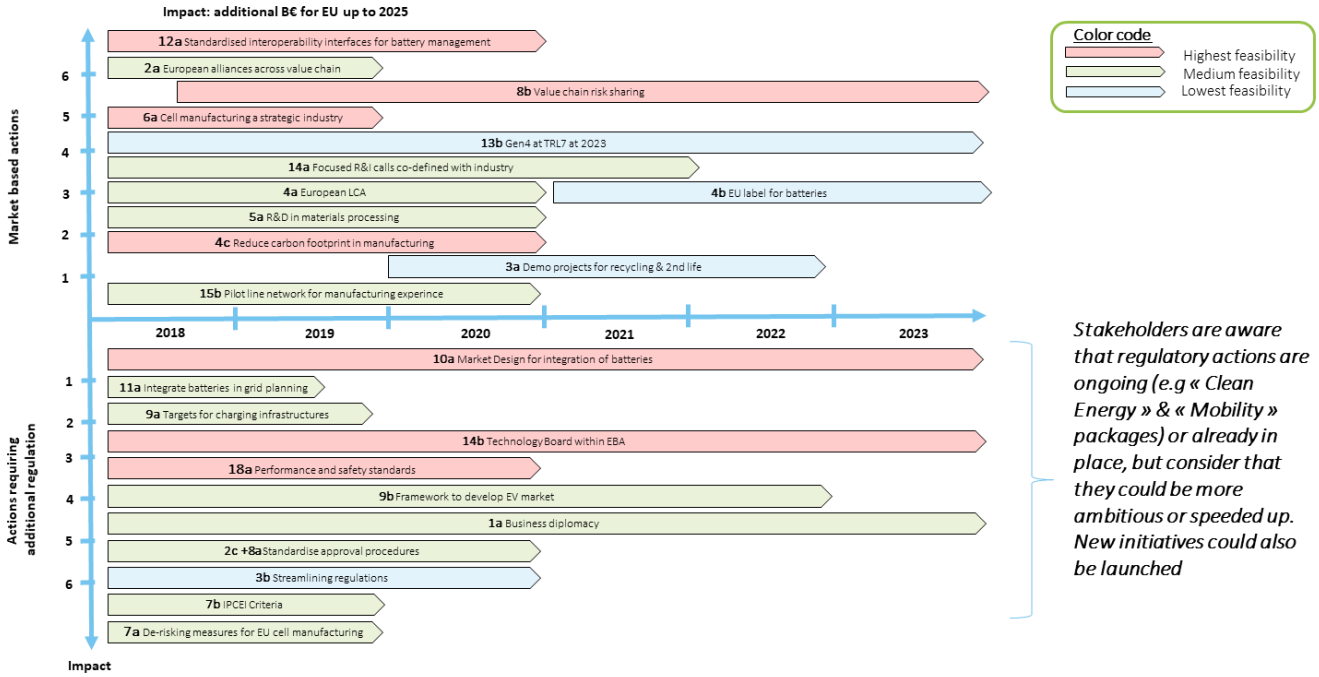
Create a pan-European and cross sectoral batteries ecoystem to make Europe a fast follower in battery technology and capture a new market worth 250B€/year in 2025

Objective	Recommendations	Actions	Priority (1 highest-3 lowest)	Feasibility (1 easy-5 difficult)
Secure access to sustainably produced battery raw materials at reasonable costs	1. Secure access to raw materials from resource rich countries outside the EU	1a. Apply diplomacy, strategic investments and stretch trade agreements (e.g. Canada, Republic of Congo) to secure access to raw materials	1	3
		1b. Implement same compliance rules to foreign battery products imported to Europe as applied to European products	2	3
	2. Facilitate the expansion/creation of European sources of raw materials	2a. Build European alliances between industries from different parts of the value chain and politics to boost mining and intermediate product production in EU	1	3
		2b. Map geological and urban sources, and potential scenarios considering conflicting interests – and possible actions to take from a European and National perspectives	2	1
		2c. Define and implement a simplified application process for opening of new mines	2	4
	3. Secure access to secondary raw materials through recycling in a Circular Economy of Batteries	3a. Define and implement demonstration projects and regulation for recycling and second life of batteries.	1,5	3
		3b. Improve regulation: Align strategic objectives of the Battery Directive, Energy Union RES-legislation, REACH, Critical Raw Materials, Mobility Package, Permitting, Transport Regulations, Mining Waste Directive, Mine Permission	1	4
Make Europe the global leader in sustainable battery technology	4. Support the growth of a cell manufacturing industry that comes with the smallest environmental footprint possible. This will provide a key competitive and commercial edge versus competitors.	4a. Develop a standardised EU life cycle assessment scheme, with targets of environmental and social footprint including guidelines for the calculation thereof	1,5	3
		4b. Define and implement certification/labelling of batteries made in Europe. Use the declaration as a tool in trade agreements / tax treatment with non-EU battery providers	1	2
		4c. Reduce carbon footprint of advanced battery materials making and cell manufacturing by securing access to increasing supply of renewable Energy	1	2
		4d. Develop a standardised life cycle assessment for all transport technologies	2	3
	5. Create and sustain a cross-value chain ecosystem for batteries, incl. mining, processing, materials design, 2nd life, and recycling within the EU, encouraging cross-sectoral initiatives between academia, research, industry, policy, and the financial community.	5a. Invest in R&D and pilot plants to take the technology lead in primary and secondary raw materials processing	1	2
		5b. Establish a clearing house for battery recycling	2	2
		5c. Strengthen all currently existing battery collection systems	2	1
Support European Battery manufacturing in order not to miss the hockey stick phenomenona in market demand (250B€/year in 2025)	6. Ensure the availability of high quality and high-performance cells for European industries to maintain the competitiveness of several European industries.	6a. Define cell manufacturing as a strategic industry for the high-tech area Europe	1	1
		6b. Suggest tax incentives that can help establish cell manufacturing in Europe	2	3
		6c. Generate and secure European IP	2	2
	7. Front loading financially, e.g. IPCEI (important projects of common European interest) and/or other financial instruments such as tax incentives, the needed investments is a must for not missing the demand uptake.	7a. Investigate and implement de-risking possibilities (e.g. direct funding and funding bridges) for cell manufacturers	1	3
		7b. Define and implement criteria for IPCEI (Important Projects of Common European Interest) projects for cell manufacturing.	1	3
	8. Accelerate time to market to meet market demand and international competitors	8a. Standardize and simplify approval procedures ("Fast track") and permitting (environmental, manufacturing, construction) process	1,5	3
		8b. Investigate and implement investment risk sharing between companies along the value chain, EU and member states to support new cell manufacturing	1	4
Create and support new markets for batteries, e.g through the "Clean Energy" & the "Mobility" packages but also new initiatives, in order to support sustainable solutions for power, transportation and industry sectors in line with EU climate goals.	9. Increase the demand for e-mobility solutions including "yellow machines"	9a. Set clear targets, requirements and incentives for the installation of recharging infrastructure for buildings and publicly accessible areas (urban areas and public roads as well as along freeways).	1	2
		9b. Define and implement a consistent incentivizing framework for the uptake of the EV market (e.g. emission standards for "yellow machines", promotion schemes for ZEV sales, public procurement targets for clean vehicles including public transport, tax and "soft" incentives such as use of public lanes and free parking)	1	2
		9c. Implement favourable tax incentives for e-taxi operators e.g. special VAT schemes	3	1
	10. The function of batteries and battery systems must be seen pluri-functional, in a context of both power and transportation sectors. For ESS, regulation (or absence of it) enabling of right business models is crucial.	10a. Develop a power market design that enables the integration of ESS (including EV batteries through vehicle to grid) allowing ESS and EV batteries to support the power system management with high penetration of EV charging. Battery based actors/systems shall be able to participate in all parts of the power market and network tariff shall not penalize storage while driving electrification (capacity based + Time-of-use, with no charges for producers)	1	2
		10b. Establish a transparent data hub for use data for e-vehicles (similar to best practice data for hub metering data of electricity customer)	1,5	3
	11. Incentivize storage as alternative to conventional grid reinforcement.	11a. Integrate battery storage options and V2G in grid planning and resource planning (addressing security of supply)	1	2
	12. Enable integration of ESS on all levels of the power system including behind the meter	12a. Develop standardized interoperability interfaces allowing seamless secure integration of battery management systems of ESS and EVs and bi-directional communication with aggregation platforms or Energy markets. Evolution of digitalized innovative energy services shall be enabled.	1	2
Grow the European R&I capacity. Develop and strengthen skilled workforce in all parts of the value chain and make Europe attractive for world class experts.	13. Create competitive advantage with constant incremental (e.g. Lithium ion) and disruptive (e.g. solid state) R&I connected to the industrial ecosystem in all the steps of the value chain (advanced materials, new chemistries, advanced manufacturing process, BMS, recycling, business model innovations).	13a. Define how to reach TRL 7 in 2023 on Generation 3b (advanced lithium-ion technologies with liquid electrolyte) for e-mobility	2	1
		13b. Define how to faster reach TRL 7 on Generation 4 (all-solid-state lithium-ion technologies, e.g., with polymer or ceramic electrolyte) for e-mobility in 2023 by concentrating R&I efforts on this strategic topic	1,5	3
	14. Conduct advanced research in battery chemistry, battery systems, manufacturing, recycling and increase university output in these areas by involvement of industrial stakeholders.	14a. Create stronger focus and more prescriptive R&I calls, co-defined with Industry and sustained over longer periods	1	2
		14b. Establish a technology advisory board within the EU Battery Alliance, with the mandate to update the roadmaps and the R&I orientations, and manage the project portfolio (R&I project portfolio management)	1	1
	15. Sufficient and key human capital skills are missing in Europe especially on applied process design. Lighthouse projects for cell manufacturing will attract worldwide talent.	15a. Actively identify and utilize synergy effect between large scale cell production and educational system to secure workforce competence transition	2	2
		15b. Establish a European open access pilot line network to gain manufaturing experience	1	2
		15c. Create a link between the educational network (Master programs in Universities) and the European pilot line network, in order to train the students on battery manufacturing	2	2
		15d. Build new degree courses in consultation between universities and industries	2	1
		15e. Dedicate national and ESF (European Social fund) funds for training professionals to new technologies systems and applications	2	2
	16. Make Europe attractive for world class experts and create competent workforce.	16a. Define instruments to attract global key talents including process engineers and operations	2	2
Involve (= inform, educate & motivate) the EU citizens in the journey.	17. At the end of the supply chain there is always a B2C transaction. Public efforts (education in schools, role modelling, …) should be spent on citizen awareness of the whole valuechain, so there is a societal appropriation from the start. Fighting for keeping the supply chain in Europe will definitely help to bridge the gap citizen-politics.	17a. Involve Industry + Citizens + Policy makers on Use patterns/Re-use & Sustainability	2	2
		17b. Highlight importance of batteries as a means to meet decarbonization goals in power and transport.	2	1
		17c. Safeguard non-discriminatory access for consumers to energy service providers including charging services	2	2
Ensure maximum safety for European citizens and create competetive advantage through standardization.	18. Standardize storage related installations including charging infrastructure, safety rules, active load compensation and enable vehicle to grid solutions	18a. Develop and implement performance and safety assesment standards for batteries	1	1
		18b. Harmonise charging protocols and billing systems in Europe	2	3

InnoEnergy is supported by the EIT, a body of the European Union

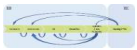
First draft planning vs Impact vs Regulated/Free market actions



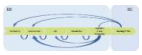
Stakeholders are aware that regulatory actions are ongoing (e.g « Clean Energy » & « Mobility » packages) or already in place, but consider that they could be more ambitious or speeded up. New initiatives could also be launched

Priority Actions Templates

Action 1a- Final

	Code and name of the action	1a. Establish and implement a "Scientific & Business Diplomacy" strategy to secure access to raw materials	
	Recommendations it contributes to	1,4,6,13,16,18	
	Linked to actions #	1b, 4a, 4b	
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	1	
	Feasibility (1-easy; 5-Difficult)	3	
	Time to design (months)	12	
	Time to delivery (months)	24 (first results)	
1	**Objectives (*What for?*) Impact we want to achieve**	1. Secure global supply for EBA based on a **diplomacy strategy**: raw materials, human resources, scientific knowledge 2. **Influence** the international trade, regulatory and scientific frames in favor of EBA 3. Improve the **sustainable sourcing** of mineral raw materials to Europe 4. **Co-develop** capacities in partner countries and contribute to increase standards (social, environmental...) in partners countries.	
2	**Action** *(description)*	EU and Member States **set up an "EBA Team"** (or task force) with specialists (trade, R&D ...) that establishes **an agreed by all EBA Plan** and this task force **promotes around the world** (EBA Tour), with the assistance of all the European diplomatic network (Member States + EU delegations), **the European interests** (raw materials, licences, scientific cooperation, attraction of the best brains in the world ...). The task force should also contribute to a regulatory framework for the sustainable sourcing of battery raw materials to Europe (e.g Cobalt), which are currently out of the scope of the 2017 EU conflict mineral regulation. The task force should develop guidelines for the industry's due diligence activities when sourcing battery raw materials, in co-operation with the Extractive Industries Transparency initiative and the European Partnership for Responsible Minerals. **Focus Areas**: 1) current and future FTAs negotiations (e.g. Chile, Indonesia, Australia) 2) EPA's with ACP countries 3) Develop EU-LAC raw materials talks; 4) Attract best talent globally	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	Common negotiation by the EU to secure access to sustainably produced battery raw materials from resource rich countries
		Active Materials	Same as below
		Cell Manufacturing	Capture the best brains, benefit from the scientific cooperation, security of supply for raw and active materials
		Modules/Pack/BMS	Same as above
		Application – ESS	
		Application – e-mobility	
		Application – Industrial	
		User	
		Recycling/2nd life	
		New player	**A European team of** specialists from various sectors and various Member States/European Commission/Private companies. Impact of this team is directly related to 1) **the empowerment they would get from Member States and European Commission, and confidence from the private sector** 2) **the attractiveness of the EBA Plan** (scholarships, R&D budget available, facility to come and work in Europe for white collars ...). Strong relation with the private sector is required (set up confidence).
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. Cost of the EBA Plan (but actually, instruments already exist, like H2020 and other European instruments) 2. Cost of the"EBA Team" (financing)
		More benefits	1. Europe speaking with one voice 2. Security of supply for raw and active materials, at a lower cost ("critical mass" in negotiations) 3. Europe attracting the best brains 4. Europe influencing the regulatory (also standardization) international frame 5. Improved working conditions and human rights in the developing resource rich countries
5	**Winners**	**EU, Member States & Private sector** : by promoting such an "EBA Plan" and Tour, it can appears as the driving force behind the battery challenge, and set up the frame able to capture the key resources for the future (materials, human resources ...). People working at the sources of origin for imported battery raw materials would be the clear winners.	
	Affected	**Individual approach** (by Member States and private stakeholders) would be affected, as the impact of this action is based on playing the "common team" card in order to reach critical mass	
6	**Who implements?**	EU-Institutions	1. Creation of the "EBA Team" (together with Member States and the private sector) 2. Elaboration of the EBA Plan and associated resources (together with Member States) 3. Mobilization of the diplomatic network (together with Member States) 4. Channel funding to the socio-economic development of mining regions in the developing countries
		Member States	Same as above. International associations like UNIDO could also be associated.
		Business	They can provide experts for the EBA Team (also research organizations, universities ...). Stakeholders will be consulted when actions have potential impact on their activities.
7	**Existing Best Practices**	Campaigns like this are carried out very often by Member States individually (e.g commercial campaigns, or to welcome international infrastructure like CERN, ITER ...). At EU level, there have been negotiations for Free Trade Agreements with Canada (CETA), Chile, Australia, Indonesia. The H2020 Strade project has developed objectives on how to support the socio-economic development in raw materials rich developing nations.	
8	**Pre-requisites (regulatory or no-regulatory) to be successful**	EU and Member States have to get a shared ambition on the EBA. If not with all Member States, those who have expressed interest should be the first to be approached (for example, reinforced cooperation with France, Germany, Sweden and the EU). The activity should be led by the European Commission, particularly DG Grow C2 and C4. The Raw Materials Group in C2 already now is engaged in a wide range of stakeholder activities in resource rich third countries. The Raw Materials co-operation visits by the Raw Materials Group should take a specifc theme of battery relevant raw materials. The tour should include experts from the Member States but led by the EC to elevate the political importance of battery raw materials.	
9	**Planning to implement the action (initial)**	1. Design: 6 to 12 months 2. Implementation: To be developped after presentation to VP (depending on priorities)	
10	**Financial resources requested**	yes, will be defined as part of design (1. Cost of the EBA Team set up; 2. Aggregation of the EU (and Member States ?) financial support tools)	
11	**How will this action directly benefit EU citizen?**	1. Lowering the cost of batteries/EV for consumers 2. Sustainability of batteries and social awareness will be at core of the EBA Team negotiation arguments 3. EU and Member States speak with one voice 4. By developing industrial activities in Europe, by promoting international scientific cooperation, by bringing in Europe the best brains, we create jobs and growth for your children	
12	**KPI to monitor progress**	1. Number of long-term trade agreements with countries rich in innovation critical materials 2. Percentage of raw materials used for EU batteries derived from sustainable sources from outside of the EU (CO2 footprint, social and environmental impact etc.) 3. Number of non-EU experts in the battery sector attracted	

Action 2a- Final

	Code and name of the action	2a. Build European alliances between industries from different parts of the value chain and politics to boost mining and intermediate product production in EU	
	Recommendations it contributes to	4, 5, 6, 16, 17	
	Linked to actions #	4, 5	
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	1	
	Feasibility (1-easy; 5-Difficult)	3	
	Time to design (months)	12	
	Time to delivery (months)	60	
1	**Objectives (*What for?*) Impact we want to achieve**	Secure access to sustainably produced battery raw materials at reasonable costs	
2	**Action** *(description)*	Build European alliances between industries from different parts of the value chain and politics to share investment risks, including the upper part of the value chain. This will boost mining and intermediate product production in the EU, thus, make it possible to secure access to sustainably produced raw materials. In Finland, for example, 3000 t of Co are already extracted today, but large amounts are stockpiled and not processed any further. The country holds one of the largest Co processing capacities in the world (11% of world refined Co production in 2016); all of the Co produced in the last years has been exported to Asia (source: Roskill). Other key battery raw materials are lithium and graphite. The production of both in Europe, from European mines is currently intended to be ramped up by several actors. The financial mechanism could be, for instance, i) tax incentives promoting the use of EU raw materials; ii) a strategic public-private partnership co-investment into the installation of industrial pilot plants (see action 5a); iii) targeted investments by the European Investment Bank.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	Allows for a faster market entry of, for example, Lithium and Cobalt from European sources
		Active Materials	Are based on sustainably produced raw materials
		Cell Manufacturing	Will significantly reduce the CO2 footprint of the entire cell
		Modules/Pack/BMS	
		Application: ESS	
		Application: e-mobility	
		Application: Industrial	
		User	more stable market, more diversified, more sustainable
		Recycling/2nd life	would benefit from an overall increased attention towards the processing of battery raw materials, that is, for example in terms of financial investments, talents, waste streams of primary production
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. Initial investment costs
		More benefits	1. The main benefit is to close the value chain by European actors and also to reduce dependence on raw materials from conflict areas such as the DRC. 2. Risk mitigation through supply chain diversification
5	**Winners**	i) Mining companies operating in Europe; ii) metallurgical companies as well as OEMs producing mining and processing equipment; iii) European battery manufacturers as well as OEMs integrating batteries in that they will have a lower supply risk for cost efficient, high quality, and sustainably produced battery metals which form the basis of their products; the environmental footprint of a battery is significantly influenced by the footprint of its raw materials.	
	Affected	Competitors	
6	**Who implements?**	EU Institutions	Implements and monitors financial mechanisms
		Member States	Implements and monitors financial mechanisms
		Industry	Strategic financial investments; agreements on partnerships
7	**Existing Best Practices**	The financial instrument of Untied Loan Gurantees of the Federal Republic of Germany (Ungebundener Finanzkredit "UFK") that are an integral element of the Germany's raw materials strategy. Projects which serve to increase the supply security of raw materials are eligible.	
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	Must conform to competition regulation and anti-trust regulation	
9	**Planning to implement the action (initial)**	1. Design: 12 2. Implementation: 60	
10	**Financial resources requested**	yes, will be defined as part of design	
11	**How will this action directly benefit EU citizen?**	1. Creates more jobs in raw material extraction and processing	
12	**KPI to monitor progress**	1 Number of industry alliances created	

