

Agreed strategic targets for become competitive in the global battery sector to drive e-mobility and stationary storage forward

As an overarching objective, R&I related to Key Action 7 of the SET Plan will aim at developing and demonstrating technologies, manufacturing processes, science-based standards and regulations, to increase performance and safety and reduce overall cost of battery systems used for storage purposes in the automotive and other sectors. The R&I effort will cover materials, cells, packs and systems with a focus on high energy and resource efficiency, modularity and re-configurability, while also taking into account second life and recycling (the later as regulated by Directive 2006/66/EC). In terms of chemistries, the core focus is on Li-ion batteries. Nevertheless post Li-ion technologies should also be considered for strong support, covering e.g. basic technology, materials, manufacturability, LCA, second life and recyclability).

Targets outlined in this Declaration of Intent have been agreed by all stakeholders starting from a set of values taken from a number of sources [5, 13-33]. They should steer R&I actions and guide coordination of EU and Member States funding in areas of materials research, nanotechnology, electrochemistry, manufacturing processes and manufacturing technologies. Achievement of the targets will require coordination of R&I activities, with responsibilities and efforts shared between different stakeholders during the implementation phase.

Targets are not relevant to batteries for portable/electronic equipment which falls outside the scope of this Action. Targets are differentiated into performance, cost and manufacturing targets. Considering the expected dominance of Li-ion chemistry in the coming decades for electrochemical energy storage, barring unexpected but possible breakthroughs, the performance and cost targets defined are application-specific and based on technology improvements deemed achievable for Li-ion batteries up to 2030. Targets may be exceeded through developments in other advanced technologies

a) Performance targets - Table a

Successful deployment of batteries for automotive applications requires meeting a number of performance criteria. It is acknowledged that it may be difficult to achieve some targets concurrently, e.g. gravimetric versus volumetric energy density, gravimetric energy density versus fast charge time or energy versus power demand at cell level). Furthermore, some performance parameters are affected by use conditions (e.g. battery cycle life may strongly be strongly affected by the frequency of fast recharge). Such interdependencies need to be considered.

	Current (2014/ 2015)	2020	*2030	
Performance targets for automotive applications unless otherwise indicated				
1	Gravimetric energy density [Wh/kg]			
	pack level	85-135	235	> 250
	cell level	90-235	350	> 400
2	Volumetric energy density [Wh/l]			
	pack level	95-220	500	> 500
	cell level	200-630	750	> 750
3	Gravimetric power density [W/kg]			
	pack level	330-400	470	> 470
	cell level		700	> 700
4	Volumetric power density [W/l]			
	pack level	350-550	1.000	> 1.000
	**cell level		1.500	> 1.500
5	Fast recharge time [min] (70-80% ΔSOC)	30	22	12
6	Battery life time (at normal ambient temperature)			
	Cycle life for BEV*** to 80% DOD [cycles]		1.000	2000
	Cycle life for Stationary to 80% DOD [cycles]	1000-3000	3000-5000	10000
	Calendar life [years]	8-10	15	20

*: Post-Lithium ion technologies are assumed relevant in this time frame

** : May also be relevant to stationary applications

*** Cycle life for PHEV must be bigger

b) Cost targets - Table b

The medium term target date for cost targets is set to 2022 (as opposed to 2020) to allow more time for these targets to be met.

TARGETS	Current (2014/ 2015)	2022	2030	
Cost target				
1	Battery pack cost for automotive applications [€/kWh]	180-285	90	75
2	Cost for stationary applications requiring deep discharge cycle [€/kWh/cycle]		0,1	0,05

c) Manufacturing targets - Table c

TARGETS	Current (2014/ 2015)	2020	2030	
Manufacturing targets				
1	Automotive (Li-ion and next generation post-lithium) battery cell production in EU [GWh/year] ¹ (% supporting EU PHEV+BEV production)	0,15 – 0,20	5 (50% of the 0.5 M EVs with 20 kWh)	50 (50% of the 2 M EVs with 50 kWh)
2	*Utility Storage (Li-ion and next generation post-lithium) battery cell production in EU [GWh/year]	0,07 – 0,10	2.2	10
3	Recycling			
	**Battery collection/take back rate	45% (Sept 2016)	70%	85%
	Recycling efficiency (by average weight)	50%	50%	50%
	Economy of recycling	Not economically viable	Break even	Economically viable
4	Second Life	Not developed	Developed	Fully established

* The energy storage capacity in GWh depends strongly on the implementation rate of intermittent renewable electricity sources and market models behind those.

** These targets are based on numbers defined in Directive 2006/66/EC. This Directive is being revised and targets should be consistent with the revised Directive.

For stationary energy storage the SET-Plan R&I will aim at developing and demonstrating technology, manufacturing processes, standards and systems, which have the potential of driving high-efficiency (>90%) battery based energy storage system cost **below €150/kWh** (for a 100kW reference system) and a lifetime of thousands of cycles by 2030 to enable them to play an important role in smart grids. This will require development of a variety of battery chemistries and supercapacitors to cope with varying operation modes. For stationary storage systems the cost of electrochemical modules (in €/kWh), the cost of the inverters / power electronics (in €/kW), and the cost of installation/integration (in €) need to be considered. Efforts should cover materials, cells, modules but with a focus on battery systems targeting modularity and re-configurability and considering as well second life and recycling aspects.

In addition to the targets above, there are other requirements for which it is more difficult to set SMART targets. Such requirements include enhanced safety through risk mitigation as well as increased efficiency, reduction in the use of critical materials, reduced environmental impact and implementation of Eco-design (energy savings and solvent reduction) for advanced battery materials/components manufacturing processes. Furthermore, interoperability, system integration at pack level, standardization, regulations, workforce and education are important.

¹Two assumptions were made when defining this target value, based on projected global sales for PHEV+BEV in 2020 and 2030 of 2.5M and 10 M vehicles respectively: (a) the percentage for EU OEMs production of PHEV+BEVs is assumed to be maintained at the current level of 20% for both 2020 (with an average energy capacity of 20 kWh) and 2030 (with an average energy capacity of 50 kWh); (b) EU battery manufacturers will supply half of the cells needed for the PHEVs+BEVs produced by EU OEMs.