Action 3a- Final

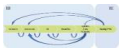
	Code and name of the action	3a. Define and implement demonstration projects and regulation for recycling and second life of batteries.	
	Recommendations it contributes to	3,5,14	
	Linked to actions #	3b,5a	
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	1,5	
	Feasibility (1-easy; 5-Difficult)	3	
	Time to design (months)	12	
	Time to delivery (months)	48	
1	**Objectives (*What for?*) Impact we want to achieve**	**Objective:** Secure access to sustainably produced battery raw materials at reasonable costs through recycling in a Circular Economy of Batteries **Impact:** Increased collections rates; high value recycling streams; clear legal and business framework for a second life of batteries Focus areas: collection, dismantling, sorting; at a later stage: up-scaling of metallurgical plants to become able to deal with massive volumes of automotive batteries; regulation of second life of batteries	
2	**Action** *(description)*	i) Define and implement regulation and demonstration projects for recycling and second life of batteries. There is a need to develop pilot lines for dismantling and sorting processes suitable for large volumes of batteries. Recycling technology needs to be adapted to new materials, ideally enabling the re-use advanced battery materials, for instance for regainng active materials or precursors of active materials. Robust scaling of metallurgical or chemical processes represents an R&I challenges. Although recycling projects for Lithium batteries have been ongoing for several years, Lithium battery recycling is not mature. R&I actions should start at TRL 5 and achieve TRL 7 (See Implementation Plan – TWG Action 7 SET-Plan, Fiche 1.5: Recycling of batteries and Recycling Flagship). ii) Legislative clarification with focus on incentivising battery collection and EPR for second life. iii) Create a EU Battery Safety Certification Unit; iv) Introduce a Battery Label in order to facilitate sorting of different battery chemistries. v) R&I actions should be taken. A preliminary technical study to better quantify second life criteria and methods to assess battery reliability, safety and performance at end of its first use and the development of a standard platform for intelligent life long battery management system will be an area for research (See Implementation Plan – TWG Action 7 SET-Plan, Fiches 3.2: Second use and smart integration into the Grid - pag 52 and Second-Use Flagship).	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	Improved access to sustainably produced battery raw materials and intermediate products made in EU
		Active Materials	
		Cell Manufacturing	
		Modules/Pack/BMS	
		Application – ESS	Second life of e-mobility batteries are expected to be a cost-efficient complement for the ESS market.
		Application – e-mobility	The business case of the e-mobility batteries can be improved by any solution bringing a better added value to the batteries at the end of life.
		Application – Industrial	
		User	A more diverse market will give the end user a greater degree of freedom of choice. Better safety and warranty legal framework.
		Recycling/2nd life	Significant added value could be associated to this part of the value chain in case positive business cases are identified. Recycler needs to guarantee the warranty and safety of second life batteries.
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	Today, the cost of recycling Lithium batteries is larger than the value of the metals recovered. Recycling larger amounts of batteries will significantly lower costs.
		More benefits	1. Battery raw materials made in EU 2. Low environmental footprint compared to those of primary raw materials
5	**Winners**	Recyclers, materials producers, OEMs	
	Affected	1.Primary materials suppliers may compete with more secondary raw materials suppliers. 2. Possibly low cost products made of second life batteries may compete on the ESS or industrial batteries markets.	
6	**Who implements?**	EU Institutions	Financial support for the industrial up-scaling of dismantling technologies; regulatory framework.
		Member States	Financial support for the industrial up-scaling of dismantling technologies; regulatory framework.
		Industry	Strategic investments and business creation in collection and recycling
7	**Existing Best Practices**	i) Recycling is already a requirement for batteries in Europe. ii) Several EU recycling companies exist that have processes for the metallurgical treatment of batteries. Raw materials recovered, such as Cobalt, are competing on a free international market with primary materials. iii) Limited collection rates, high costs of recycling, lack of dismantling and sorting technologies hamper business growth. iv) Concerning the second life, there is a lack of legislative structure to ensure a stable business environment for the second life, for example when it comes to the Extended Producer Responsibility (EPR).	
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**		
9	**Planning to implement the action (initial)**	2019	
10	**Financial resources required**	yes, will be defined as part of design	
11	**How will this action directly benefit EU citizen?**	1. A European e-mobility industry, based on resilient supply chains with the benefits of jobs, growth, and the access to ecompetitive EU products.	
12	**KPI to monitor progress**	1. A minimum of 3 industry scale recycling plants built by 2025 2. Batteries Directive revision, including the legislative framework for second life use. EU Battery Safety Certification Unit founded.	

Action 3b- Final

	Code and name of the action	3b. Improve regulation: Align strategic objectives of the Battery Directive, Energy Union RES-legislation, REACH, Critical Raw Materials, Mobility Package, Permitting, Transport Regulations, Mining Waste Directive, Mine Permission	
	Recommendations it contributes to	2,3,4,5,6	
	Linked to actions #	3,6	
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	1	
	Feasibility (1-easy; 5-Difficult)	4	
	Time to design (months)	12	
	Time to delivery (months)	60	
1	**Objectives (*What for?*) Impact we want to achieve**	**Objective:** Secure access to sustainably produced battery raw materials at reasonable costs through recycling in a Circular Economy of Batteries **Impact:** Faster business creation through streamlined regulation processes and targeted public funding	
2	**Action** *(description)*	**Improve regulation: Align strategic objectives of the Battery Directive, Energy Union RES-legislation, REACH, Critical Raw Materials, Mobility Package, Permitting, Transport Regulations, Mining Waste Directive, Mine Permission.** Specific points identified: 1. Batteries Directive: the future environmental objectives (measured through collection rate and recycling efficiency) should be compatible with the economical objectives (see action 3a). This environmental directive should avoid any governing the hazardous substances, which are under REACH. The protection of the EU industry competitiveness through the implementation of "equivalent conditions" for manufacturing or recycling inside or outside EU should be clarified (what is expected to be equivalent, and how is it enforced?). EPR for second life should be clarified (see action 3a), and good practices for Collection and takeback obligation shared between EU Member States. 2. The Waste Directive or the Battery Directive should harmonize the criteria for end of waste through all Member States in order to enable a EU market of the secondary materials. The same criteria should be applicable for import and export. 3. Waste legislation harmonisation: waste batteries should have the same classification through all EU. Waste batteries should not be considered hazardous waste when not relevant (mirror codes). 4. The waste directive should avoid redundant requirements for safe transport and storage of lithium batteries, when the UN regulation for the transport of dangerous (Li batteries classified UN 3480) is applicable. 5. Concerning the regulation for the protection of hazardous substances, the interface between REACH and the OSH, including national legislations, should be clarified and overlaps removed: see CII ongoing initiative. www.cii-reach-osh.eu 6. The currently ongoing revision of LES legislation (for period 20121-2030) could further facilitate the access to renewable energy for recycling (see action 4c).	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	Establish a level playing field for the raw materials market in the EU
		Active Materials	
		Cell Manufacturing	
		Modules/Pack/BMS	
		Application – ESS	
		Application – e-mobility	
		Application – Industrial	
		User	A more diverse market will give the end user a greater degree of freedom of choice.
		Recycling/2nd life	Establish a level playing field for raw materials market in EU
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	None
		More benefits	Lower costs through streamlined processes
5	**Winners**	Electric mobility industry	
	Affected	Competition	
6	**Who implements?**	EU Institutions	Directives modifications
		Member States	Legislation implementation
		Industry	Application
7	**Existing Best Practices**	Number of regulations are impacting the batteries manufacturing and recycling in EU. The combined objectives of several of these regulations should support the development of the EU batteries industry. Nevertheless, the large number of applicable requirements, including some limitations or overlaps are creating a complex framework, becoming a burden for the industry. Clarification will make the production and processing of battery materials in the EU more competitive.	
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	Regulatory action	
9	**Planning to implement the action (initial)**	2019	
10	**Financial resources requested**	Will be defined as part of design	
11	**How will this action directly benefit EU citizen?**	1. A European e-mobility industry, based on resilient supply chains with the benefits of jobs, growth, and the access to competitve EU products.	
12	**KPI to monitor progress**	1. Degree of redundancies by different Directives 2. Reduction of waste shipping out of Europe 3. Number of business cases related to moving secondary raw materials across EU	

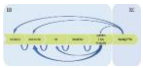
Action 4a – Final

	Code and name of the action	4a. Develop a standardised EU life cycle assessment scheme, with targets of environmental and social footprint including guidlines for the calculation thereof
	Recommendations it contributes to	1-6, 13 and 17
	Linked to actions #	1c, 4b, 4d, 13a, 13b and 17a
	Dependent on actions #	
	Priority (1-Highest; 3 lowest)	1,5
	Feasibility (1-easy; 5-Difficult)	3
	Time to design (months)	6
	Time to delivery (months)	18

1	**Objectives (*What for?*) Impact we want to achieve**	Make Europe the global leader in sustainable battery technology. Support the growth of a cell manufacturing industry that comes with the smallest environmental & social footprint possible. This will provide a key competitive and commercial edge versus competitors & encourage innovation to into advanced batteries with least environmental and social impact		
2	**Action** *(description)*	1) **Create a consortium** of industry representatives from the whole value chain, policy makers, and academics to design EU life cycle assessment scheme 2) The **EU life cycle assessment scheme** should include targets of footprints and guidlines for the calculation of the following as a first step: **- carbon footprint** **- human toxicity potential** **- share of recycled raw materials (vs primary) used** **- obligations of responsible sourcing of minerals** (e.g. through certification schemes) Additional parameters can be added in the subsequent reviews, e.g. land acidification, water eutrophication, ecotoxicity, land occupation, etc. Also social indicators need to be included (e.g. respect of International Labour Organisation conventions incl. child labour, forced labour, health & safety, delocalization and migration, cultural heritage etc.)		
3	**Impact in the value chain** *(if blank then none)* 	Raw materials		Provides a transparent and well-defined quality standards for a global battery industry
		Active Materials		Incentivises the devlopment and use of more sustainable materials and production methods
		Cell Manufacturing		Informs manufacturers of better options of materials and design; more environmentaly sustainable, advanced and efficient manufacturing; give competitive advantage to EU manufacturers
		Modules/Pack/BMS		Incentiivises efficient production, use, and recycling options; design for recycling
		Application	ESS	yes
			e-mobility	yes
			Industrial	yes
		User		Raises awareness of the battery's environmental and social footprint; informs about opinions to choose among different technologies in favour of EU manufacturing
		Recycling/2nd life		Boost demand for recycled materials, thus improves business case
		New player		
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. Initial costs of designing LCA methodology, data gathering, and setting standards in production. LCA will vary with battery design that creates complexity connected to costs.	
		More benefits	1. Transparent methodology to highlight the competitive advantage of an EU battery life cycle in terms of sustainability 2. By being first to design a comprehensive LCA, influencing other global measures to the advantage of EU industry 3. Helping industry identify best design options in favour of more sustainable and efficient batteries	
5	**Winners**	EU cell manufacturing and value chain; citizens and environment		
	Affected	All players across the value chain		
6	**Who implements?**	EU Institutions		Create a consortium of industry representatives, policy makers, and academics that will develop LCA methodology
		Member States		Part of the consortium
		Industry		Part of the consortium
7	**Existing Best Practices**	The US EPA has recently conducted a screening-level LCA of environmental impacts of batteries with the same aim as EU. While it looks at materials, carbon footprint and toxicity, the responsible sourcing of materials seems to be missing in the current work. However, cooperation & partnership with the US authorities can speed up the design of battery LCA for EU certification & labelling scheme. EU initiative on Product Environmental Footprint (PEF), in the context of which there was a pilot on batteries has been launched. Regarding human toxicity, the current model is weak, and some of the metrics are not usable.		
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	Choice of key parameters to make LCA comprehensive and meaningful vs timing considerations Include academic institutions, policy makers, and industry Working with all players involved in the industrial value chain to gather accurate data		
9	**Planning to implement the action (initial)**	1. Design: 3 months for creating the consortium; 18 months to design methodology 2. Implementation: 12 months for industry to start using methodlogy & adjust to targets		
10	**Financial resources requested**	Will be defined as part of design		
11	**How will this action directly benefit EU citizen?**	1. Raise awareness of environmental/social footprint of batteries, which will enable informed consuer choices 2. Increased confidence in EU cell manufacturing		
12	**KPI to monitor progress**	1. Creating an LCA Design Consortium 2. Design comprehensive LCA with key climate, toxicity, and social responsibility parameters 3. Establish clear targets for manufacturers and transparent calculation/reporting 4. Agree timeline for implementation		

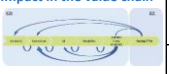
Action 4b- Final

	Code and name of the action	4b. Define and implement certification/labelling of batteries made in Europe. Use the declaration as a tool in trade agreements / tax treatment with non-EU battery providers		
	Recommendations it contributes to	1-6, 13 and 17		
	Linked to actions #	1c, 4b, 4d, 13a, 13b and 17a		
	Dependent on actions #	4a		
	Priority (1-Highest; 3 lowest)	1		
	Feasibility (1-easy; 5-Difficult)	2		
	Time to design (months)	12		
	Time to delivery (months)	12		

1	**Objectives (*What for?*) Impact we want to achieve**	Make Europe the global leader in sustainable battery technology. Support the growth of a cell manufacturing industry that comes with the smallest environmental footprint possible. This will provide a key competitive and commercial edge versus competitors.		
2	**Action** *(description)*	Design and implement certification and labelling scheme for cells and batteries made in Europe. Keep the "Green Battery- Made in Europe" label; developing an EcoDesign label would take too much time. EU labelling should involve multiple EU industry stakeholders and building of consortia between Europen actors from the whole value chain should be encouraged. Use the declaration as a tool in trade agreements / tax treatment with non-EU battery providers		
3	**Impact in the value chain** *(if blank then none)* 	Raw materials		Provides a transparent and well-defined quality standards for a global battery industry
		Active Materials		Incentivises the devlopment and use of more sustainable materials and production methods
		Cell Manufacturing		Informs manufacturers of better options of materials and design; more environmentaly sustainable, advanced and efficient manufacturing; incentivise use of RES; provides competitive advantage to EU manufacturers
		Modules/Pack/BMS		Incentivises efficient production, use, and recycling options; design for recycling
		Application	ESS	yes
			e-mobility	yes
			Industrial	yes
		User		Raises awareness of the battery's environmental and social footprint; informs about opinions to choose among different
		Recycling/2nd life		Boost demand for recycled materials, thus improves business case
		New player		
4	**Cost Benefit Analysis** *(Initial)*	More costs	Development of EU label	
		More benefits	Increased transparency in value chain; label will enable to develop competitive advantage relating to improved sustainability	
5	**Winners**	EU cell manufacturing and value chain; citizens and environment		
	Affected	All players across the value chain		
6	**Who implements?**	EU Institutions		Design certification together with industry (A - F grading on key parameters in LCA in action 4a) and choose best means to trace materials
		Member States		Implement either via guidelines (faster) or regulation (12 months)
		Industry		Supports development of EU-label with experts. Uses certification/labelling on cells/battery packs
7	**Existing Best Practices**	This certification and labelling tool can **follow the logic of EU Eco-design and Labelling regulations** (and grade batteries on a scale of A to F as per individual parameters identified in LCA) **Blockchain technology** can be used to trace materials from extraction via all uses (e.g. as done by De Beers with diamonds) Food industry was suggested as benchmark for labelling		
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	Need to have Life Cycle Assessment Methodology on key environmental and social parameters as a basis for certification. To be effective, labellisation should require a minimum of 2 to 3 European industrial players representing different part of the value chain in order to ensure that the industrial value is created in Europe.		
9	**Planning to implement the action (initial)**	1. Design: Choose method and design certification/labelling scheme in 2018 2. Implementation: industry uses from 2019		
10	**Financial resources requested**	Cost of implementing the labelling regime (similar to other EU label regulations)		
11	**How will this action directly benefit EU citizen?**	1. Raise awareness of environmental/social footprint of batteries, which will enable informed consuer choices 2. Increased confidence in EU cell manufacturing		
12	**KPI to monitor progress**	1. Scope best traceability method to use (e.g. blockchain) 2. Design certification (grading) based on 4a calculations/targets 3. Design battery labelling scheme 4. Implementation timetable		

Action 4c- Final

	Code and name of the action	4c. Reduce carbon footprint of advanced battery materials making and cell manufacturing by securing access to increasing supply of renewable Energy
	Recommendations it contributes to	2a, 4a, 6c, 7d, 10a, 11a, 12b, 14a, 14b, 17
	Linked to actions #	1a, 1b, 10a, 11a, 12b, 17a, 17b, 17c
	Dependent on actions #	2a, 4a, 4b
	Priority (1-Highest; 3 lowest)	1
	Feasibility (1-easy; 5-Difficult)	2
	Time to design (months)	3
	Time to delivery (months)	6 to tbd

1	**Objectives (*What for?*) Impact we want to achieve**	Make Europe the global leader in sustainable battery technology. Support the growth of a cell manufacturing industry that comes with the smallest environmental footprint possible. This will provide a key competitive and commercial edge versus competitors.		
2	**Action** *(description)*	Reduce carbon footprint of advanced battery materials making and cell manufacturing by securing access to renewable Energy 1) Ensure a high share of RES electricity in the grid by implementing requirements of the EU Renewable Energy Legislation (including forthcoming REDII) and even going beyond. 1a) Use the possibility of concluding power purchase agreements with RES producers; as well as possibilities offered by the trade in Guarantees of Origin once the the system of GoO is more robust (REDII). 2) Optimize processes in general but in particular with high energy consumption for reduction, e.g. metal oxide processes. 3) Define max carbon footprint on produced MWh storage energy 4) Design of plants for optimized utilization of carbon free energy (e.g. flat roofs for solar energy) 5) Plan ES-systems to support the activities at the e-mobility supply chain plants and industrial application plants 6) Design applications (cell, module, pack) to be suitable for recycling. 7) Consider ESS systems in material manufacturing and cell making plants as well as localizations (e.g. built own storage systems at cell manufacturers) 8) EC suuport for research required to trade off various process choices that can reduce CO2 footprints, linked to action 5a		
3	**Impact in the value chain** 	Raw materials		Sustainably produced batteries in terms of carbon footprint - at all levels. Optimize process resource efficiency by targeting higher recovery of metals from raw materials and on particular with high energy consumtion for reduction, e.g. metal oxide processes.
		Active Materials		Sustainably produced batteries in terms of carbon footprint - at all levels. Optimize process resource efficiency by targeting higher recovery of metals from raw materials and on particular with high energy consumtion for reduction, e.g. metal oxide processes.
		Cell Manufacturing		Sustainably produced batteries in terms of carbon footprint - at all levels. Optimize process resource efficiency by targeting higher recovery of metals from raw materials and on particular with high energy consumtion for reduction, e.g. metal oxide processes.
		Modules/Pack/BMS		Sustainably produced batteries in terms of carbon footprint - at all levels. Optimize process resource efficiency by targeting higher recovery of metals from raw materials and on particular with high energy consumtion for reduction, e.g. metal oxide processes.
		Application	ESS	
			e-mobility	
			Industrial	
		User		
		Recycling/2nd life		Enable recycling by incentives.
		New player		
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. not necessarily - strategic planning of locations for economy of scale affects, R&D in process design and application design as well recycling processes necessary with target to have no cost disadvantage	
		More benefits	1. Boost for European technologies in production, materials and energy supply: carbon free energy production, storage and transport systems, machine industry benefits from new plants in multiple areas	
5	**Winners**	Raw material mining in Europe will get better image and new energy supply and extraction technologies, Energy Supply Industry will get a boost to supply the new plants, chosen areas will receive competitive plants and new employments (regional support)		
	Affected	Access to renewable energy will be a key factor for identifying places of production		
6	**Who implements?**	EU Institutions		promoting the Energy Union and higher RES targets (REDII)
		Member States		Implement EU rules; promoting promote the Energy UnionRES deployment in line with applicable State aid rules
		Industry		consider access to renewable energy as key performance indicator
7	**Existing Best Practices**	Avoidance of carbon related energy in the whole value chain from raw materials to recycling		
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	Member states need to agree about concept regarding locations and energy supply		
9	**Planning to implement the action (initial)**	1. Design: 3 to 6 months 2. Implementation: 6 months to several years		
10	**Financial resources required**	yes, (Energy Union: depending on negotiations at EU and Member States policy levels)		
11	**How will this action directly benefit EU citizen?**	1. Access to batteries with low carbon footprint		
12	**KPI to monitor progress**	1.carbon footprint per produced MWh Battery capacity 2. installed capacity in MWh in Europe for cell production 3. carbon footprint on each involved process step		

Action 5a – Final

	Code and name of the action	5a. Invest in R&D and pilot plants to take the technology lead in primary and secondary raw materials processing	
	Recommendations it contributes to	1b, 3a, 4c	
	Linked to actions #	1b, 4c	
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	1	
	Feasibility (1-easy; 5-Difficult)	2	
	Time to design (months)	6	
	Time to delivery (months)	24	Depends on the aims and technical goals, many interim milestones
1	**Objectives (*What for?*) Impact we want to achieve**	1. Make Europe the global leader in sustainable battery technology by developing expertise in the key material technologies that contribute to high performance batteries; 2. Launch pilot plants that work towards demonstration scale preparation and optimization of high performance battery materials, particularly using raw materials from European primary or secondary sources; 3. Encourage initiatives that move the development of battery materials from low TRL levels (research) to high TRL levels (production ready); The R&I efforts should aim at the development of battery materials and technologies for automotive applications (advanced lithium-ion and post Li-ion), stationary energy storage applications (alternative ion based systems (Na, Mg or Al), redox flow batteries and high temperature batteries) (See Implementation Plan – TWG Action 7 SET-Plan, Material; Flagship); 4. Provide the product data (quality, cost, reproducability) that will promote direct investment in product development along the supply chain; 5. Gain the technical data required to support LCA analysis to demonstrate sustainability of a European LiB manufacturing network using European raw materials.	
2	**Action** *(description)*	i) Invest in R&D and pilot plants that enable the development of commercially viable flowsheets for the conversion of low value raw materials to high value market ready battery materials. ii) Focus on value chain driven development, with final raw material end-user (battery manufacturer) developments in material science directly affecting the way downstream processing is organized flexibly (minimize the amount of processing steps). iii) Invest in R&D programs and specificly process and plant scale-up development programs preparing the European industry for the upcoming potential of recycled (EV) battery raw materials. Example: R&I actions should support the extraction of lithium from European brines and indigenous hard rock occurrences, as well as cobalt from challenging crystal structures such as pyrite. Industrial pilot plants are necessary to implement processes and technologies (see also Implementation Plan – TWG Action 7 SET-Plan, Fiche 1.6: Lithium recovery from European geothermal brines and sustainable beneficiation processes for indigenous hard rock occurrences of lithium - pag 37).	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	Technology development to convert low value raw materials to market ready high value products (anode, cathode, battery chemicals..) with high performance. Will allow for transferable technology development, minimization of waste, and potential valorization of by-products. Effective use of technology will allow European suppliers to compete against market dominant Asian suppliers and take a technology lead in primary and secondary raw material conversion.
		Active Materials	Secure access to raw materials will allow for more rapid, efficient and specific development of active materials. Raw material preparation can be tailored to the emerging needs of improved active materials (C-Si, C-Sn, C-graphene, LiCoNiMn-graphene….etc)
		Cell Manufacturing	Much greater flexibility in raw materials when not relying on distant supplier. Supply stability and confidence. Lower product variation and therefore waste. Higher investment confidence. Greater ability for continual material development with local supplier.
		Modules/Pack/BMS	
		Application – ESS	
		Application – e-mobility	
		Application – Industrial	
		User	Sustainability demands to the primary and secondary raw material production
		Recycling/2nd life	Process technology developed at pilot plant scale can be equally applied to end of life and SWARF materials.
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	Cost to produce can approach Asian competitors if market becomes large enough. The commercialization of higher energy density materials shall allow for lower cost/kWh.
		More benefits	Materials can be tailored and improved to suit European industry demands; if local production and development is not available, material properties will always be determined by third parties who may be integrated within direct competitors. Complete supply chain transparency. Higher sustainability and green branding.
5	**Winners**	European mining, recycling and battery materials and manufacturing related companies. European battery manufacturers.	
	Affected	Non-European suppliers, commodity traders	
6	**Who implements?**	EU Institutions	Financial support to encourage relevant research institutions (public or private) to immediately engage with the potential suppliers of raw materials, both primary and secondary, and initiate pilot plant planning and development.
		Member States	Local resources and industry based national development programs
		Industry	Industry to take the lead in building and operating pilot plants with support from funding agencies (e.g. MetNET, ProMetia; KIC's)
7	**Existing Best Practices**	Europe's positioning vs Best Practice is dependent on the raw material. Cathode manufacture is at a relatively mature position, based largely on imported materials. Best practice for anode materials lies in Asia (Japan, China, Korea) within private companies. Europe is advanced with the small scale development of next generation battery materials and in recycling technologies.	
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	Access to skilled people and equipment. Access to funds for both capital items and operating costs. Access to appropriate locations where waste management is permitted. Relationships with anode/cathode manufacturers to support the development of appropriate specifications, and for product testing.	
9	**Planning to implement the action (initial)**	1. Design: 6 months - as long as it is made a priority 2. 24 months for implementation: continual improvement - an on going process	
10	**Financial resources required**	yes	
11	**How will this action directly benefit EU citizen?**	lower cost batteries; higher energy density; reduced reliance on imports; European jobs; skill development within Europe; secure value chain within Europe; higher probability that complete LiB industry can thrive; lower CO2 footprints; greater sustainability; greater transparency of the supply chain	
12	**KPI to monitor progress**	Many facets to KPI development depending on processes targeted. Development of a work program to produce high performance anode material; development of a work program to produce cathode material; work program for cobalt and nickel sulphate…	

Action 6a- Final

	Code and name of the action	6a. Define cell manufacturing as a strategic industry for the high-tech area Europe.	
	Recommendations it contributes to	6, 7	
	Linked to actions #	4a, 6c, 7a, 7b,	
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	1	
	Feasibility (1-easy; 5-Difficult)	1	
	Time to design (months)	6	
	Time to delivery (months)	18	
1	**Objectives (*What for?*) Impact we want to achieve**	*Support European Battery manufacturing in order not to miss the hockey stick phenomenon in market demand (250B€/year in 2025)* 1. Increase visibility of the topic within the EU member states and policy measures 2. Support European players establishing of competitive large-scale cell production in Europe 3. Ensure cell supply for European automotive, stationary and other industries	
2	**Action** *(description)*	1.This initiative has to be supported by policy measures from EU Commissions to MS in as many as possible dimensions (research/innovation, education/talents, finance, regulation/politics, etc.) 2. Ensure continuation of the workstreams created within the EU Battery Alliance 3. Create special support and priorities to ensure a fast and powerful built-up of companies, IP, workforce and manufacturing capacity. 4. Prioritized access to needed infrastrucure, e.g. electricity, water, transport (see action 8a) 5. Establish a level playing field (clear and same rules and conditions for all market participants and products) to ensure a fair competition.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	Increase of demand, chance for growth
		Active Materials	Increase of demand, chance for growth
		Cell Manufacturing	Implementation of large-scale production
		Modules/Pack/BMS	Ensuring supply of cells, shortening of supply chain
		Application – ESS	Ensuring supply of cells, shortening of supply chain
		Application – e-mobility	Ensuring supply of cells, shortening of supply chain
		Application – Industrial	Ensuring supply of cells, shortening of supply chain
		User	
		Recycling/2nd life	
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. It is hard to define costs for this point
		More benefits	1. Reduce dependency on Asian players 2. Increased competition 3. Increased visibility of the topic within the EU members
5	**Winners**	- The complete value chain; as well as citizens, consumers and environment. - The definition as a strategic industry will indirectly impact the whole value chain because a greater focus will be on the whole topic of lithium ion batteries. Demands will grow in each step of the value chain.	
	Affected	- The complete value chain will be affected, but competitiors will be alarmed and particularly affected	
6	**Who implements?**	EU Institutions	Yes, Create the programs and initiatives recommeded by EU Battery Alliance to facilitate the built up of cell manufacturing industry in Europe
		Member States	Yes, Create the programs and initiatives recommeded by EU Battery Alliance to facilitate the built up of cell manufacturing industry in Europe
		Industry	Yes, it has to support and approve the statement
7	**Existing Best Practices**	Are there any other industries which have been defined as strategic in the past?	
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**		
9	**Planning to implement the action (initial)**	1. Design: 6 months 2. Implementation: 2018/2019	
10	**Financial resources requested**	It will be defined as part of design	
11	**How will this action directly benefit EU citizen?**	1.European cell manufacturing industry, based on resilient supply chains with the benefits of jobs, growth, and the access to competitve EU products.	
12	**KPI to monitor progress**	1. Speed of implementation of key initiatives of the EU Battery Alliance 2. Size of budgets assigned to key initiatives of EU Battery Alliance 3. Investments (investment decisions) into new cell manufacturing capacity	
13	**Comment**	1. Create competitive advantage through standardized and sustainable EU lifecycle of batteries (linked to action 4.a)	

Action 7a- Final

	Code and name of the action	7a. Investigate and implement de-risking possibilities (e.g. direct funding and funding bridges) for cell manufacturers
	Recommendations it contributes to	6,7,8
	Linked to actions #	7b
	Dependent on actions #	6a
	Priority (1-Highest; 3 lowest)	1
	Feasibility (1-easy; 5-Difficult)	3
	Time to design (months)	4
	Time to delivery (months)	12

1	**Objectives (*What for?*) Impact we want to achieve**	*Support European Battery manufacturing in order not to miss the hockey stick phenomenon in market demand (250B€/year in 2025)* 1. Enable cell maker to survive the first years until supply chains and related competitiveness are fully established 2. Facilitate investment decisions for manufacturing plants by reducing the risk for investors (e.g.through guarantees) 3. Through the way funding is used, this action is a mean to encourage all along the value chain the European players to play together and not against each other. 4. Facilitate market creation
2	**Action** *(description)*	1. Small margins and large start are factors causing the EU cell manufacturing industry to be weak. It must be the goal of this action therefore to find financial support for the cell manufacturing industry within the EU. One way to grow the margins of cell production is by distributing the margins of the whole value chain more evenly if possible. 2. Direct funding or funding bridges for building up cell production capacity needs to be established. 3. We should make sure that the implemented measures are available to all participants in the market. This will open battery cell manufacturing capacity within the EU. 4. Prevent subsidy grabbing (plants are erected and operated as long as subsidies create a premium on economics and shut down immediately after end of subsidy period) 5. The funding should not focus on R&D funding 6. Develop a separate sizeable captive market through public procurement secured primarily for European cell producers (industry need a market more than OPEX and/or CAPEX support), and ensure that a large free market is created through actions 9a-10b.
3	**Impact in the value chain** *(if blank then none)* 	Raw materials: Increased demand for raw materials in EU Active Materials: Increased demand in EU Cell Manufacturing: Increase competitiveness, get jump-start Modules/Pack/BMS: Ensuring supply of cells, shortening of supply chain Application – ESS: Ensuring supply of cells, shortening of supply chain Application – e-mobility: Ensuring supply of cells, shortening of supply chain Application – Industrial: Ensuring supply of cells, shortening of supply chain User: Recycling/2nd life: Increased need for recycling New player:
4	**Cost Benefit Analysis** *(Initial)*	More costs: 1. For EU or member states since they provide financial supports More benefits: 1. Increase of jobs in cell industry and entire value chain 2. Benefits will occur for all players in the value chain because of the growths of the battery market
5	**Winners**	- Investors, Cell Manufacturers and - indirect - partners in value chain (upstream, downstream) - EU/member states/citizens benefitting from jobs/growth/prosperity
	Affected	- Non-European based companies, if the programm is somewhat reduced to the EU
6	**Who implements?**	EU Institutions: Yes, Complement/open existing financial programs on EU level Member States: Yes, Complement/open existing financial programs on MS level Industry: The industry has to support the process by providing input and assessment on the possibilities that are to be implemented by the EC
7	**Existing Best Practices**	E.g. Renewable support schemes
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	
9	**Planning to implement the action (initial)**	1. Design: Must be possible in 4 months (200 k€) 2. Implementation: must be available fast, max. 12 months
10	**Financial resources requested**	Yes will be defined as part of design
11	**How will this action directly benefit EU citizen?**	1. More employment 2. Less dependencies 3. Securing of the whole value chain within the EU
12	**KPI to monitor progress**	1. Cell manufacturing capacity within the EU (Investments (investment decisions) into new cell manufacturing capacity)
13	**Comment**	1. Ensure that same benefits are available for new and already established European cell manufacturers

Action 7b- Final

	Code and name of the action	7b. Define and implement criteria for IPCEI (Important Projects of Common European Interest) projects for cell manufacturing
	Recommendations it contributes to	7
	Linked to actions #	7a
	Dependent on actions #	6a
	Priority (1-Highest; 3 lowest)	1
	Feasibility (1-easy; 5-Difficult)	3
	Time to design (months)	6
	Time to delivery (months)	12

1	**Objectives (*What for?*) Impact we want to achieve**	Support European Battery manufacturing in order not to miss the hockey stick phenomenon in market demand (250B€/year in 2025) 1. Enable cell manufactures to build up capacities within the EU 2. Reduce risk for investments for cell makers 3. Shorten time and increase success of IPCEI projects 4. This strategic industry definition will allow each EU country to financially support local initiatives/projects in the frame of the existing EU rules.		
2	**Action** *(description)*	1. Shorten time to approval for IPCEI applications on cell manufacturing; allowing the battery industry to catch up with the hockey stick phenomenon in market demand. 2. Educate industry on IPCEI criteria in order to design projects for satisfying them.		
3	**Impact in the value chain** *(if blank then none)* 	Raw materials		
		Active Materials		Increased demand in EU
		Cell Manufacturing		Increase competitiveness, get jump-start
		Modules/Pack/BMS		Ensuring supply of cells, shortening of supply chain
		Application	ESS	Ensuring supply of cells, shortening of supply chain
			e-mobility	Ensuring supply of cells, shortening of supply chain
			Industrial	Ensuring supply of cells, shortening of supply chain
		User		
		Recycling/2nd life		
		New player		
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. For EU or member states for funding	
		More benefits	1. Increase of jobs in cell industry and entire value chain 2. IPCEI allows a greater variety of support instruments (e.g. repayable advance, loans, guarantee, grants etc.), as well as the possibility to cover up to 100% of the funding gap on the basis of a large scope of eligible costs. 3. Member States may grant aid up until the first industrial deployment of new research-intensive products or services, which, unlike the provisions of the R&D&I framework, allows to support the full development process or the deployment of innovative production processes.	
5	**Winners**	- Investors, Cell Manufacturers and partners in value chain (upstream, downstream) - EU/member states/citizens benefitting from jobs/growth/prosperity		
	Affected	Competitors		
6	**Who implements?**	EU Insitutions	Framework and Criteria already set in the '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 (2014/C 188/02)	
		Member States	Yes, must support the project through funding schemes	
		Industry	Key actor: must promote projects as part of the industrial initiative (matching the EU criteria, compliant with other State Aid rules, clearly contributing to competitiveness goals, foreseeing co-investment from the beneficiary and ideally involving EIB or other EU funding) and supported by the MS through different funding schemes	
7	**Existing Best Practices**	- Check with already approved and implemented IPCEI projects; - SET-Plan already description of IPCEI and defined the criteria for batteries/cell manufacturing.		
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	Industry initiatives matching the criteria can be eligible as IPCEI, without any further regulatory/policy requirement needed.		
9	**Planning to implement the action (initial)**	1. Design: Must be possible in 4 months (200 k€) 2. Implementation: must be available fast, max. 12 months		
10	**Financial resources requested**	Will be defined as part of design		
11	**How will this action directly benefit EU citizen?**	1. More employment 2. Less dependencies 3. Securing of the whole value chain within the EU		
12	**KPI to monitor progress**	1. Cell manufacturing capacity within the EU (Investments (investment decisions) into new cell manufacturing capacity) 2. Number of IPCEI Grants for cell manufacturing		
13	**Comment**	1. IPCEI allows member states to financially support CAPEX; there are some rules about the percentage, but not very clear		

Action 8a- Final

	Code and name of the action	8a. Standardize and simplify approval procedures ("Fast track") and permitting (environmental, manufacturing, construction) process	
	Recommendations it contributes to	8	
	Linked to actions #	4a, 4d, 10a, 10b, 12a, 18a, 18b	
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	1,5	
	Feasibility (1-easy; 5-Difficult)	3	
	Time to design (months)	24	
	Time to delivery (months)	36	
1	**Objectives (*What for?*) Impact we want to achieve**	**Create a clear and reliable guideline to allow fast approval for new systems:** 1. Reduce time to market and investment risk supporting establishing of European Battery industry. 2. Create transparency and traceability of battery over life cycle. 3. Simplify battery life cycle use, open the path for new value chains. 4. Generate new usage profiles for second life batteries	
2	**Action** *(description)*	**Provide clear and well defined standards:** 1. Prioritized access to needed infrastrucure, e.g. electricity, water, transport **2**. Clearly define battery key parameters including State of Health. 3. Define measurement procedures for key battery parameters, including SOC and SOH. 4. Define "nameplate" for traceability over life cycle (cell, module and pack level). 5. Define data that have to be saved/communicated (system parameters, use history) over live cycle including communication protocol and cyber security.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	life cycle traceability
		Active Materials	life cycle traceability
		Cell Manufacturing	"nameplate"
		Modules/Pack/BMS	Adaption of "nameplate"
		Application – ESS	yes, respect of nameplate, identification and communication of battery data
		Application – e-mobility	yes, respect of nameplate, identification and communication of battery data
		Application – Industrial	yes, respect of nameplate, identification and communication of battery data
		User	All participants of value chain
		Recycling/2nd life	knowledge of battery indispensable for second life use, standards will also define battery end of life
		New player	possible in centralizing battery information, blockchain
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. cost of battery identification 2. costs of battery test according to standard 3. battery data identification and communication 4. application of standards to other batteries
		More benefits	1. optimized value chain for European batteries
5	**Winners**	Reduction of carbon footprint due to addapted use over system life Second life battery applies, ESS applications New business models for invenstment rest sharing along the value chain	
	Affected	Battery manufacturers and battery pack suppliers	
6	**Who implements?**	EU Institutions	Yes, Definition of Standards
		Member States	Yes
		Industry	Apply standard and benefits from new business models for investment risk sharing along the value chain
7	**Existing Best Practices**	Different approaches under development	
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	Concordance of industrial/institutional expert gremium on SOH definition and SPH and SOC testing possibilities Legal framwork /compliance (data storage and communication)	
9	**Planning to implement the action (initial)**	1. Definition: 24 month to elaborate and tests and define procedures 2. Implementation: 36 months to adopt approach, implementation over value chain will take longer	
10	**Financial resources requested**	Yes, on European level	
11	**Does this action help to establish a European cell production**	Direct measure, tracability over life time reinforces trust building Indirect measure that stimulates market growth- but it is important that the ecosytem is there and supportive for batteries in all part of the energy system.	
12	**How will this action directly benefit EU citizen?**	1. Clear and reliable infomation will increase the confidence of citizen in Batteries 2. Reduction of EV battery costs, due to 2nd life added value	
13	**KPI to monitor progress**	1. Number of permitted applications	

Action 8b- Final

	Code and name of the action	8b. Investigate and implement investment risk sharing between companies along the value chain, EU and member states to support new cell manufacturing	
	Recommendations it contributes to	8	
	Linked to actions #	7a, 7b, 7c, 7d	
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	1	
	Feasibility (1-easy; 5-Difficult)	4	
	Time to design (months)	12	
	Time to delivery (months)	24	
1	**Objectives (*What for?*) Impact we want to achieve**	**Support European Battery manufacturing in order not to miss the hockey stick phenomenon in market demand (250B€/year in 2025):** 1. Maintain the meeting place established for Key industrial players along the entire battery value chain 2. Consider granting subsidized loans to downstream operators for the purchase of EU manufactured batteries 3. Reduce investment risks for investors/companies / Reward actors supporting establishing a European Battery industry. This will result in reducing financing cost, hence reducing investment cost and higher margin 4. Mitigate the impact of "bad investment"/ failed project. This will result in reducing financing cost, reducing investment cost, higher margin and reducing risk of economic failure / drop-out of players in early stage 5. Offtake agreements in connection with public procurement targets for clean vehicles.	
2	**Action** *(description)*	**Provide solutions for investment risk sharing :** 1. Create evidence on a positive impact for establishing European cell manufacturing when investment risks will be shared between public and private investors. 2. EU and member states to provide solutions for the investment risk sharing. 3. Companies along the value chains to provide business models and solutions for investment risk sharing.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	Secured off-take, reduced investment risk/financing cost, improved competitiveness
		Active Materials	Secured off-take, reduced investment risk/financing cost, improved competitiveness
		Cell Manufacturing	Secured off-take, reduced investment risk/financing cost, improved competitiveness
		Modules/Pack/BMS	Secured supply
		Application – ESS	Secured supply
		Application – e-mobility	Secured supply
		Application – Industrial	Secured supply
		User	
		Recycling/2nd life	
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. Costs for loans
		More benefits	2. reduction of investment barrier will increase the production capacity within the EU and will secure the rest of the value chain within the EU
5	**Winners**	- Investors, Cell Manufacturers and partners in value chain (upstream, downstream) - EU/member states/citizens benefitting from jobs/growth/prosperity	
	Affected		
6	**Who implements?**	EU Institutions	Yes, Complement/develop solutions to support/facilitate investment risk sharing along the value chain on EU level
		Member States	Yes, Complement/develop solutions to support/facilitate investment risk sharing along the value chain on MS level
		Industry	Develop and implement business models for investment risk sharing along the value chain
7	**Existing Best Practices**	1. The foundry business model 2. Investors as e.g. EIT InnoEnergy 3. supporting long-term (supply/offtake) agreements 4. subsidized loans to downstream operators has been already done within the AIRBUS consortium.	
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	1. Evidence of positive impact for establishing the European battery manufacturing (cell manufacturing?) when investment risks will be shared between public and private investors. 2. legal framwork /compliance	
9	**Planning to implement the action (initial)**	1. Design: 12 months 2. Implementation: probably in various steps over a longer period, ca. 24 months	
10	**Financial resources required**	will be defined as part of design	
11	**How will this action directly benefit EU citizen?**	1. Establishment of a complete European battery eco-system creates new job opportunities and helps maintain Europes position as a high-tech area.	
12	**KPI to monitor progress**	1. Number of closed deals	

Action 9a- Final

	Code and name of the action	9a. Set clear targets, requirements and incentives for the installation of recharging infrastructure for buildings and publicly accessible areas (urban areas and public roads as well as along freeways).	
	Recommendations it contributes to	9b,10a	
	Linked to actions #	10a, 18b	
	Dependent on actions #	18a	
	Priority (1-Highest; 3 lowest)	1	
	Feasibility (1-easy; 5-Difficult)	2	
	Time to design (months)	12	
	Time to delivery (months)	12	
1	**Objectives (*What for?*) Impact we want to achieve**	Create and support new markets for batteries, e.g through the "Clean Energy" & the "Mobility" packages but also new initiatives, in order to support sustainable solutions for power, transportation and industry sectors in line with EU climate goals. 1. Achieve an adequate and built out charging infrastructure to support a high penetration of EV and avoid "fidelisation" programs (requiring registration /specific cards) to pay the recharge to facilitate free movement of EV users. 2. Enable and support market growth of EVs and thus Batteries as well	
2	**Action** *(description)*	Define a target roadmap for EV charging station geographical penetration and coverage (households and public). Design targeted financial support program for investment in building and operating of charging infrastructure.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	indirect by growing market
		Active Materials	indirect by growing market
		Cell Manufacturing	indirect by growing market
		Modules/Pack/BMS	indirect by growing market
		Application – ESS	demand for ESS batteries to be integrated with high power EV chargers
		Application – e-mobility	accelerates EV deployment by overcoming range anxiety
		Application – Industrial	medium
		User	Extended range and charging becomes ubiquitous
		Recycling/2nd life	no
		New player	providers of system services for charging
4	**Cost Benefit Analysis** *(Initial)*	More cost	1. Cost of installation and equipment. Potentially increased grid costs (affects grid and might increase costs locally but beneficial for the grid at large)
		More benefits	1. Larger stakeholder group: Additionally long distance driver and urbanites which do not have an own garage 2. Customer convenience; less range concerns. Potentially less requirement on battery size per car
5	**Winners**	End customer by convenience and by cleaner air; increased electric car sales; operators of charging infrastructure and providers of clean energy	
	Affected	Oil companies; value chain for producing combustion drive trains. Manufacturers not willing to invest in R&D for clean vehicles and divest from internal combustion.	
6	**Who implements?**	EU Institutions	Funding programs (e.g. CEF Connecting Europe Facility calls). EPBD – Amendments to Energy performance in buildings directive – key for boosting electro-mobility Under the provisional agreement (still to be formalised and approved by the Parliament and the Council) MS will be required to set obligations for the installation of a minimum number (to be defined by Member States) of charging points in all existing non-residential buildings with more than 20 parking spaces by 2025. For new and major renovations (affecting the car park or the electric infrastructure) of non-residential buildings, the compromise found will require that ducting is installed for 1 in every 5 parking spaces and that 1 charging point is installed per building. For new and major renovations (affecting the car park or the electric infrastructure) of residential buildings, ducting will be required for every parking space. The provisional agreement also includes provisions to simplify the deployment of recharging points, by addressing regulatory barriers, including on permitting procedures. REDII –recast of Renewable Energy Directive: as negotiations currently stand at EP/Council, the new rules are likely to include; RES supply obligation on fuel suppliers (concrete% is discussed); one of the obvious ways to satisfy the requirement is by supply of RES-electricity to EVs
		Member States	NPFs – National Policy Frameworks; authorization procedures; national funding programs; create favourable conditions for EV charging in buildings: notably, as soon as the amended EPBD is adopted, to correctly transpose and properly implement the related recharging infrastructure provisions (preferably - in ambitious way). Idem for supply obligation of RES on fuel suppliers (as soon as REDII is adopted)
		Industry	private investments, especially after kick-start phase supported by public funds
7	**Existing Best Practices**	Establishment of a Battery Alliance best practice data base would help stakeholders to exercise peer pressure. Solutions for home charging and fast charging are existing and dissemination is increasing. Nevertheless there are no standards for the billing structure. Fast charging might become too expensive. Normal charging in the street of cities is sometimes based on time sometimes on energy. It is difficult to integrate the vehicle in a grid structure with optimized charging schedule. In gated communities it is sometimes not allowed to install additional charges because common ground might be affected. See also SET Plan TWG Action 7 on Batteries - Fast Charging Flagship (it provides for R&I actions to ensure that batteries are well adapted to fast charging needs). There is also a parallel activity in SET Plan action on Energy Systems: R&I to help to accommodate fast charging in the grid/energy system.	
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	National Rregulation needs to be adoapted to allow V2G, other storage products and applications (nothing at EU level prevents it). Current electricity market design discussions at EU level must be supported to ensure that the final legislative texts stemming from the Clean energy package proposals are supportive ofrequire MS to introduce enabling rules for storage. Storage industry must invest time and effort into influencing the policy framework.	
9	**Planning to implement the action (initial)**	1. Design: EU Working group on standardisation for billing systems; EU Smart Grid Task Force for grid integration (vehicle to grid); MS Start legislation process and incentives. 2. Implementation: Incentives partly already available and installations ongoing. ENTSO-E; Accelerate with additional budget	
10	**Financial resources requested**	Yes, for incentives	
	How does this action help to establish a European cell production	Indirect measure that stimulates market growth- but it is important that the ecosytem is there and supportive for batteries in all part of the energy system.	
11	**How will this action directly benefit EU citizen?**	1. better health and less associated costs to bear, cleaner environment with less GHG 2.less concerns; convenient mobility	
12	**KPI to monitor progress**	1.Geografical distribution. Charging points per EV. Storage capacity in EV fleet	

Action 9b- Final

	Code and name of the action	9b. Define and implement a consistent incentivizing framework for the uptake of the EV market (e.g. emission standards for "yellow machines", promotion schemes for ZEV sales, public procurement targets for clean vehicles including public transport, tax and "soft" incentives such as use of public lanes and free parking)
	Recommendations it contributes to	4, 5a, 6a, 7a, 8b, 9a,9b 10a
	Linked to actions #	4a-d, 7a, 9a, 9b, 10a,11a, 12a,18a
	Dependent on actions #	4a-d, 9a, 10a, 11a, 12a, 18a
	Priority (1-Highest; 3 lowest)	1
	Feasibility (1-easy; 5-Difficult)	2
	Time to design (months)	8-12
	Time to delivery (months)	>12

1	**Objectives (*What for?*) Impact we want to achieve**	Create and support new markets for batteries, e.g through the "Clean Energy" & the "Mobility" packages but also new initiatives, in order to support sustainable solutions for power, transportation and industry sectors in line with EU climate goals. 1. Enable and support market growth of EVs to increase demand and thereby give market support for battery production		
2	**Action** *(description)*	Include specialized niche markets for batteries (incl. yellow machines with e.g. forklifts, military sectior, trucks, busses and ships in this action and evaluate their market share). Focus to maintain European leaderships on local markets. Low CO2 footprint in all products along the value chain- connects to recommendation 4. Stronger leaderships on MS and city level- procurement of low emission public transport to be enforced. - Increase ambition of Mobility Package: (i) stricter CO2 standards in line with long-term decarbonization targets for cars and vans, and new effective standards for Heavy duty vehicles (ii) mandate with flexible crediting system for zero emission vehicles (ZEV quota on sales/production) along with penalty for non - compliance, (iii) development of real world emission test cycle, (iv) expand scope of clean vehicle directive including also taxis and waste collecting vehicles and increase procurement targets - promote EV charging infrastructure (see 9a). - More systematic deployment of fair and efficient tools based on the polluter/user pays principle to account for externalities. In the absence of such measures, and while the phase-out of gasoline and diesel fuel subsidies takes place, specific support schemes for the purchase of EVs are needed to kick-start the market (e.g. tax reductions, incentives to purchase) - power market design elements enabling the integration of EVs into the power system and valuing flexibility (see 10.a) - non-economic incentives (e.g. access and parking restrictions in the city centerscentres for polluting vehicles, fast preferential lanes access during traffic jams limited to clean vehicles, facilitated access and parking to public charging points in traffic-clogged areas) - automotive OEM to put new EV models on the market and launch marketing activities		
3	**Impact in the value chain** *(if blank then none)* 	Raw materials		indirect by growing market
		Active Materials		
		Cell Manufacturing		
		Modules/Pack/BMS		
		Application	ESS	demand for ESS batteries to be integrated with high power EV chargers
			e-mobility	accelerated uptake; sustained EV batteries demand (with positive impact upstream the value chain)
			Industrial	indirect by lower cost cell driven by volume in automotive sector
		User		lower cost
		Recycling/2nd life		no immediate effect; long term significantly higher volumes
		New player		bigger potential for development of new business models, products and services in EV area
4	**Cost Benefit Analysis** *(Initial)*	More costs		public procurement may entail an initial cost for obliged parties
		More benefits		1. environmental and health benefits due to a more sustainable transport sector. And lower health costs to bear for the society 2. new flexibility sources for the power system → more efficient integration of RES in the power sector (acceleration of decarbonization) 3. savings for public procurement obliged parties from mid-term on
5	**Winners**	Lower cost for consumers; value chain for demand pull; citizens and environment for better air quality, lower health cost, cheaper and faster decarbonization; industry by better margins		
	Affected	Government budget may be initially affected by public procurement of certain types of EV's		
6	**Who implements?**	EU Institutions		all legislative proposals mentioned
		Member States		national incentive schemes
		Industry		automotive OEM to embrace the change; utilities to make sure EVs are used as flexibility sources
7	**Existing Best Practices**	US and Norwegian ZEV programs. To be updated taking into account the Revision of the Clean Vehicles Directive (part of November 2017 Mobility package).		
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	dependent on legislation/regulation mentioned above		
9	**Planning to implement the action (initial)**	1. Design: Legislation 2. Implementation: Define budget and process of access		
10	**Financial resources required**	yes, to be defined during implementation phase		
11	**Does this action help to establish a European cell production**	Indirect measure that stimulates market growth- but it is important that the ecosytem is there and supportive for batteries in all part of the energy system.		
12	**How will this action directly benefit EU citizen?**	1. environmental and health benefits due to a more sustainable transport sector. And lower health costs to bear for the society 2. new flexibility sources for the power system → more efficient integration of RES in the power sector (acceleration of decarbonization)		
13	**KPI to monitor progress**	share of Evs on new vehicles sales share of EVs providing flexibility services to power markets		

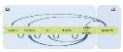
Action 10a- Final

	Code and name of the action	10a. Develop a power market design that enables the integration of ESS (including EV batteries through vehicle to grid) allowing ESS and EV batteries to support the power system management. Battery based actors/systems shall be able to participate in all parts of the power market and network tariff shall not penalize storage while driving electrification.	
	Recommendations it contributes to	11a,12a	
	Linked to actions #	10b	
	Dependent on actions #	12a	
	Priority (1-Highest; 3 lowest)	1	
	Feasibility (1-easy; 5-Difficult)	2	
	Time to design (months)	6-12	
	Time to delivery (months)	>12	
1	**Objectives (*What for?*) Impact we want to achieve**	Create and support new markets for batteries, e.g through the "Clean Energy" & the "Mobility" packages but also new initiatives, in order to support sustainable solutions for power, transportation and industry sectors in line with EU climate goals. Achieve an adequate well-functioning power market design enabling the integration of ESS and EV batteries with high penetration of EV charging and valuing the flexibility and contribution to system adequacy that such assets can bring about.	
2	**Action** *(description)*	Efficient wholesale energy and capacity markets, open to all energy sources: - Participation allowed to all sources (including demand response and storage) to all energy and capacity markets timeframes - Markets Gate Closure near time of delivery - Scarcity prices allowed (no caps) - Market based dispatch and balancing responsibility for all market participants - Aggregation allowed in all energy markets timeframes - Balancing markets with small minimum size of balancing products (e.g. 1MW), and where products exist that can value the accuracy and rapidity of batteries in responding to activation signals (e.g. Ultra fast freq response / synthetic inertia products) - The design of capacity markets shall not penalize limited reservoir units (the use of penalties for non-delivery is to be preferred to ex-ante derated capacity) Network operators remuneration and tariff design: - Network operators' remuneration shall be calculated according to a performance-based framework prompting them to operate efficiently their networks and use flexibility from flexible market assets (including batteries) - Network tariffs should not discriminate against storage and reflect the costs of building grids; efficient, fair and transparent distribution tariff structures and methodologies (Capacity-based + time-of-use network tariffs and dynamic pricing) - No net metering, or netting limited to the ISP window - Removal of inappropriately overburdening charges from the electricity bills to promote consumers' energy efficient behaviors (e.g. taxes, levies, subsidies) evelopment of bi-directional chargers to support rollout of V2G solutions	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	demand pull beneficial for the whole value chain
		Active Materials	
		Cell Manufacturing	
		Modules/Pack/BMS	
		Application – ESS	more value to services sold to power markets
		Application – e-mobility	more value to services sold to power markets
		Application – Industrial	more value to services sold to power markets; more value to load optimization items
		User	reduced charging energy costs (OPEX) by monetizing EV's battery flexibility in power markets
		Recycling/2nd life	
		New player	bigger potential for development of new business models, products and services in ESS and EV area
4	**Cost Benefit Analysis** *(Initial)*	More costs	For regulations such as network codes, time must be invested by storage industry/Member States/Commission experts to analyse storage-related aspects and propose new solutions
		More benefits	1. more efficient power market functioning and reduced system management costs, e.g. for congestion management and more efficient grid development (and citizens expense) 2. new flexibility sources for the power system → more efficient integration of RES in the power sector (acceleration of decarbonization at a reduced price and related environmental benefits)
5	**Winners**	citizens, battery manufacturing value chain, new electricity market players	
	Affected	inefficient power production based on fossil fuels	
6	**Who implements?**	EU Institutions	Finalize the market design initiative including the elements mentioned above (those which are in EU competence)
		Member States	Develop incentivizing output based regulation for DSOs remuneration and efficient tariff design
		Industry	Develop cost efficient V2G solutions including bi-directional chargers; innovative integrated service offerings enabling new players in the power market
7	**Existing Best Practices**	UK for output based regulation and capacity market, PJM for balancing services; Nissan and Renault has already V2G functionality as standards	
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	minimum regulatory requirements stated in action description box	
9	**Planning to implement the action (initial)**	1. Design: MS regulators and EU 2. Implementation: MS, DSO, Industry	
10	**Financial resources required**	Will be defined as part of design	
11	**Does this action help to establish a European cell production**	Indirect measure that stimulates market growth- but it is important that the ecosytem is there and supportive for batteries in all part of the energy system.	
12	**How will this action directly benefit EU citizen?**	1. more efficient power market functioning and reduced system management costs (and citizens expense) 2. new flexibility sources for the power system → more efficient integration of RES in the power sector (acceleration of decarbonization at a reduces price and related environmental benefits) 3.Lower cost to own EV	
13	**KPI to monitor progress**	1. No of V2G vehicles 2. share of storage and V2G in overall energy and ancillary services 3. Installed stationary battery capacity 4. Level of battery utilization (MW installed and MWh of services supplied) 5. Diversity of battery utilization services	

Action 10b- Final

	Code and name of the action	10b. Establish a transparent data hub for e-vehicles (similar to best practice data for hub metering data of electricity customers)	
	Recommendations it contributes to	10	
	Linked to actions #	4a, 4d, 10a, 12a, 18a, 18b	
	Dependent on actions #	8a	
	Priority (1-Highest; 3 lowest)	**1,5**	
	Feasibility (1-easy; 5-Difficult)	**3**	
	Time to design (months)	12	
	Time to delivery (months)	24	
1	**Objectives (*What for?*) Impact we want to achieve**	Upon consumer consent, valuable consumer data will be available to market actors who will be able to offer consumers tailor-made solutions. Better regulated and non-discriminatory access to consumer data will benefit the consumers through increased competition among market actors. In the power sector important steps are now taken to make this happen. One key action is to give consumers the power over the data about their electricity consumption that are generated in their own homes! The access to these data are essential to build new business models and allow consumers to become actors on the power market. But other actors can with the use of these data to create new business models.	
2	**Action** *(description)*	- EU to issue guidelines to member countries to establish Data Hubs for openly accessible data from electric vehicles in a standardized format. (2020) - Regulators to incorporate these guidelines in regulation. (2020) - Member Countries to make it happen in the individual countries. (2022) - EU to mandate that V2G (Vehicle to Grid) functionality is implemented in all electric cars on the market from 2022 - Member countries to mandate that in the case support is given to home chargers these chargers should have public data and potentially by open for external use. (2020)	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	no
		Active Materials	no
		Cell Manufacturing	foresee data measurement
		Modules/Pack/BMS	define and implement data hub
		Application – ESS	yes
		Application – e-mobility	yes, allowing grid integration EV use as ESS
		Application – Industrial	yes, new value chains
		User	yes, EV becomes ESS
		Recycling/2nd life	
		New player	possible in centralizing battery information
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. implementation of data hub on all EV 2. application of standards to other domains (EV maintenance)
		More benefits	- Better ROI for customers -Electric vehicles will have a fair chance to act in the power market and give valuable contributions. - The power sector will become more efficient given higher competition for the services needed in the power sector. - The resilience of the power system will increase. - Several actors will develop business models and software tools for this market. Europe can take the lead in the development of this type of software.
5	**Winners**	EV manufacturers, Grid providers, customers	
	Affected	Modules/Pack/BMS providers	
6	**Who implements?**	EU Institutions	Yes, Design of data hubs and definition of standards for SOC and SOH measurements
		Member States	Yes, start with local standards
		Industry	Have to be involved
7	**Existing Best Practices**	One good example how this is created in practice is the "Data Hub" recently established in Denmark and under implementation in Norway and Sweden. The Data Hub is described like this: "The purpose of DataHub is to ensure uniform communication methods and standardized processes for professional participants in the electricity market in order to stimulate competition and optimize market conditions for electricity consumers." More info here: https://en.energinet.dk/Electricity/DataHub#Documents	
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	Yes, data hub definition and measurement standards required	
9	**Planning to implement the action (initial)**	1. Definition: 12 months 2. Implementation: 24 months requires accordance of all stakeholders	
10	**Financial resources requested**	Yes, on European level for definition of standard and to foster implementation	
	Does this action help to establish a European cell production	Direct measure, increases grid stability, facilitates RE implementation Indirect measure that stimulates market growth- but it is important that the ecosytem is there and supportive for batteries in all part of the energy system.	
11	**How will this action directly benefit EU citizen?**	The collected data (e.g. driving patterns, consumption details, impact from speed, temperature, geography and other relevant data) will most likely open for a large number of business solutions and creative apps using the data. Here the development of apps related to public transport can serve as a good example once the databases were opened to external actors. Other benefits include the possiblility of gain using personal EV as ESS and increased grid stability	
12	**KPI to monitor progress**	1. share of Evs on new vehicles sales 2. share of EVs providing flexibility services to power markets	

Action 11a- Final

	Code and name of the action	11a. Integrate battery storage options and V2G in grid planning and resource planning (addressing security of supply)	
	Recommendations it contributes to	10a,12a	
	Linked to actions #	10a	
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	1	
	Feasibility (1-easy; 5-Difficult)	2	
	Time to design (months)	3-6	
	Time to delivery (months)	>12	
1	**Objectives (*What for?*) Impact we want to achieve**	Create and support new markets for batteries, e.g through the "Clean Energy" & the "Mobility" packages but also new initiatives, in order to support sustainable solutions for power, transportation and industry sectors in line with EU climate goals. EU has ambitious plans for the integration of the increased renewable energy production but EP/MS still need to approve and implement them. Battery storage can offer a cost efficient solution for this integration.	
2	**Action** *(description)*	Integrate market-based battery storage options in grid planning exercises, such as the Ten-Year Network Development plan and PCI's. Incentivize DSOs at local level to procure flexibility through - among others - storage and V2G options in their network development plans . Support for further discussion amongst Member State electricity experts from ministries and regulators on the role of storage for the security of supply as well as exchange of best practices in this field.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	demand pull beneficial for the whole value chain
		Active Materials	
		Cell Manufacturing	
		Modules/Pack/BMS	
		Application – ESS	yes
		Application – e-mobility	yes
		Application – Industrial	yes
		User	yes
		Recycling/2nd life	yes. Creating new market opportunities for 2nd life
		New player	Will constitute a new actor in the electricity market
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. Some additional cost for V2G functionality in cars;
		More benefits	1. Reduced Grid cost due to investment deferral/enhanced efficiency of existing assets 2. Fast implementation
5	**Winners**	Overall system cost for power system will be reduced while RES share can be increased. If TSOs and DSOs can own/operate storage under specific circumstances (for the provision of only those services that they can currently provide with their grid infrastructure assets), they have a new tool in their toolbox. This would help storage to be deployed more rapidly in the grid. Potentially higher reliability.	
	Affected	Will reduce grid investments and thereby income for distribution companies with current regulation. Storage industry will benefit from much bigger market, more opportunities to deploy storage.	
6	**Who implements?**	EU Institutions	Should mandate batteries to be included in grid planning; mandate market-based procurement of ancillary and system services that can allow storage to participate; must reduce barriers to storage deployment across the board, including for example the network codes; must mandate further improvements to ENTSO-E's CBA for energy storage in the TYNDP/PCIs
		Member States	Implement regulation that supports batteries; ensure that tariff/grid fees for energy storage are fair and not placing undue burden on storage
		Industry	Storage industry: Develop cost efficient ESS solutions, incl. hybrid storage systems. TSOs/DSOs: gain better understanding of storage capabilities. Ensure that procurement of services is done in an open way so that storage can participate and with specifications that do not discriminate against storage; develop new products as needed (e.g. fast frequency response, synchronous inertia)
7	**Existing Best Practices**	California. UK National Grid work on developing new system services. Enhanced Frequency Response tender showed importance of long-term contracts for storage industry. Ireland's TSO Eirgrid also developing new services.	
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	The barriers to storage deployment must be reduced. Market-based procurement should be developed for all energy and ancillary services, and long-term contracts for storage should be considered. It must be clarified whether multiple services can be "stacked" on one storage device. The unique value of storage (e.g. very fast response) should be monetised. Double grid fees and taxes should be removed (storage is sometimes taxes as both a consumer and generator, which hampers the storage business case). For V2G applications, much more research is needed to understand the possible business cases, applications, etc.	
9	**Planning to implement the action (initial)**	1. Design: Setup installation regulations 2. Implementation: Set targets	
10	**Financial resources requested**	Will be defined as part of design	
	Does this action help to establish a European cell production	Indirect measure that stimulates market growth- but important that the ecosytem is there and supportive for batteries in all part of the energy system.	
11	**How will this action directly benefit EU citizen?**	Lower overall grid costs, decarbonisation	
12	**KPI to monitor progress**	1. Amount of storage deployed at grid level 2. Number of TSOs/DSOs implementing new service	

Action 12a- Final

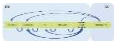
	Code and name of the action	12a. Develop standardized interoperability interfaces allowing seamless secure integration of battery management systems of ESS and EVs and thus more efficient bi-directional communication with aggregation platforms or Energy markets. Evolution of digitalized innovative energy services shall be enabled.	
	Recommendations it contributes to	9a,10a,11a,12a	
	Linked to actions #	10a, 10b, 18a	
	Dependent on actions #	10a	
	Priority (1-Highest; 3 lowest)	**1**	
	Feasibility (1-easy; 5-Difficult)	**3**	
	Time to design (months)	12	
	Time to delivery (months)	48	
1	**Objectives (*What for?*) Impact we want to achieve**	ESS & EVs should be able to serve with their flexibility all five power circles: local, community, DSO, TSO and cross-border. Therefore interoperability needs to be an integral part of product design. Otherwise implementation costs risk to be much higher, time to market longer and system benefits delayed. Deployment of ESS & EV's flexibility should be seamless like installing new printer – plug into power socket, login to wireless network and start offering flexibility services to any electricity market player (regulated and non-regulated) targenting true Plug and Play Internet of Things (IoT) devices. Several connection standards already exist on the market. It is not the goal of this task to develop new standards but to define which ones (to be selected and recommended from the existing SGAM library) and in what way they should be used. This will allow seamless connection of batteries from all EU manufacturers (interoperability) to digital layer and provision of innovative services and thus scaling. Without interoperability (across manufacturers) this innovation layer can not develop efficiently.	
2	**Action** *(description)*	Standards and interoperability allow best possible service for consumers by enabling innovation and diversity. Existing Smart Grid Reference Architecture (SGRA; see: ftp://ftp.cencenelec.eu/EN/EuropeanStandardization/HotTopics/SmartGrids/Reference_Architecture_final.pdf) would be used as underling conceptual model to represent the current ESS & EVs situation, map future concepts and achieve a common understanding of stakeholders. Existing standards should be used as much as possible and extended only where needed to enable/fine-tune standardization of bi-directional data exchange on device (battery/BMS/EMS/EV) and system level (management, aggregation, trading). Data security is vital for system stability and reliability and should have high priority from the beginning. A task force, working on this action recommendation, would need to study and select the most appropriate existing standard(s), which should be aligned with SGRA and CEN-CENELEC-ETSI and would cover communication of EVs or ESS with the grid and communication with or inside the BMS itself. In case some amendments would be needed, it would have to be evaluated in cooperation with CEN-CENELEC-ETSI Smart Grid Coordination Group (SG-CG) and ESOs. Once the ESS & EVs communication standard is agreed, its implementations needs to be harmonized. The task force would need to provide detailed implementation guidelines, systematically disseminate those within ESS & EVs industry and monitor its deployment and compliance (KPIs). It might consider help/coordinate developing certification methodology with certification authorities. These measures should prevent same standard being implemented differently, hindering interoperability (as seen with DLMS standard).	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	no
		Active Materials	no
		Cell Manufacturing	no
		Modules/Pack/BMS	Yes. The BMS API (application programming interfaces) should be open, standardized and interoperable.
		Application – ESS	Yes. The ESS API should be open, standardized and interoperable.
		Application – e-mobility	Yes. The EV Charging Station API should be open, standardized and interoperable.
		Application – Industrial	Yes. The Industrial API should be open, standardized and interoperable.
		User	Yes. User should be able to fully utilize the ESS & EVs potential, both locally and system wise. It facilitates higher penetration of RES
		Recycling/2nd life	Yes. Supports 2nd life by cost efficient and seamless data integration.
		New player	Yes. New players should have cost efficient, seamless and standardized access to ESS and EVs data and remote control.
4	**Cost Benefit Analysis** *(Initial)*	More costs	Initial development. Standard updates and maintenance.
		More benefits	Better ROI for customers. Reduces deployment costs. Increases utilization factor. Better customer services. Faster battery market penetration. Enables efficient 2nd battery life. Decreasing market entry barriers for new market players.
5	**Winners**	Customers, battery suppliers, grid operators, electricity retailers, RES generators, new energy market players.	
	Affected	Established players with proprietary digital layers.	
6	**Who implements?**	EU-Institutions	CEN-CENELEC ETSI (under guidance of the Commission where necessary, IEC.
		Member States	All
		Industry	EUROBAT, ESMIG, SmartEn
7	**Existing Best Practices**	Horizon projects (e.g. Flexciency and FutureFlow) could provide certain recommendations, either directly or via Bridge initiative. After completion of standardisation mandate M490, now a very big family of standards exists for smart grids accommodating inter alia batteries/storage and, more generally, distributed energy sources: ftp://ftp.cencenelec.eu/EN/EuropeanStandardization/Fields/EnergySustainability/SmartGrid/CGSEG_Sec_0042.pdf - page 106 and following. As additional examples, could serve: - Flexiciency Horizon 2020 project (http://www.flexiciency-h2020.eu/), coordinated by Enel, where interoperable communication protocol was defined based on SGRA and CIM IEC standard. It serves to seamlessly exchange SmartMeters data between DSOs and Market players, thus lowering entry barriers, promoting new energy services and pan-European cross-border business. - EVERLASTING Horizon 2020 project, (http://everlasting-project.eu), working on standardized BMS hardware and software platform, - Fraunhofer work on open-source foxBMS (https://www.foxbms.org/). - ELECTRIFIC Horizon 2020 project, (https://electrific.eu/), concerning interoperability of EVs and the grid.	
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	Proof of concept and pilot testing and demonstrating several use cases. Important that majority of manufacturers are involved from early-on. Proprietary solutions will present a barrier to innovation and new players. In the absence of action, there is a risk that battery & EV manufacturers will develop proprietory connection protocols and integration of batteries with the energy sector will be inconsistent due to "fragmentation" of interoperability standards. The solutions of the largest market players might eventually be accepted as de-facto standard which will affect competition and interests of smaller EU market players.	
9	**Planning to implement the action (initial)**	2018: Setting up of task force 2019 and onwards: Implementation	
10	**Financial resources required**	Setting up the task force. Total cost to be defined.	
	Does this action help to establish a European cell production	From an engineering perspective, the battery (as used e.g. in an electric vehicle or stationary storage application) is an embedded system, meaning that it consists of a physical/chemical process, and sensors/electronics that controls this process (e.g. the charging and discharging phases, etc.). The overall performance of the system, then, depends both on the quality of its physical/chemical and its electronics/control/software part (BMS). For cells produced in Europe we will have required knowledge about the cell's physical and chemical composition to be able to build optimal control models matched to the cells, without having to rely on retrospective and error-prone analysis of imported cells. From the business perspective enabling valuable services on top of a specific hardware is a game changer that was exploited and successfully demonstrated by many American players (e.g. Apple, Google, Tesla, etc.). By defining functional and data interoperability, European cell manufacturers could gain competitive market advantage, being first to comply with the European market requirements and being able to offer cells which have capability to be fully utilized in all energy system domains.	
11	**How will this action directly benefit EU citizen?**	European cell production will heavily depend on the value the products bring to the customer. While one set of advantages originates from product itself (chemical process, BMS), significant competitive advantage must be gained through development of innovative services based on innovative digital solutions – digital layer (i.e. Apple App Store) Successful implementation of a digital layer is only possible through standardization and product interoperability. 1. Reduced CAPEX and OPEX of ESS and Evs. 2. Reduced costs of energy. 3. Higher share of RES - environmental benefits. 4. Improved security of electricity supply. 5. Better energy grid and supply services.	
12	**KPI to monitor progress**	1. ESS & EV's integration time and cost.	

Action 13b- Final

	Code and name of the action	13b. Define how to faster reach TRL 7 on Generation 4 (all-solid-state lithium technologies, e.g., with polymer or ceramic electrolyte) for e-mobility in 2023 by concentrating R&I efforts on this strategic topic			
	Recommendations it contributes to	13			
	Linked to actions #	14a, 13.a			
	Dependent on actions #				
	Priority (1-Highest; 3 lowest)	2			
	Feasibility (1-easy; 5-Difficult)	3			
	Time to design (months)	8			
	Time to delivery (months)	2023 for TRL7. Intermediate milestone in 2020 (flexibility on roadmaps and orientations).			
1	**Objectives (*What for?*) Impact we want to achieve**	**Grow the European R&I capacity. Develop and strengthen skilled workforce in all parts of the value chain and make Europe attractive for world class experts.** 1. Gain competitive advantage on new generation batteries, with respect to Asian competitors 2. Accelerate the development of next generation batteries (beyond the measures already in place) 3. Speed-up EV industry development (solid state batteries are expected to fix issues related to weight, safety, hopefully cost and performance)			
2	**Action** *(description)*	1. R&I should cover the full value chain (materials, processes, cells, systems, recycling). 2. The developments should be compatible with fast charging. 3. More agressive timeline than in SET-Plan TWG7, while on substance the recommendations on "Post Li ion batteries for e- mobility" is clearly valid (see Implementation Plan – TWG Action 7 SET-Plan, Fiche 1.4 Post Li ion for e- mobility - pag 31 and Material Flagship). Larger efforts to be put on this strategic topic, in order to reach TRL7 by 2023 for some solid-state technologies (all-solid state is a large family of different technologies).			
3	**Impact in the value chain** *(if blank then none)* 	Raw materials		All solid state batteries may use different set of materials	
		Active Materials		All solid state batteries may use different set of materials; develop/adapt production processes to new materials	
		Cell Manufacturing		New cell technologies will impact on the cell manufactures with new investments in production lines; develop/adapt production processes to new materials	
		Modules/Pack/BMS		Define impact on BMS and pack design: Since generation 4 cell is designed from scratch, this might allow for closer integration of cells and their control (integrating sensors and battery management electronics with the cells); better control (= software) is one of the cheapest ways to improve system KPIs as well as its safety; develop/adapt assembling processes	
		Application	ESS		
			e-mobility	Solid state technology will help to solve problems in e-mobility applications and therefore will help to boost the e-mobility; it will lower cost and enhance the safety; support R&D and adapt production to new batteries	
			Industrial		
		User			
		Recycling/2nd life		Recycling concept have to be adjusted to the new technologies for example when elemental lithium is used	
		New player			
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. R&I and especially Innovation		
		More benefits	1. Create competitive advantage compared to Asian players if advancing on next Generation of batteries. 2. Create European IP		
5	**Winners**	- The complete value chain; - Cell manufacturers taking a competitive advantage over Asian competitors, provided that solid state batteries will confirm expectations as regards safety, cost and performance. EV/car manufacturer will gain from this action.			
	Affected				
6	**Who implements?**	EU Institutions		Yes - EC + MS + Industry. R&I calls needs to be more focused, prescriptive, and the efforts should be sustained over long periods. - DG R&I will fund R&I projects dedicated to Gen4 technologies within H2020 (see the outcomes of the dedicated workshop organized by DG R&I on January 11-12, 2017). - In order to accelerate the innovation process and complement the R&I actions supported within H2020 at medium TRLs (typically TRL3-6), the EU should use other relevant funding instruments, e.g., EIT Innoenergy and/or EIT RawMaterials could support innovation projects at higher TRLs (typically TRL6-8). This coordinated effort at EU level (H2020 focusing on medium TRLs + other relevant funding instruments focusing on higher TRLs) should lead to at least one technology within the Gen4 family reaching TRL7 by 2023. - It is very important to point out that the Gen4 family encompasses a potentially very broad range of technologies and material chemistries as detailed in Batteries' SET Plan (see Implementation Plan – TWG Action 7 SET-Plan, Fiche 1.4 Post Li ion for e- mobility - pag 31). H2020 will mostly focus on Gen4 technologies based on existing chemistries. Therefore, in order to prepare the ground for Gen4 technologies based on radically new chemistries and offering higher performance levels (reaching the market after 2030), the EU should use funding instruments such as FET Flagships starting at low TRLs (typically starting at TRL 1-2). This is crucial in order to maintain the EU leadership on the long run.	
		Member States		Yes; MS should design and implement focused R&I programmes to complement the actions launched at the EU level.	
		Industry		Yes, Industry should be involved in the definition of the calls; Industrial companies should be of course strongly involved in the different R&I projects at both EU and national level.	
7	**Existing Best Practices**	Are there any other industries/technologies for which specific acceleration programs have been defined in the past? Analysis of lessons learned.			
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	Better coordination/bundling of research activities across Europe to avoid parallel structures.			
9	**Planning to implement the action (initial)**	1. Design: Must be possible in 8 months (300 kEuro) 2. Implementation: first pilot manufacturing available 2023			
10	**Financial resources required**	will be defined as part of design			
11	**How does this action directly benefit EU citizen?**	1. Provided that solid state batteries will confirm expectations as regards safety, cost and performance customers will gain from this action.			
12	**KPI to monitor progress**	1. Acceleration on TRL progress			
13	**Comment**	1. w/o a large scale cell manufacturer this action will not be possible 2. important to sustain R&I support for advancing other other battery technologies, as well			

Action 14a- Final

	Code and name of the action	14a. Create stronger focus and more prescriptive R&I calls, co-defined with Industry and sustained over longer periods	
	Recommendations it contributes to	13,14,15,16	
	Linked to actions #	2a, 2b, 5a, 13b, 14b	
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	1	
	Feasibility (1-easy; 5-Difficult)	2	
	Time to design (months)	12	
	Time to delivery (months)	12 to 48	

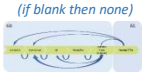
1	**Objectives (*What for?*) Impact we want to achieve**	Conduct advanced research in battery chemistry, battery systems manufacturing, battery energy storage integrated systems including battery managment software, recycling , and increase university output in these areas by involvement of industrial stakeholders.		
2	**Action** *(description)*	Create stronger focus and more prescriptive R&I calls, co-defined with Industry and sustained over longer periods. High impact and high visibility R&I activities to form flagship activities which are relevant. Calls for Industrial and commercial processes to recover strategic/critical raw materials and also research to identify where strtategic/critical materials (i.e. lithium) can be found in Europe. Important R&I calls co-defined with Industry could be about production lines with extensive use of automation, development of modular battery storage packages able to be used both for EV and for stationary storage, promotion of standards for of energy storage system integration, development of battery energy storage managment softwares. A coordination with R&I activities defined in the Implementation Plan of the TWG-Action 7 should be ensured as the TWG has identified five Flagship R&I initiatives already.		
3	**Impact in the value chain** *(if blank then none)* 	Raw materials		Yes
		Active Materials		Yes
		Cell Manufacturing		Yes
		Modules/Pack/BMS		Yes, packages should be as much modular as possible in order to be used in multiple applications; softwares has a lot of
		Application	ESS	Large positive impact of many new, improved battery technologies come into the market
			e-mobility	Large positive impact of many new, improved battery technologies come into the market
			Industrial	Yes, while battery packs are more and more standard, at system level more improvement is need on order to lower down
		User		having lower cost high modular products improves conveninec e for each user in the value chain
		Recycling/2nd life		Yes. Designing cells, modules and systems for ease of disassembly and recyclability. An important R&I call co-defined with
		New player		New start-ups focusing on different battery technologies
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. Significant investment in R&D required	
		More benefits	1. Further improvements in LCOSE would have enormous impact on energy sector 2. Strengthen European competitiveness, including in newer battery types (advanced Li-ion, liquid metal batteries, Li-air and other metal-air	
5	**Winners**	Each battery technology has the poetntial for significant technical improvements, and all can provide unique and iportant functions to grid operators. Therefore, battery research would significantly increase EU's competitiveness in battery manufacturing but also R&D, with important outcomes across the board. Winners would be any industrial player involved in battery manufacturing, R&D centres and universities. Storage users (prosumers, grid operators, RES generators....) would win if they had access to a wider range of technologies, each of which would be suited to a particular set of applications.		
	Affected	Due to the limited amount of R&D funding, other storage technologies could lose out. The EU must still support R&D in other storage technologies (thermal storage, power-to-gas/power-to-liquids, compressed air, liquid air, etc) since these will be needed for certain storage applications and in particular for longer-term storage than batteries can efficiently provide. Significant cost decreases in battery technologies could have a negative impact on competing technologies (gas-fired plants for balancing, for example).		
6	**Who implements?**	EU Institutions		Implement recommendations of EBA technology board, dedicate significant amounts of EU funding towards battery research.
		Member States		Coordinate R&D efforts between MS to avoid overlaps/inefficiencies. Build on each country's strenghts. Be willing to accept
		Industry		Must be willing to invest in R&D efforts in collaboration with universities/R&D centres.
7	**Existing Best Practices**	Italy: an example of collaboration between Research and Industry due to the presence of big islands, big islands not grid connected, grid congestions caused by the stochastic renewable energy sources and, on the other side, big industries (ENEL, Terna) and research organizations (RSE). The volume "Roadmap for Sustainable Mobility" , recently published by RSE, is aimed to give support to the diffusion of EVs and it is another example of collaboration between Government, Research and Industry. See also the identified flagship projects in the Implmentation Plan of SET-Plan TWG7. Flagships serve as projects illustrating how coordinated R&I, at national and EU level, can contribute to achievement of the agreed targets and entail activities of interest and visible to the public at large. Flagships are: MATERIALS FLAGSHIP - Advanced materials for batteries; MANUFACTURING FLAGSHIP - Eco-efficient production; FAST-CHARGE FLAGSHIP - Development of batteries with fast charging capability; SECOND-USE FLAGSHIP - Second-use of EV batteries; RECYCLING FLAGSHIP - High yield recycling		
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	strong interaction and agreement in call definition process between R&I institutions and relevant industries along the value chain. Initiatives winning the calls have to show potential strong business cases and clear economic value		
9	**Planning to implement the action (initial)**	Q2 2018 high level definition of actions and rules for calls. Q3 2018 setup of technical items of interest, organizational preparation and selection process including legal and financial aspects. 2019 - 2021 issue calls, award and deployment of projects, evaluation of results and selection of most effective initiatives 2022 start of development of industrialization		
10	**Financial resources required**	Costs of setting up calls, budget for calls		
	Does this action help to establish a European cell production	It is essential to focus R&I efforts on this topic in order to catch up with non-European competitors, especially if we adress the topic of reachin TRL 7 for Generation 4 before 2023. Todays public funding instruments are not sufficient as the calls are to diverse and separate funding possibilites too small. Industry funding is needed to complement public funding.		
11	**How will this action directly benefit EU citizen?**	1. Reduced CAPEX and OPEX of ESS and Evs. 2. Reduced costs of energy.		
12	**KPI to monitor progress**	1. ESS & EVS integration time and cost.		

Action 14b- Final

	Code and name of the action	14b. Establish a technology advisory board within the EU Battery Alliance, with the mandate to update the roadmaps and the R&I orientations, and manage the project portfolio (R&I project portfolio management)	
	Recommendations it contributes to	5, 13,14	
	Linked to actions #	3a, 4a, 5a, 14a	
	Dependent on actions #	t.b.d.	
	Priority (1-Highest; 3 lowest)	1	
	Feasibility (1-easy; 5-Difficult)	2	
	Time to design (months)	3	
	Time to delivery (months)	>3	
1	**Objectives (*What for?*) Impact we want to achieve**	Conduct advanced research in battery chemistry, battery systems, manufacturing, recycling and increase university output in these areas by involvement of industrial stakeholders, giving clear indication to the overall value chain in order to meet demands from industrial stakeholders	
2	**Action** *(description)*	Establish a technology board composed of key industrial stakeholders within the EU Battery Alliance, with the mandate to update the roadmaps and the R&I orientations, and manage the project portfolio (R&I project portfolio management), and comparable to the Smart Grid Task Force, ERECON or ETIP-SNET. This advisory group should consist of stakeholders along the entire battery value chain including the supply side. The SET-Plan Action 7-Batteries Implementation Plan should be used as the reference document outlying the minimum R&I needs and requirement for the technology advisory board. Mandate of SET-Plan WG on Batteries should be prolonged and extended.	
3	**Impact in the value chain** *(if blank then none)*	Raw materials	give indications on raw materials of interest and process to achive them in EU in a sustainable way
		Active Materials	give indications on material/technologies s of interest and process to achive them in EU in a sustainable way
		Cell Manufacturing	give clear reference on technologies of interest for both automotive and stationary applications, to be manufactured in EU in a sustainable way, under the paradigm of circular economy
		Modules/Pack/BMS	give clear guidelines on technologies of interest for both automotive and stationary applications. Packages have to be modular in order to maximize flexible usage
		Application – ESS	Yes
		Application – e-mobility	Yes
		Application – Industrial	Yes
		User	Yes
		Recycling/2nd life	Yes, strong need of modularity since the concept design of cells/modules, in order to enable re-usage; can be achieved with clear technical guidelines (comment applies also to the Application above)
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	Part of the activities of EU Battery Alliance technical team. May require occasional support from technical specialist (consultancies)
		More benefits	Enables more competitive products for EV, ESS and 2nd life batteries Better ROI for customers.
5	**Winners**	Winners would be any industrial player involved in the battery manufacturing value chain, R&D centres and universities, including final Customers, battery suppliers, battery manufacturing equipment suppliers, system integrators, software developers, grid operators, electricity retailers, RES generators, new energy market players, EV manufacturers.	
	Affected	The value chain for fossil fuels	
6	**Who implements?**	EU Institutions	EIT and Commission
		Member States	ALL
		Industry	All value chain industries are potentially interested
7	**Existing Best Practices**	See also the recommendations in the SET-Plan TWG Action 7 about workforce and skills (see Implementation Plan, Annex H - Statement on improving	
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	Empower technological board, in order that technical guidelines can be applied at all level of the value chain, following market and users requirements.	
9	**Planning to implement the action (initial)**	Q1 2018 high level definition of board activities. Q2 2018 identification of board members and definition of areas of competency	
10	**Financial resources required**	Costs of setting up process, budget for specialist consultancies	
11	**How does this action help to establish a European cell production**	Accelerate the development and deployment of European cell manufacturing through coordination of national research efforts.	
12	**How will this action directly benefit EU citizen?**	1. Reduced CAPEX and OPEX of ESS and Evs. 2. Reduced costs of energy.	
13	**KPI to monitor progress**	1. ESS & EVS integration time and cost.	

Action 15b- Final

	Code and name of the action	15b. Establish a European open access pilot line network to gain manufaturing experience
	Recommendations it contributes to	15
	Linked to actions #	13a, 15c, 15e
	Dependent on actions #	
	Priority (1-Highest; 3 lowest)	1
	Feasibility (1-easy; 5-Difficult)	2
	Time to design (months)	12
	Time to delivery (months)	36

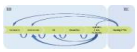
1	**Objectives (*What for?*) Impact we want to achieve**	Grow the European R&I capacity. Develop and strengthen skilled workforce in all parts of the value chain and make Europe attractive for world class experts. 1. EU Skills shortages can slow down the development of a cell manufacturing industry and there is lack of process engineers. Being a new industrial sector to be developed, cell manufacturing could benefit of new promising technologies and/or manufacturing processes that so far have been developed and tested only at lab scale. 2.Based on the highly multi-physical nature of battery technology, it is necessary to organize new degree courses on multiple competences (chemistry, electrical engineering, electronics, production, data management, management and legal aspects 3. Research/commercial pilot lines would offer the opportunity to both strengthen and grow European R&I capacities and represent a training/development/test environment to improve skills and train young generation of engineers/technicians, along the whole value chain. 4. Accelerate technology transfer in the battery/cell manufacturing field, bridging the gap between research and industry 5. Involve industry in the definition and teaching of degree courses. 6. Integrate professional training (short courses) for professionals in the definition of degree courses. 7. Provide an R&D and training facility to improve skills of young engineers / scientists 8. Offer industry cell/process engineers an opportunity to gain practical experience and develop and test new manufacturing processes 9. Foster cooperation between universities throughout Europe. 10. Attract extra European students for with the goal to form counter skills shortages.		
2	**Action** *(description)*	1. Pilot lines should be an integrated R&D platform offering a set of different manufacturing techniques and the possibility to develop, prototype and test new batteries technologies at the different stages of the innovation chain: from materials to cells; from cells to packs; from packs to recycling 2. Pilot lines have to be shared among different industrial players, covering all the value chain (from materials to technology integration) and shall offer opportunity to develop new processes/technologies from ideation, to concept validation and manufacturing, IP protection included. 3. Build on/complement with ongoing attempts to create transparency about existing pilot-lines with members from SET-Plan group 4. Create a network of "teaching factories" along the whole value chain for building an ecosystem of cooperation between academia and industry and for sharing knowledge and increasing skills of students and workers in line with Implementation Plan – TWG Action 7 SET-Plan (see Annex H - Statement on improving technological, economic, behavioural and social knowledge; training, capacity building and dissemination - pag 67).		
3	**Impact in the value chain** *(if blank then none)* 	Raw materials		All aspects of raw material use
		Active Materials		New chemistries
		Cell Manufacturing		faster test and feedback of materials; fast prototyping; test/develop new production processes; train skilled personnel Productionand testing of prototypes
		Modules/Pack/BMS		Define common and open standards for BMS sensor and data interfaces, open-source solutions for BMS control solftware; test/develop new production/assembling processes; train skilled personnel
		Application	ESS	Integrade in global ESS efforts
			e-mobility	strong link to be foreseen (specialization for automotive engineering studies)
			Industrial	to be integrated in definition of degree courses, industrial training to be integrated
		User		european citizens (acces to education), industry (well trained employes), research
		Recycling/2nd life		develop and test 2nd life applications and recycling methods
		New player		benefit from existing landscape, but define new job profiles
4	**Cost Benefit Analysis** *(Initial)*	More costs		1. Industry should contribute to partly finance large scale pilot lines (at EU or national level), which however should be public research facilities, open to all players 2. Reasonable share between study fees, industrial funding and long term support for studies has to be found.
		More benefits		Pilot lines would support the development of a cell manufacturing industry by lowering investment in R&D&I, in particular as regards Gen 3a, Gen 3b and post or beyond Li-Ion: 1. validate any technology under technical product formats 2. opportunity to tackle with manufacturing-specific issues before scaling-up 3. fine-tuning technologies, optimize final electrode/cell parameters before scale up production, and shorten time to market of new cell technologies 4. lower investment risk related to new technologies/processes (since tests are carried under realistic conditions) 5. create the conditions to develop an integrated value-chain (from powder to power), in particular when new production, assembling, recycling processes are needed
5	**Winners**	- Cell makers, cell system suppliers, 2nd life solution providers, recycling, automotive industry, power grid; - Manufacturing industry that can develop more easily new production processes, shortening the time-to-market of innovation and lowering the risk of failure. - Cooperation research/industry enhances knowledge and technology transfer. - Countries that already own large pilot lines, have a competitive asset that can support the development of a cell manufacturing capacity. - Make Europe more attractive		
	Affected	- In principle no counter-impact: if pilot lines are conceived as large public open research facilities, all actors can benefit of an R&D infrastructure to develop and test product/process innovation.		
6	**Who implements?**	EU Institutions		Yes; Dedicated support through FP for R&I and analysis of avaliable European resources.
		Member States		Yes; should support a national initiative aggregating more actors along the R&I to valorise national research capacities
		Industry		Yes; contribute to the implementation of pilot lines (of relevant scale) - Cooperation research/industry enhances knowledge transfer - Additional spill over effect related to availability of characterisation and modelling facilities
7	**Existing Best Practices**	Lighthouse projects for cell manufacturing will attract worldwide talent operational; highly specialised graduate schools, e.g. CEA (France); CIDETC (Spain)		
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	Analysis of existing university landscape and pilot lines. Parallel to identifying potential pilot lines a more systematically identification on what existing technology solutions Europe/European companies actually have in this value chain vs. no European actors, will provide valuable information that helps focusing and prioritising activites. This analysis could naturally be part of a publicly funded R&D program and may also be investigated already in some of ongoing work.		
9	**Planning to implement the action (initial)**	1. Design: 12 months 2. Implementation: long term, at least 36 months		
10	**Financial resources required**	Yes, will be defined as part of design		
11	**How does this action directly benefit EU citizen?**	1. Cost and skill advantage by sharing resources 2. Education possibilites for EU citizens 3. Attract worldwide talents		
12	**KPI to monitor progress**	1. Number of lines 2. More relevant KPI's to be defined		

Action 18a- Final

	Code and name of the action	18a. Develop and implement performance and safety assesment standards for batteries	
	Recommendations it contributes to	3, 4	
	Linked to actions #	3a, 3b, 4a-d, 12a	
	Dependent on actions #	12a	
	Priority (1-Highest; 3 lowest)	**1**	
	Feasibility (1-easy; 5-Difficult)	**1**	
	Time to design (months)	24	
	Time to delivery (months)	12	
1	**Objectives (*What for?*) Impact we want to achieve**	Ensure maximum safety for European citizens and create competetive advantage through standardization. Standardize storage related installations including charging infrastructure, safety rules, active load compensation and enable vehicle to grid solutions	
2	**Action** *(description)*	Develop and implement performance and safety assesment standards for batteries.	
3	**Impact in the value chain** *(if blank then none)*	Raw materials	perhaps
		Active Materials	perhaps
		Cell Manufacturing	no
		Modules/Pack/BMS	yes
		Application – ESS	yes
		Application – e-mobility	yes
		Application – Industrial	yes
		User	yes; better and safer products
		Recycling/2nd life	yes
		New player	some new opportunities
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. Safety aspects could result in high product costs.
		More benefits	1. On a long term less cost by better performance, easier exchange of data and better security. 2. Testing to comply with different standards is cost intensive. On common EU standards will reduce costs for testing. 3. Proven track record by EU players producing high quality and safe products gives a price premium (market advantage). 4. Citizens as consumers are able to make informed choices when aware of a product's quality
5	**Winners**	1. customer industry and user by better and more reliable product.	
	Affected	2. supplier industry because they have to consider the standards. On the other hand it brings more clarity and less variations in the development. Actors not complying to European safety and performance standards.	
6	**Who implements?**	EU Institutions	1. initiate working group on standards (coordinate with initiated SFEM WG Energy Storage)
		Member States	2. Take over the standards
		Industry	3. Implement
7	**Existing Best Practices**	There are already many standards available, but each with slightly different conditions. Synchronization is mandatory. Can be compared to how European Commission has issued mandates to European Standardisation Organisations (ESOs) - CEN, CENELEC and ETSI - to develop and update technical standards on smart grids, EV's and smart metres on advice from the Smart Grid Task Force	
8	**Pre-requisites (regulatory or no-regulatory) for this action to be successful**	Cross border coordination is key in order to avoid fragmentation. This helps to spend development efforts more efficiently.	
9	**Planning to implement the action (initial)**	1. Design: 12 month evaluation phase 2 Implementation: TBD	
10	**Financial resources required**	Project budget in the range of €2mio/year	
11	**How does this action help to establish a European cell production**	One common EU performance and safety standard will create competetive advantage for European players	
12	**How will this action directly benefit EU citizen?**	1. Safety 2. Convenience with a satisfying product	
13	**KPI to monitor progress**	1. Incidences on the road	

Remaining Action templates

Action 1b- Draft

	Code and name of the action	1b. Implement same compliance rules to foreign battery products imported to Europe as applied to European products	
	Recommendations it contributes to	1	
	Linked to actions #	4a, 4b	
	Dependent on actions #	4b	
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	3	
	Time to design (months)	tbd	
	Time to delivery (months)	tbd	
1	**Objectives (*What for?*) Impact we want to achieve**	Secure access to raw materials from resource rich countries outside the EU	
2	**Action** *(description)*	General Comment – this action needs to be elaborated in more detail and the compliance target to be defined? Depends highly on the implementation of action 4b. The action can adress more about the product history than the product itself (c.f. conflict minerals) and could be about the environmental and social impact. Suggested actions: • Registration/definition of products requiring control • Clarification of compliance rules currently effecting European suppliers • Identification of the compliance shortfall for imported materials	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	yes
		Active Materials	yes
		Cell Manufacturing	yes
		Modules/Pack/BMS	yes
		Application: ESS	
		Application: e-mobility	
		Application: Industrial	
		User	
		Recycling/2nd life	
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	
		More benefits	
5	**Winners**		
	Affected		
6	**Who implements?**	EU-Institutions	
		Member States	
		Business	
7	**Existing Best Practices**		
8	**Pre-requisites (regulatory or no-regulatory) to be successful**		
9	**Planning to implement the action (initial)**		
10	**Financial resources requested**		
11	**How will this action directly benefit EU citizen?**		
12	**KPI to monitor progress**		

Action 2b- Draft

	Code and name of the action	2b. Map geological and urban sources, and potential scenarios considering conflicting interests – and possible actions to take from a European and National perspectives	
	Recommendations it contributes to	2	
	Linked to actions #		
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	1	
	Time to design (months)	tbd	
	Time to delivery (months)	tbd	
1	**Objectives (*What for?*) Impact we want to achieve**	Secure access to sustainably produced battery raw materials at reasonable costs by facilitating the expansion/creation of European sources of raw materials.	
2	**Action** *(description)*	• Provide on-line data hub that aggregates the knowledge of battery raw material potential sources across all European countries; make use of existing national data platforms as well as the JRC Raw Materials Informtion System; in additon, make use of and develop existing database systems on urban raw materials stocks (e.g. ProSum) • Provide information in standard format, including size/tonnage, grade, mineralogy, as well as an assessment - if possible/available - on the boundary conditions to start a mining business • Include information as to the ownership of the resource if it can be identified (who owns urban waste, etc) • Provide research incentive to companies to consider current and former mine waste materials as potential supply • Encourage government authorities to identify formerly mined material as potential future resources • Encourage business development around formerly mined material as potential future resources, through incentives and innovation projects	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	yes
		Active Materials	yes
		Cell Manufacturing	
		Modules/Pack/BMS	
		Application: ESS	
		Application: e-mobility	
		Application: Industrial	
		User	
		Recycling/2nd life	yes
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	Funding to aggregate existing data and align existing data exchange platforms at national and EU level.
		More benefits	Strong communication and research tool on EU raw materials sources.
5	**Winners**	Stakeholders of the lower part of the value chain as raw materials sources become more transparent.	
	Affected		
6	**Who implements?**	EU-Institutions	yes
		Member States	yes
		Business	
7	**Existing Best Practices**		
8	**Pre-requisites (regulatory or no-regulatory) to be successful**		
9	**Planning to implement the action (initial)**		
10	**Financial resources requested**		
11	**How will this action directly benefit EU citizen?**		
12	**KPI to monitor progress**		

Action 2c- Draft

	Code and name of the action	2c. Define and implement a simplified application process for opening of new mines	
	Recommendations it contributes to		
	Linked to actions #		
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	4	
	Time to design (months)		
	Time to delivery (months)		
1	**Objectives (*What for?*) Impact we want to achieve**	Secure access to sustainably produced battery raw materials at reasonable costs by facilitating the expansion/creation of European sources of raw materials.	
2	**Action** *(description)*	• Encourage fast track mine permitting processes at national and regional levels that maintain the level of standard but that are more efficient in all respects • Provide guidance for EU and MS minerals policy • Facilitate minerals policy decision making through knowledge co-production for transferability of best practice minerals policy • Foster community and network building for the co-management of an innovation catalysing minerals policy framework • Develop tools to inform and educate the wider society on modern mining technology and safety • Proactively define "areas of potential future mining activity" so that everyone knows there is something of interest, even if it is not of adequate value at the moment (**Sweden sort of has this system, but is indicative only as it overlaps with, rather than excludes, other priority areas**) • System to assign single Government/EC contact for significant critical materials projects in recognition that it has greater value to Europe than just to the company. The Government contact supports the mining company in ensuring permitting documentation is correct and sufficient, and their right agencies have been consulted • Strengthen the "proof of interest" test during legal appeals against mining of critical materials (in most jurisdictions, appellants need to provide an adequate proof on interest to support an appeal. Today the hurdle of proof is very low in many countries. • Align permitting systems across countries, or at least within regions so there is less local variation.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	yes
		Active Materials	yes
		Cell Manufacturing	
		Modules/Pack/BMS	
		Application: ESS	
		Application: e-mobility	
		Application: Industrial	
		User	
		Recycling/2nd life	
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	Up-front investment in several action points to optimise mine permitting processes and to gain greater social acceptance to operate
		More benefits	Sustainably produced battery raw materials from European sources.
5	**Winners**	Stakeholders across the value chain, from mine to battery.	
	Affected		
6	**Who implements?**	EU-Institutions	
		Member States	Mainly MS
		Business	
7	**Existing Best Practices**	Regarding policies: EIT RM is active in the MIN-GUIDE Laboratory. There are several projects in the field of Social Acceptance to Operate: MineFacts, RACE, Closurematic, iRIS, RE-Activate, VR-Mine	
8	**Pre-requisites (regulatory or no-regulatory) to be successful**		
9	**Planning to implement the action (initial)**		
10	**Financial resources requested**		
11	**How will this action directly benefit EU citizen?**	Jobs and growth in the mininig and minerals processing sector; batteries and, thus, electric vehicles based on sustainably produced raw materials from European sources.	
12	**KPI to monitor progress**		

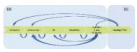
Action 4d- Draft

	Code and name of the action	4d. Develop a standardised life cycle assessment for all transport technologies	
	Recommendations it contributes to	4	
	Linked to actions #	3b, 4a, 4b,9b	
	Dependent on actions #	4a, 4b	
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	3	
	Time to design (months)	t.b.d.	
	Time to delivery (months)	t.b.d.	
1	**Objectives (*What for?*) Impact we want to achieve**	Make Europe the global leader in sustainable battery technology. Reduce emissions in the transport sector including "yellow machines"; marine sector; etc;... Encourage utilization of (EU)batteries with lower environmental foot prints for all transport solutions.	
2	**Action** *(description)*	1. Reduce the footprint of all sectors of the transport industry by increasing share of EVs including heavy vehicles (yellow machines; public transport; marine sector) 2. Promote position of batteries in the industry by identifying the differences between footprints of ICE and EVs 3. Differentiate between EVs powered by (EU) batteries with low footprint and others	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	
		Active Materials	
		Cell Manufacturing	Higher demand for low carbon footprint batteries
		Modules/Pack/BMS	
		Application – ESS	
		Application – e-mobility	Increase investments in e-mobility
		Application – Industrial	Increase investments in e-mobility
		User	
		Recycling/2nd life	
		New player	Increase investments in e-mobility solutions in the transport sector
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. 2. etc...
		More benefits	1. Reduce environmental impacts of produced batteries 2. etc...
5	**Winners**	1. European cell manufacturer based on their battery production with lower emission 2. EU battery business to have a competitive advantages in compare with batteries produced in other countries	
	Affected	All users of batteries	
6	**Who implements?**	EU-Institutions	Set regulations demanding announcement of CO2 footprint on all transport options
		Member States	Implement regulation
		Business	Inplement regulation
7	**Existing Best Practices**		
8	**Pre-requisites (regulatory or no-regulatory) to be successful**		
9	**Planning to implement the action (initial)**		
10	**Financial resources requested**		
11	**How will this action directly benefit EU citizen?**	1. Lowering the environmental footprint of EU 2. Providing competitive advantages for product produced in EU (here for batteries)	
12	**KPI to monitor progress**		

Action 5b- Draft

	Code and name of the action	5b. Establish a clearing house for battery recycling	
	Recommendations it contributes to	1,2,3,15,16,18	
	Linked to actions #	5c	
	Dependent on actions #	t.b.d.	
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	2	
	Time to design (months)	6	
	Time to delivery (months)	24	
1	**Objectives (*What for?*) Impact we want to achieve**	1. Create a market for 2nd life batteries and recycling facilities. 2. Increase the independence of the EU in Raw Materials supply 3. Enlarge the stock for recycling batteries and consequently encrease profitability of recycling facilities 4. Lower the cost of recycled materials 5. Design, from scratch, a circular economy, as far as raw materials for batteries is concerned	
2	**Action** *(description)*	Battery and cell manufacturing enabling subsequent recycling: Recycling and cell/pack manufacturers interact to adapt (if business case flies) the assembly so separation for recycling is more optimal (thus at lesser cost and decreased cost for raw materials). Needs a LCA end to end analysis. Clearing house for addressing the "lead times"?	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	
		Active Materials	
		Cell Manufacturing	Adapt their processses from design to cost and manufacturability to **design to cost, and manufacturability and de-assembly** for recycling.
		Modules/Pack/BMS	Adapt their processses from design to cost and manufacturability to **design to cost, and manufacturability and de-assembly** for recycling.
		Application – ESS	
		Application – e-mobility	
		Application – Industrial	
		User	
		Recycling/2nd life	Interact with the cell and packs manufacturers so their assembly processess are geared to efficient separation of raw materials
		New player	A **clearing house** at industry level is required to absorb the additional cost when manufacturing cells (the process needs to be adpated so instead of design to cost and manufacturability, the cell and pack manufacturers design to cost, manufacturability and de-assembly -for recycling-). This extra cost will be lower cost for the recycling players, but only 6-7 years downstream until the stock of batteries has build sufficient volume; so this lead time needs to be cattered for through a clearing house.
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. Manufacturing processess for cells and packs/modules **upgraded** for enabling more efficient recycling. 2. Cost of the clearing house (financing)
		More benefits	1. Lower dependance from commodity markets 2. Lower TCO in raw materials for batteries 3. Lower cost in recycling
5	**Winners**	A. EU: (1) Leadership in **circular economy** in a new industry (batteries), (2) increase independence as far as raw materials supply is concerned, (3) develop a recycling industry. B. EU Consumer: (1) Decrease the volume of waste, (2) protect the environment, (3) decrease the volatility of battery prices	
	Affected	1. Mining companies (that normally want to sell mined raw materials) 2. Cell manufacturers (if they want to export outside EU) because their manufacturing processess will be slightly less competitive because the clearing house will not apply at ww level.	
6	**Who implements?**	EU-Institutions	1. Front load the Clearing House, as a financing (not granting): The extra costs incurred by the cell and pack manufacturers need to be compensated, on the year of production, for being returned 6-7 years down the road through the savings in recycling, and independence of supply.
		Member States	
		Business	1. Cell manufacturers, Pack Manufacturers and Recycling actors to define **the rules of the game of the clearing house.** 2. Interaction between the three players for **adapting their processess** for enabling this circular economy.
7	**Existing Best Practices**	None I am aware of for so long lead times	
8	**Pre-requisites (regulatory or no-regulatory) to be successful**		
9	**Planning to implement the action (initial)**	1. Design: 6 months 2. Implementation: To be developed after presentation to VP (depending on priorities)	
10	**Financial resources requested**	appr. 250K€ for design phase	
11	**How will this action directly benefit EU citizen?**	1. We are building from scratch a circular economy around batteries and raw materials 2. We are preserving the earth 3. EU is leading, you are part of it 4. Your contribution is key for "returning" the battery timely 5. The battery could have a % of recycled material as selling argument	
12	**KPI to monitor progress**	1. Price of a recycled raw material (full LCA analysis) vs price in the commodity market.	

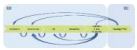
Action 5c- Draft

	Code and name of the action	5c. Strengthen all currently existing battery collection systems	
	Recommendations it contributes to	1a,3a	
	Linked to actions #	5a,5b	
	Dependent on actions #	t.b.d.	
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	1	
	Time to design (months)	3	
	Time to delivery (months)	9	
1	**Objectives (*What for?*) Impact we want to achieve**	1. Create a market for 2nd life batteries and recycling facilities. 2. Enlarge the stock for recycling batteries and consequently encrease profitability of recycling facilities	
2	**Action** *(description)*	Strengthen all currently existing battery collection systems: this would enlarge the stock for recycling facilities, revive raw materials from all the batteries used in consumers devices.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	
		Active Materials	
		Cell Manufacturing	
		Modules/Pack/BMS	
		Application: ESS	
		Application: e-mobility	
		Application: Industrial	
		User	They need to arrange delivery of used batteries to the closest collection center. This creat new reponsibility and opportunities for the users
		Recycling/2nd life	Interact with batteries' consumers and customers in order to collect 2nd hand batteries from collection systems and which result in effective separation of raw materials
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. Cost of collection systems (financing) and delivering the batteries to recycling facilities
		More benefits	1. Lower dependance from commodity markets 2. Lower TCO in raw materials for batteries 3. Lower cost in recycling due to a larger scale
5	**Winners**	A. EU: (1) Leadership in **circular economy** in a new industry (batteries), (2) increase independence as far as raw materials supply is concerned, (3) develop a recycling industry. B. EU Consumer: (1) Decrease the volume of waste, (2) protect the environment	
	Affected	1. Mining companies (that normally want to sell mined raw materials) 2. Users who need to take care of delivering used batteries to collection centers	
6	**Who implements?**	EU-Institutions	1. Set targets for percentage of recycled materials used in centern battery groups
		Member States	
		Business	1. Recycling actors deciding on cost and delivering of recycled batteries from the collection centers. 2. Interaction between recycling actors and collection centers to for better inventory management and estimation of potentials.
7	**Existing Best Practices**		
8	**Pre-requisites (regulatory or no-regulatory) to be successful**		
9	**Planning to implement the action (initial)**	1. Design: 3 months 2. Implementation: To be developped after presentation to VP (depending on priorities), but it takes about 9 months	
10	**Financial resources requested**		
11	**How will this action directly benefit EU citizen?**	1. They do not need to keep their waste, and instead could benefit from them y delivering them to recycling centers 2. We are preserving the earth 3. EU is leading, you are part of it 4. Your contribution is key for "returning" the battery timely 5. The battery could have a % of recycled material as selling argument	
12	**KPI to monitor progress**		

Action 6b- Draft

	Code and name of the action	6b. Suggest tax incentives can help establish, maintain and develop cell manufacturing in Europe	
	Recommendations it contributes to	6	
	Linked to actions #	6a, 9b, 10a	
	Dependent on actions #	9b	
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	3	
	Time to design (months)	tbd	
	Time to delivery (months)	tbd	
1	**Objectives (*What for?*) Impact we want to achieve**	Support European Battery manufacturing in order not to miss the hockey stick phenomena in market demand	
2	**Action** *(description)*	This is a market action aiming at developing a strong home market for European battery industry. Based on the expectation that the European battery industry is competitive in producing green batteries they will capture a significant part of the market. Examples of market stimulating taxes related incentives are found in many European countries.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	Increases the market for environmentally acceptable minig products
		Active Materials	Increases the European market for active materials
		Cell Manufacturing	Increases the market for environmentally acceptable cell production
		Modules/Pack/BMS	Increases the market for environmentally acceptable modules production
		Application – ESS	
		Application – e-mobility	
		Application – Industrial	
		User	
		Recycling/2nd life	
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	
		More benefits	Contributes to reaching the environmental goals. Increases the competitiveness of European battery industry along the value chain.
5	**Winners**	Companies in the entire battery valie chain.	
	Affected	Traditional actors	
6	**Who implements?**	EU-Institutions	Setting environmental goals
		Member States	Providing suitable environmental support schemes
		Business	More business opportunities
7	**Existing Best Practices**	Norway, Sweden, Holland, Germany	
8	**Pre-requisites (regulatory or no-regulatory) to be successful**		
9	**Planning to implement the action (initial)**		
10	**Financial resources requested**		
11	**How will this action directly benefit EU citizen?**		
12	**KPI to monitor progress**		

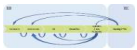
Action 6c- Draft

	Code and name of the action	6c. Generate and secure European IP	
	Recommendations it contributes to	4,5,13,14,15,16	
	Linked to actions #	5a, 12a, 13a-b; 14a, 15b	
	Dependent on actions #	5a, 13a, 13b,	
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	2	
	Time to design (months)		
	Time to delivery (months)		
1	**Objectives (*What for?*) Impact we want to achieve**	Battery technologies are under strong development through the entire value chain from chemistry, cell production technologies, BMS systems, Battery packs and applications. Today there is a strong development of patent applications dominated by Asian companies. The volumes of patents related to solid state batteries is approaching 1000 per year! Investment in European R&I as well as manufacturing capabilities will help to generate and secure European IP	
2	**Action** *(description)*		
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	
		Active Materials	
		Cell Manufacturing	
		Modules/Pack/BMS	
		Application: ESS	
		Application: e-mobility	
		Application: Industrial	
		User	
		Recycling/2nd life	
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	
		More benefits	
5	**Winners**		
	Affected		
6	**Who implements?**	EU-Institutions	
		Member States	
		Business	
7	**Existing Best Practices**		
8	**Pre-requisites (regulatory or no-regulatory) to be successful**		
9	**Planning to implement the action (initial)**		
10	**Financial resources requested**		
11	**How will this action directly benefit EU citizen?**		
12	**KPI to monitor progress**		

Action 9c- Draft

	Code and name of the action	9c. Implement favourable tax incentives for e-taxi operators e.g. special VAT schemes	
	Recommendations it contributes to	9b, 10a	
	Linked to actions #	10a, 18b	
	Dependent on actions #	18a	
	Priority (1-Highest; 3 lowest)	3	
	Feasibility (1-easy; 5-Difficult)	1	
	Time to design (months)		
	Time to delivery (months)		
1	**Objectives (*What for?*) Impact we want to achieve**	Create and support new markets for batteries, e.g through the "Clean Energy" & the "Mobility" packages but also new initiatives, in order to support sustainable solutions for power, transportation and industry sectors in line with EU climate goals. Traffic is one of the main causes of air pollution and CO2 emissions. Taxis are great polluters in the city. A taxi based in Amsterdam produces on average an equal amount of emissions as 35 private cars. That is why electric taxis are a great contributor to a cleaner city.	
2	**Action** *(description)*	Create and support a rapid transformation of the taxi business through the "Clean Energy" & the "Mobility" packages but also new initiatives. Incentivise EV taxis and create target and follow up systems.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	Indirect by growing market
		Active Materials	Indirect by growing market
		Cell Manufacturing	Indirect by growing market
		Modules/Pack/BMS	Indirect by growing market
		Application – ESS	demand for ESS batteries to be integrated with high power EV chargers
		Application – e-mobility	accelerates EV deployment by overcoming range anxiety
		Application – Industrial	
		User	Acess to clean transport
		Recycling/2nd life	Increases the market for secoond life batteries
		New player	New companies with only electric vehicles?
4	**Cost Benefit Analysis** *(Initial)*	More costs	Cost for member states for incentives
		More benefits	Means to reach climate goals; Better local air quality; Less sound emissions;
5	**Winners**	Society as a whole with better quality of life. Battery industry by creating a bigger market for batteries.	
	Affected	The traditional players in the entire Taxi value chain	
6	**Who implements?**	EU-Institutions	Set targets for penetration of electric taxis
		Member States	Implement supprt schemes; Set locla targets
		Business	Take responsible actions by promoting EV:s for taxis
7	**Existing Best Practices**	The Netherlands has very high penetration of EV Taxis at Shiphold Airport; Norways has generally favorable tax conditions for EV:s	
8	**Pre-requisites (regulatory or no-regulatory) to be successful**		
9	**Planning to implement the action (initial)**	1. Design: EU Battery Alliance 2. Implementation: Incentives partly already available. Accelerate with additional budget	
10	**Financial resources requested**	Yes, for incentives	
11	**How will this action directly benefit EU citizen?**	1. better health and less associated costs to bear, cleaner environment with less GHG 2.less concerns; convenient mobility	
12	**KPI to monitor progress**	Number of EV Taxis	

Action 13a- Final

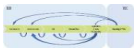
	Code and name of the action	13a. Define how to reach TRL 7 in 2023 on Generation 3b (advanced lithium-ion technologies with liquid electrolyte) for e-mobility	
	Recommendations it contributes to	13	
	Linked to actions #	14a; 13b	
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	1	
	Time to design (months)	6	
	Time to delivery (months)	24	
1	**Objectives (*What for?*) Impact we want to achieve**	Grow the European R&I capacity. Develop and strengthen skilled workforce in all parts of the value chain and make Europe attractive for world class experts. 1. Gain competitive advantage on new generation batteries, with respect to Asian competitors 2. Acclerate the development of next generation batteries (beyond the measures already in place) 3. Speed-up EV industry development (solid state batteries are expected to fix issues related to weight, safety, hopefully cost and performance)	
2	**Action** *(description)*	See in particular action 1.1 of the SET-Plan TWG7 1. R&I should cover the full value chain (materials, processes, cells, systems, recycling). 2. The developments should be compatible with fast charging.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	yes
		Active Materials	yes
		Cell Manufacturing	yes
		Modules/Pack/BMS	yes
		Application: ESS	
		Application: e-mobility	yes
		Application: Industrial	
		User	
		Recycling/2nd life	yes
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	1. R&I and especially Innovation 2.
		More benefits	1. Create competitive advantage compared to Asian players 2.
5	**Winners**		
	Affected		
6	**Who implements?**	EU-Institutions	Yes. R&I calls needs to be more focused, prescriptive, and the efforts should be sustained over long periods. - DG RTD will fund R&I projects dedicated to Gen3b technologies within H2020 (see the outcomes of the dedicated workshop organized by DG RRTD on January 11-12, 2017 and SET Plan TWG7 Implementation Plan). - In order to accelerate the innovation process and complement the R&I actions supported within H2020 at medium TRLs (typically TRL3-6), the EU should use other relevant funding instruments, e.g., EIT Innoenergy and/or EIT RawMaterials could support innovation projects at higher TRLs (typically TRL6-8). This coordinated effort at EU level (H2020 focusing on medium TRLs + other relevant funding instruments focusing on higher TRLs) should lead to at least one technology within the Gen3b family reaching TRL7 by 2023
		Member States	Yes; MS should design and implement focused R&I programmes to complement the actions launched at the EU level.
		Business	Yes, Industry should be involved in the definition of the calls; Industrial companies should be of course strongly involved in the different R&I projects at both EU and national level.
7	**Existing Best Practices**		
8	**Pre-requisites (regulatory or no-regulatory) to be successful**	DG RTD will be consulted for further input to this action	
9	**Planning to implement the action (initial)**	2023 for TRL7. Intermediate milestone in 2020 (flexibility on roadmaps and orientations).	
10	**Financial resources requested**	will be defined as part of design	
11	**How will this action directly benefit EU citizen?**		
12	**KPI to monitor progress**	Performance, cost, manufacturability, sustainability	

	Code and name of the action	15a. Actively identify and utilize synergy effect between large scale cell production and educational system to secure workforce competence transition
	Recommendations it contributes to	4,5,13,14,15,16
	Linked to actions #	5a, 13a-b; 15b
	Dependent on actions #	
	Priority (1-Highest; 3 lowest)	2
	Feasibility (1-easy; 5-Difficult)	2
	Time to design (months)	tbd
	Time to delivery (months)	tbd
1	**Objectives (*What for?*) Impact we want to achieve**	Implementing (in the short term) a large manufacturing capacity for cell production will have a significant spill over effect on the workforce: it will be one of the most efficient way to prepare the workforce and develop the skills in Europe (different markets other than e-mobility can be considered for those first production lines). Cell quality and performance will be determined to the same extent by materials and production. Learing curves to gain the nesseccary production experience have to be go through in order to achive high productivity. Production experience cannot acquired theoretical. Production experience can only gaines in large scale manufacturing. Therefore theoretical training should be supplemented by practical traning in large scale manufacturing. Because of the lack of a European large scale cell manufacturing production experience is very low in Europe and has to be built up. Pilotplants could be a very valuable tool to gain practical expereince in production. Therefore, European pilot lines should be integrated in different training cources (academia, manual). Based on a network of European pilot lines traning cources should be developed that allow employees to gain experience on different lines. Well prepared works would accelerate the establishment of a competitive European cell production. Pilot lines could also be used to learn new and upcoming technoligies and would be valuable to complement company based training. 1. Link the education programmes to real environments and processes for large scale cell production. 2. Create an environment where experimentation for learning is possible. 3. Enable learning by doing. 4. Increase the efficiency and effectiveness of the learning programmes by adding a significant hands-on component. 5. Increase the skill level and the transition readiness of the workforce. 6. Provide professional certificates based on education programmes delivered in combination with large scale cell production pilots.
2	**Action** *(description)*	1. Consultation with industry about the requirements for the synergy between large scale cell production and education. 2. Assess the capacity requirements for such education programmes based on future roles and skill needs. 3. Prepare and install a certification body for those types of training for both trainers and learners. 4. Identify the areas in large scale cell production pilots that can be used directly for education. 5. Determine the conditions and the costs of providing learning activities in larges scale cell production. 6. Design and implement the learning activities in large scale cell production pilots. 7. Pilot the learning activities and scale up the activities to meet the capacity requirements. 8. Have a continuous feedback loop with industry to adapt the programme to new and future needs.
3	**Impact in the value chain** *(if blank then none)* 	Raw materials: Active Materials: Yes Cell Manufacturing: Yes Modules/Pack/BMS: Yes Application – ESS: To some extent Application – e-mobility: To some extent Application – Industrial: To some extent User: Recycling/2nd life: To some extent New player:
4	**Cost Benefit Analysis** *(Initial)*	More costs: The cost for using the cell production facilities by learners will be part of the training fee. Costs should be shared between public funding, industry and study fees. More benefits: The impact of training and the learning experience significantly improves when learners can work in realistic environments where they are confronted with problems and challenges that appear in real situations.
5	**Winners**	Industry: today industry has to spend a lot of resources to provide new hires training about the equipment and the processes used. This time will be reduced since at least the generic part of the training will already be possible. High productivity can be achieved sooner on the basis of well trained and experienced employees. Employees: have the possibility to improve their competencies in this domain prior to being hired in such a job. High productivity can be achieved sooner on the basis of well trained and experienced employees.
	Affected	Industry
6	**Who implements?**	EU-Institutions: Yes, provides mobility programmes to allow learners to spend sufficient time in the large scale manufacturing sites. Establish a European network of pilot lines and design training cources which support the practical learning and gaining of experience Member States: Yes Business: Yes
7	**Existing Best Practices**	In the EU education orgnisations and companies have launched similar intiatives in other industries to train the workforce in a real environment. Examples can be found in telecom and in nuclear engineering.
8	**Pre-requisites (regulatory or no-regulatory) to be successful**	- Traning cources should be designed by a jointly dialogue bewtween traning organisation (academia, manual) and industry, Industry needs to agree on parts of the training that are considered non competitive and not related to confidential processes. - Industry needs to recognize the value of the education by supporting a certification system.
9	**Planning to implement the action (initial)**	Industry reqirements gathering will take 6 months. Design of each learning activity will take 3 to 6 months including a pilot. The number of learning activities as well as the volume will be determined after the industry consultation. Creating and implementing the certification body will take 18 months.
10	**Financial resources requested**	Yes. Financing will be required for the requirements gathering phase and to design and offer the hands-on work and the learning activities that are executed in the large scale cell production pilots. In addition trainers will need to be trained (train-the–trainer programme)and the certification body will require operational funding. Designing of tranings cources on the basis of pilot lines have to be financial supported.
11	**How will this action directly benefit EU citizen?**	- Lifelong learning with improved employability in new sectors. - Attract international talent to Europe
12	**KPI to monitor progress**	- The number of participating industry partners in education co-creation. - The number of learning activities created. - Availability of a certification system. - Number of participants per programme or course. More KPI's to be defined during design.

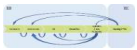
Action 15c- Draft

	Code and name of the action	15c. Create a link between the educational network (Master programs in Universities) and the European pilot line network, in order to train the students on battery manufacturing	
	Recommendations it contributes to	4,5,13,14,15,16	
	Linked to actions #	5a, 13a-b; 15b	
	Dependent on actions #	15b	
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	2	
	Time to design (months)	tbd	
	Time to delivery (months)	tbd	
1	**Objectives (*What for?*) Impact we want to achieve**	Battery cell prodction is a highly complex process and research and a high level of expertise in various areas of electrode and cell production is needed. An open access pilot line network can bundle competencies and guarantee access to equipment. This "pre-competitive research platform" can serve as a training ground for students in battery manufacturing. 1. Link the master programmes to real environments and processes for battery manufacturing. 2. Engage universities and industry to work together in the EU pilots. 3. Create an environment where experimentation for learning is possible. 4. Enable learning by doing, project and challenge based learning. 5. Increase the efficiency and effectiveness of the learning programmes by adding a significant hands-on and mobility component.	
2	**Action** *(description)*	1. Consultation with industry and academia about the role of the EU pilot network in graduate education. 2. Identify the areas covered in EU pilot line network that can be used directly for graduate education. 3. Determine the conditions and the costs of providing learning activities in the EU pilot such as internships, master thesis, challenge based learning activities. 4. Design and implement the learning activities for the EU pilots. 5. Pilot the learning activities and scale up the activities to meet the capacity requirements. 6. Have a continuous feedback loop with industry to adapt the master programmes to new and future needs by installing a scientific & industry committee.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	
		Active Materials	Yes
		Cell Manufacturing	Yes
		Modules/Pack/BMS	Yes
		Application – ESS	Yes
		Application – e-mobility	Yes
		Application – Industrial	Yes
		User	
		Recycling/2nd life	
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	Costs should be shared between public funding, industry and study fees. The cost for using the EU pilot lines by master students could be part of the tuition fee.
		More benefits	The impact of training and the learning experience significantly improves when learners can work in realistic environments where they are confronted with problems and challenges that appear in real situations.
5	**Winners**	Industry: today industry has to spend a lot of resources to provide new hires training about the equipment and the processes used. This time will be reduced since at least the generic part of the training will already be possible. Employees: master students with this type of training will be better positioned on the labor market.	
	Affected	Industry	
6	**Who implements?**	EU-Institutions	Yes, provides mobility programmes to allow students to spend sufficient time in the EU pilot plants
		Member States	Yes
		Business	Yes. contributes with equipment and materials to the project. Tu ensure close networking with the industry, a management board with representatives from both academia and industry will be implemented. This board should work closely with the EBA advisory board in action 14b.
7	**Existing Best Practices**	In the EU education organisations and companies have launched similar initiatives in other industries. Examples can be found in telecom and in nuclear engineering.	
8	**Pre-requisites (regulatory or no-regulatory) to be successful**	Industry needs to agree on parts of the EU pilot plant learning activities that are considered non-competitive or pre-commercial.	
9	**Planning to implement the action (initial)**	Industry requirements gathering will take 6 months. Design of each learning activity will take 3 to 6 months including a pilot. The number of learning activities as well as the volume will be determined after the industry & academia consultation.	
10	**Financial resources requested**	Yes. Financing will be required for the requirements gathering phase and to design and offer the hands-on work and the learning activities that are executed in the EU pilot network. In addition teaching staff will need to be trained (train-the–trainer programme).	
11	**How will this action directly benefit EU citizen?**	- Improved employability in new sectors. - Attract international talent to Europe with a unique education infrastructure.	
12	**KPI to monitor progress**	- The number of participating industry partners in education co-creation. - The number of learning activities created. - Number of participants per programme or course. More KPI's to be defined during design.	

Action 15d- Draft

	Code and name of the action	15d. Build new degree courses in consultation between universities and industries	
	Recommendations it contributes to	4,5,13,14,15,16	
	Linked to actions #	5a, 13a-b; 15b	
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	1	
	Time to design (months)	6	
	Time to delivery (months)	12-24	
1	**Objectives (*What for?*) Impact we want to achieve**	1. Deliver a European work force with the skills and competencies need to support the competiveness of Europe in all segments of the EBA. 2. Define a long-term view on talent management for all industries in the EBA sectors and anticipate skill shortages with flexible and dynamic programmes. 3. Align universities and industry to provide the human capital to support the European ambitions in the battery sectors. 4. Understand the business impact and learning outcomes that are expected by EBA sector members at the end of courses or programmes. 5. Create and offer new programmes to support new skills and up-skilling. 6. Guarantee a sufficient supply of EBA relevant degree courses and programmes. 7. Build the capacity to meet future human capital needs of all stakeholders in the EBA sectors.	
2	**Action** *(description)*	1. Consult with EBA stakeholders to identify future skills and skill levels for all segments in the EBA value chain. 2. Determine the volumes of learners per year and per segment of the EBA value chain in order to estimate future capacity requirements. 3. Map the education landscape to identify existing offers, initiatives and best practices. 4. Identify the gap between the supply and demand of courses and programmes. 5. Co-create with universities & industry a number of flagship degree programmes to attract new students and deliver the number of graduates in line with the capacity requirements. 6. Co-create with universities & industry the new learning formats and programmes that support reskilling of the existing work force. 7. Set up partnerships with universities to cover local requirements for degree programmes and short degree up-skilling courses. 8. Produce and deliver a number of scalable online and blended stackable master programmes in the different areas of EBA. 9. Implement a certification programme for the EBA related degree programmes. (Long and short programmes). 10. Implement an awareness and recruitment campaign for the new programmes and highlight the future potential of the EBA sectors in Europe.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	Education needs at BA and MsC level: Electrochemistry: Product design; Hydrometallurgy: Process design; Material refinement and purification processes; Environmental management; etc…
		Active Materials	Education needs at BA and MsC level: Electrochemistry: Designing the products; Semiconductors: solid-state batteries; "Wet chemistry" processes; Clean room processing; Enviromental management: Integrating processes in the environment; etc…
		Cell Manufacturing	Education needs at BA and MsC level: Inorganic chemistry; Material science; Electrochemistry and Cell design, etc;…
		Modules/Pack/BMS	Education needs at BA and MsC level: Packaging and Safety, Battery testing and Monitoring; Data science; Battery managment systems; etc…
		Application – ESS	Education needs at BA and MsC level: Smart buildings and Sustainable Living; Energy managment; Battery storage for solar power; Smart grids, off-grid and micro grids; etc..
		Application – e-mobility	Education needs at BA and MsC level: EV types and technology; V2G; Sustainable mobility; Batteries in trains and aircrafts; etc…
		Application – Industrial	Education needs at BA and MsC level: Control and regulation of wind turbines; System optimisation; Power plants and VPP; Business models, etc…
		User	Education needs at BA and MsC level: Cost calculation; Policy and regulation; etc;…
		Recycling/2nd life	Education needs at BA and MsC level: Material properties; Circular economy models; Environmental management and legislation;
		New player	Education needs at BA and MsC level: Business models; etc…
4	**Cost Benefit Analysis** *(Initial)*	More costs	Costs should be shared between public funding, industry and study fees.
		More benefits	- Improve the competiveness of the entire sector on a global scale. - Shorten product development cycles and accelerate time to revenue by having the people with the required skills and competencies on time. - Reduce the amount of people that loose their jobs due to innovation and change in their sector by offering re-skilling and skill upgrade programmes.
5	**Winners**	- Companies and industries will have a higher chance to find the talent required to grow and to be competitive in this space. - Universities have the opportunity to upgrade their programmes with new content and new formats and attract more students. Industries will pay additional (tuition) fees for the employees attending the courses. - Employers will be able to collaborate with universities to co-create dedicated education programmes that are better aligned with their needs. - Individuals will be able to manage their career and prepare themselves for new roles in innovative and changing industries while leveraging their previous business experience.	
	Affected	Universities may not have the capacity to provide the required programmes and can be overtaken by alternative innovative education providers that want to work with industry without offering for academic degree programmes and courses.	
6	**Who implements?**	EU-Institutions	Yes, through dedicated programmes such as Erasmus+ and the EIT KICs that have the capability to design and implement these programmes. EU could provide support to scale existing programmes and create new ones in the EBA segments.
		Member States	Yes, by promoting and by providing special incentives for education and up-skilling in innovative sectors such as the EBA sectors.
		Business	Yes, by launching talent overhaul programmes based on sector roadmaps linked to future skill requirements and as a co-investor and co-creators of the programmes.
7	**Existing Best Practices**	A number of EU programmes have launched similar programmes on a limited scale: EIT KICs, Uniset, Erasmus+. This is a basis for scaling the approach to an entire sector and at a pan-European level.	
8	**Pre-requisites (regulatory or no-regulatory) to be successful**	- Industry needs to provide insight in the future skill needs and the skill levels based on the industry or sector roadmaps that needs to be collected per segment of the EBA value chain. - Industry has to formulate the expected learning outcomes of the programmes and the impact on their business so universities can co-design the courses and programmes with them. - Universities need to be like-minded and buy into the co-design approach: to the industry needs.	
9	**Planning to implement the action (initial)**	This information is valid for new courses and programmes and provides lead times; not FTE's. Activities can be executed in parallel if sufficient resources are allocated. Typical activities & high level planning info: - EBA sector education requirements gathering: 6 months per EBA segment. - Short course design (1-2) ECTS: design 3 months per course. - Mini master module or master class (6-10 ECTS): design 6 – 9 months per module. - New master programme – combination of existing and new modules: design 1 year. Course and programme development will be incremental. We start with short courses that will be combined with other new and existing courses into a mini-master that can then be "stacked" into full 1 or 2 year master degree programmes.	
10	**Financial resources requested**	Yes. Financing will be required to design and offer the courses and programmes.	
11	**How will this action directly benefit EU citizen?**	- Lifelong learning with improved employability in new sectors. - Attract international talent to Europe.	
12	**KPI to monitor progress**	- The number of participating industry partners in education co-creation. - The number of new programmes launched - Number of participants per programme or course. More KPI's to be defined during design.	

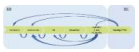
Action 15e- Draft

	Code and name of the action	15e. Dedicate national and ESF (European Social fund) funds for training professionals to new technologies systems and applications	
	Recommendations it contributes to	6, 15, 16	
	Linked to actions #	6a, 15a-d	
	Dependent on actions #	6a	
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	2	
	Time to design (months)	tbd	
	Time to delivery (months)	tbd	
1	**Objectives (*What for?*) Impact we want to achieve**	Grow the European R&I capacity. Develop and strengthen skilled workforce in all parts of the value chain and make Europe attractive for world class experts. Sufficient and key human capital skills are missing in Europe especially on applied process design.	
2	**Action** *(description)*	• Stream national and ESF (European Social fund) funds for training professionals to new technologies systems and applications. A description of ESF Fund can be found here: http://ec.europa.eu/esf/main.jsp?catId=35&langId=en	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	
		Active Materials	
		Cell Manufacturing	
		Modules/Pack/BMS	
		Application: ESS	
		Application: e-mobility	
		Application: Industrial	
		User	
		Recycling/2nd life	
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	
		More benefits	
5	**Winners**		
	Affected		
6	**Who implements?**	EU-Institutions	Define strategy and budget allocation taking into account that cell manufacturing is a strategic industry for the high-tech area Europe.
		Member States	Implementation of ESF funding based on the multi-annual Operational Programmes that are planned by Member States and their regions together with the European Commission. Cell manufacturing can be a thematic field in on of these Operational Programmes.
		Business	Develop and implement projects together with e.g. industry associations, trade unions and works councils, educational and training institution, strongly connected and as a complement to courses developed in action 15d.
7	**Existing Best Practices**		
8	**Pre-requisites (regulatory or no-regulatory) to be successful**		
9	**Planning to implement the action (initial)**		
10	**Financial resources requested**		
11	**How will this action directly benefit EU citizen?**		
12	**KPI to monitor progress**		

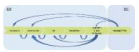
Action 16a- Draft

	Code and name of the action	16a. Define instruments to attract global key talents including process engineers and operations	
	Recommendations it contributes to	4,5,13,14,15,16	
	Linked to actions #	5a, 13a-b; 15b	
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	2	
	Time to design (months)	tbd	
	Time to delivery (months)	tbd	
1	**Objectives (*What for?*) Impact we want to achieve**	Make Europe attractive for world class talents.	
2	**Action** *(description)*	- Simplify bureaucracy for working permit applications for global key talents. Long waiting times for work permits create uncertainty and can lead to the absence of international recruitment. - Introduce a European talent visa for core competencies in cell manufacturing. - Develop a European expert tax system with generous rules to attract global key talents e.g. relief on income tax and employer fees for 3-5 years. - Implement a model for international talent managment	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	
		Active Materials	yes
		Cell Manufacturing	yes
		Modules/Pack/BMS	yes
		Application: ESS	
		Application: e-mobility	
		Application: Industrial	
		User	
		Recycling/2nd life	
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	
		More benefits	
5	**Winners**		
	Affected		
6	**Who implements?**	EU-Institutions	
		Member States	- Develop the mapping of National Employment Services to better identify skills that match employers' needs. - National Employment Services are commissioned to increase access to networking initiatives, such as mentoring programs developed by the industry.
		Business	- Develop mentor programs
7	**Existing Best Practices**		
8	**Pre-requisites (regulatory or no-regulatory) to be successful**		
9	**Planning to implement the action (initial)**		
10	**Financial resources requested**		
11	**How will this action directly benefit EU citizen?**		
12	**KPI to monitor progress**		

Action 17a- Draft

	Code and name of the action	17a. Involve Industry + Citizens + Policy makers on Use patterns/Re-use & Sustainability	
	Recommendations it contributes to	2, 3 ,4 ,5	
	Linked to actions #	4	
	Dependent on actions #	4a, 4b, 4d,	
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	2	
	Time to design (months)	tbd	
	Time to delivery (months)	tbd	
1	**Objectives (*What for?*) Impact we want to achieve**	Lack of information/knowledge is identified as a main barrier for a fast penetration of battery systems in the power and transport sector.	
2	**Action** *(description)*	Develop information material such as web page, information pamphlets. Spread information via seminars, directed campaigns towards politicians and citizens. Spread best practice. Member States should be obliged to implement a graphic and coloured label (complementing information on fuel consumption and CO2 emissions). Information/requirements for safety and for eco-conception is also nedded to give consumers the tools to make informed decisions. Price comparisons between products should include durability and environmental criteria. Industries in Europe are very good at producing long lasting and safe products and this is a major factor of differentiation.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	indirect via increased market
		Active Materials	indirect via increased market
		Cell Manufacturing	indirect via increased market
		Modules/Pack/BMS	indirect via increased market
		Application – ESS	indirect via increased market
		Application – e-mobility	indirect via increased market
		Application – Industrial	indirect via increased market
		User	
		Recycling/2nd life	indirect via increased market
		New player	Creation of the suggested programs will open business opportunities for new players and/or new constellations with traditional players.
4	**Cost Benefit Analysis** *(Initial)*	More costs	Costs for developing the suggested programs
		More benefits	
5	**Winners**	EU citizens	
	Affected	Traditional players	
6	**Who implements?**	EU-Institutions	Define policies for environmental labelling and information policies
		Member States	Implement consistent regulation following EU policies
		Business	Use required labelling systems. Contribute in speading correct information of environmental performance. Continous development of better products.
7	**Existing Best Practices**	Several car companies have created training programs for their employees. Environmental labelling of cars (https://www.sciencedirect.com/science/article/pii/S0301421516302129)	
8	**Pre-requisites (regulatory or no-regulatory) to be successful**		
9	**Planning to implement the action (initial)**		
10	**Financial resources requested**		
11	**How will this action directly benefit EU citizen?**	Faster penetration of environmetally attractive solutions	
12	**KPI to monitor progress**	Mandatory and regular monitoring of the effectiveness of car labelling and exchange of information among Member States should be supported.	

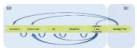
Action 17b- Draft

	Code and name of the action	17b. Highlight importance of batteries as a means to meet decarbonization goals in power and transport.	
	Recommendations it contributes to	17	
	Linked to actions #	9, 10, 11, 12	
	Dependent on actions #		
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	1	
	Time to design (months)	tbd	
	Time to delivery (months)	tbd	
1	**Objectives (*What for?*) Impact we want to achieve**	Make Europe the global leader in sustainable battery technology. Highlight the potential benfits of batteries in the future power and transport system - for decarbonization of the power and transport system and other services they could provide for the energy system and customers. This strengthens the business case for batteries over the entire value chain - and in the same time enhances consumer interests and trust in batteries as a key technology.	
2	**Action** *(description)*	- Create and sustain a cross-value chain ecosystem for battery recycling topics in the EBA, incl. mining, processing, materials design, 2nd life, and recycling, encouraging cross-sectoral initiatives between academia, research, industry, policy, and the financial community. - Include batteries and their role for a future sustainable power and transport system in school curricula - Validate the environmental impact of batteries along the entire life cycle and value chain through R&I to create transparency and trust - Information campains, e.g. on life cycle benefits of EV's	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	Create better opportunities for securing access to raw materials from EU through informing about sustainable mining and the benefits for society.
		Active Materials	
		Cell Manufacturing	
		Modules/Pack/BMS	
		Application – ESS	Increased interest for ESS solutions in the power system and increased interest in home storage solutions
		Application – e-mobility	Increases speed of electrification of transport system
		Application – Industrial	Increases speed of electrification in industry
		User	Higher demand for batteries combined with electrification of various customer products (e.g. power tools) increases range of products and lowers prices
		Recycling/2nd life	More products on the market will lead to increased amounts of batteries to be recycled and increased of awareness of the environmental effects to increased interst in 2nd life solutions
		New player	
4	**Cost Benefit Analysis** *(Initial)*	More costs	
		More benefits	
5	**Winners**	The entire value chain as the market and demand for batteries grows. EU perceived as a leader in sustainable transitions	
	Affected	Traditional power generation and fuels.	
6	**Who implements?**	EU Institutions	Promoting information campaigns to increase knowlege on battery markets and services, launches R&I calls in line with this action
		Member States	Implement the role of batteries in national school curricula Monitors and publishes services and benefits that have been gained due to the development and deployment of batterries for decarbonizing the power and transport system.
		Business	Develops education programs for end-users, studens and industry (e.g. MOOCS); connected to action 15
7	**Existing Best Practices**		
8	**Pre-requisites (regulatory or no-regulatory) to be successful**		
9	**Planning to implement the action (initial)**		
10	**Financial resources requested**		
11	**How will this action directly benefit EU citizen?**	Make informed decisions due to increased knowledge on services and environemtal benefits of batteries Increased demand side management possibilities and lower grid costs	
12	**KPI to monitor progress**		

Action 17c- Draft

	Code and name of the action	17c. Safeguard non-discriminatory access for consumers to energy service providers including charging services	
	Recommendations it contributes to	9, 17	
	Linked to actions #	9a, 9b, 10a,	
	Dependent on actions #	9a, 10a	
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	2	
	Time to design (months)	tbd	
	Time to delivery (months)	tbd	
1	**Objectives (*What for?*) Impact we want to achieve**	Involve the EU citizens in the development of a sustainable energy system	
2	**Action** *(description)*	Allow individuals to participate in energy service market by removing barriers such as minimum bids	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	indirect by increased market
		Active Materials	indirect by increased market
		Cell Manufacturing	indirect by increased market
		Modules/Pack/BMS	indirect by increased market
		Application: ESS	yes
		Application: e-mobility	yes
		Application: Industrial	
		User	yes
		Recycling/2nd life	
		New player	Aggregators will have a new market
4	**Cost Benefit Analysis** *(Initial)*	More costs	limited
		More benefits	New actors on the balancing and charging services market will increase choice and drive down cost
5	**Winners**	Consumers by becomming prosumers. Buyers of services will have more choice. Contributes to reach climate goals	
	Affected	More competition for traditional actors in the balancing and charging service market	
6	**Who implements?**	EU-Institutions	
		Member States	Review national regulation and implemet changes
		Business	Balancing and System servicde responsible needs to develop business models that allow for
7	**Existing Best Practices**	National Grid has a well established system for balancing services based on aggregators. National Grid in UK has a well established system for purchsing services through aggregators and a plan to provide market information that plainly sets out the needs; simplify products to create transparency; and ensure routes to market for all participants. (https://www.nationalgrid.com/sites/default/files/documents/8589940796-14131_NG_Future%20of%20Balancing%20Services_6PP_A4_leaflet_A06.pdf)	
8	**Pre-requisites (regulatory or no-regulatory) to be successful**	Non-discriminatory market rules	
9	**Planning to implement the action (initial)**		
10	**Financial resources requested**		
11	**How will this action directly benefit EU citizen?**	EU citizens will become directly involved in the energy transition and also potentially see lower costs	
12	**KPI to monitor progress**	Share of regulatury and charging services provided by consumers	

Action 18b- Draft

	Code and name of the action	18b. Harmonise charging protocols and billing systems in Europe	
	Recommendations it contributes to	9	
	Linked to actions #	9a, 9b	
	Dependent on actions #	9a	
	Priority (1-Highest; 3 lowest)	2	
	Feasibility (1-easy; 5-Difficult)	3	
	Time to design (months)	tbd	
	Time to delivery (months)	tbd	
1	**Objectives (*What for?*) Impact we want to achieve**	Create open and accessible EV networks and create competetive advantage through standardization. Make EV's more attractive by opening up the European market through harmonizing charging protocols and billing systems in all European countries. A uniform communication method of communication a charge point and a central system based on a standardised open protocol it will be possible to connect any central system with any charge point, regardless of the vendor.	
2	**Action** *(description)*	Define and implement open and interoperable communication protocols for the EV charging infrastructure.	
3	**Impact in the value chain** *(if blank then none)* 	Raw materials	
		Active Materials	
		Cell Manufacturing	
		Modules/Pack/BMS	
		Application: ESS	
		Application: e-mobility	yes
		Application: Industrial	
		User	yes
		Recycling/2nd life	
		New player	yes
4	**Cost Benefit Analysis** *(Initial)*	More costs	
		More benefits	
5	**Winners**		
	Affected		
6	**Who implements?**	EU-Institutions	
		Member States	
		Business	
7	**Existing Best Practices**	The Open Charge Alliance that is a global consortium of public and private electric vehicle infrastructure leaders promoting open standards through the adoption of the Open Charge Point Protocol (OCPP) and the Open Smart Charging Protocol (OSCP).	
8	**Pre-requisites (regulatory or no-regulatory) to be successful**		
9	**Planning to implement the action (initial)**		
10	**Financial resources requested**		
11	**How will this action directly benefit EU citizen?**		
12	**KPI to monitor progress**		