EMIRI

“Input Paper SET Plan Action 7”

“Become competitive in the global battery sector to drive e-mobility forward"

EMIRI general comments

- EMIRI strongly welcomes the strategic deployment of an ambitious SET Plan Issues Paper to drive e-mobility forward in Europe and fully agrees that a self-sufficient full EU battery value chain should be developed in a hollistic approach with
  - synergies with stationary energy storage
  - the promotion of new investments at all stages of the innovation chain
  - underlining the needs for policy-pull measures
  - the building of new strategic alliances between public and private stakeholders.
- Specific comments to the issues paper are given below:

Specific EMIRI comments

- It would have been advisable to set general EU targets as to expected penetration rate of various EV type vehicles by 2020 and 2030 knowing that such targets exist or are developed in the Member States (Clean Power for Transport).
- EV deployment is not possible without the development of the necessary charging infrastructure: although mentioned in the Issues Paper again more emphasis could be given to this item: quantitative targets,development types/installment of different chargers (AC home,fast AC,fast DC,inductive).
- Manufacturing capacities should be considered over the whole battery value chain – from powder to power - including advanced materials development and production technologies, cell manufacturing, pack assembly and system integration for current lithium-ion technologies and also for emerging and future technologies.
- In terms of chemistries, the core focus is on Li-ion batteries which will remain the system of choice minimum to 2030, while attention and a certain support may be given to post-Li-ion.

Specific EMIRI comments

- The combination of EV + Stationary Energy Storage markets will help to build critical mass to install battery manufacturing capacity in Europe. In EMIRI's IDI EMIRIT, also presented as comments paper for Action 4, our KPI's are given for a) improved next generation Li Ion batteries and b) for post-Li Ion systems.They are given respectively in annexes 1 and 2. For **improved Li Ion** the Issues Paper is well in line with EMIRI.

		Current (2014/ 2015)	2020	2030
Performance targets for automotive applications				
1	Gravimetric energy density [Wh/kg]			
	pack level	85-135	250	> 250
	cell level	90-235	400	> 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	15	3
6	Battery life time			
	Cycle life to 80% DOD [cycles]		1.000	5.000
	Calendar life [years]	8-10	15	20

Specific EMIRI comments

- Cycle life targets (1000 cycles 80%DOD) by 2020 could be set higher (e.g.at 3000) to reach higher lifetime and mileage for the car.Reaching >400 Wh/kg on cell level at 2030 would most probably mean post-Li Ion chemistries which still need to be proven.
- On cost the Issues Paper sets ambitious but possible targets on pack level in line with EMIRI's expectations,however needing firm targets on Balance of Systems improvements (packaging,BMS..).

TARGETS		Current (2014/ 2015)	2020	2030
Cost target				
1	Battery pack cost for automotive applications [€/kWh]	180-285	90	75

EMIRI specific comments

- Manufacturing,recycling and second life targets are well appreciated: for recycling we refer to the need for optimizing pack construction for rendering recycling economically viable by 2030 and to established EU strong position already e.g. at Umicore. Second life will need further research e.g.establishing fast State-of-Health and pack reconfiguration optimization.
- Development of advanced materials is key to realize the performance targets as stated in the Issues Paper and a lot of attention should be paid to generate a strong IP position in these fields, IP development to become a strong KPI for future R&I programs.
- A reference/stakeholder to be further considered is http://www.rechargebatteries.org : Recharge having developed in 2013 an e-mobility roadmap for the EU battery Industry.

Annexe 1: EMIRI KPI's Li Ion ESS systems

Advanced Materials to achieve EU goals		KPI	2020	2025	Beyond
K3-I1	Advanced Materials for lower cost, high safety, long cycle life & environmentally friendly electrochemical batteries (Li-ion batteries)	Gravimetric energy density	200 Wh / kg	350 Wh / kg	400 Wh / kg
		Volumetric energy density	600 Wh / l	800 Wh / l	> 800 Wh / l
		Power density	2 - 3 kW / kg	5 kW / kg	> 10 kW / kg
		Lifetime (number of cycles)	3000 cycles 80% DOD	10.000 cycles 80% DOD	15.000 cycles 80% DOD, > 20 yrs
		Safety	Safe -10ºC, +60 °C (normalized tests)	Safe -20ºC, +70 °C (normalized tests)	Safe < - 20ºC, > +70 °C (normalized tests)
			Safety system implemented	Tests Stallion/Stabalid fully met	Tests Stallion/Stabalid fully met
		Cost	< 0.1 euro / kWh / cycle	< 0.05 euro / kWh / cycle	< 0.05 euro / kWh / cycle
		LCA & recycling	Developed	Fully established	Fully established
		Demo installed	MW scale (de)centralized	MW scale (de)centralized	MW scale (de)centralized
		P/E ratio (for energy based system)	< 3	<3	<3
		P/E ratio (for power based system)	> 15	> 15	> 15
		Advanced Materials for LiC supercapacitors			
		Gravimetric energy density	35 Wh / kg	40 Wh / kg	50 Wh / kg
		Power density	10 kW / kg	15 kW / kg	20 kW / kg
		Cycle life	1M cycles	1.5M cycles	2M cycles
		Temperature window	- 20 °C, + 70 °C	- 40 °C, + 90 °C	- 40 °C, + 90 °C

Annexe 2: EMIRI KPI's ESS post-Li Ion systems

Advanced Materials to achieve EU goals		KPI	2020	2025	Beyond
K3-I2	Advanced Materials for lower cost, high safety, long cycle life & environmentally friendly electrochemical batteries (next generation electrochemical batteries) KPIs given for metal air system	Gravimetric energy density	250 Wh/kg, Flow Batteries 60Wh/l	500 Wh/kg, Flow Batteries, 80Wh/l	> 500 Wh/kg, Flow Batteries, 100Wh/l
		Volumetric energy density	250 Wh/l, Flow Batteries 60Wh/l	500 Wh/l. Flow Batteries, 80Wh/l	500-1000 Wh/l, Flow Batteries, 100Wh/l
		Lifetime (nr cycles)	1000 cycles 80% DOD, Flow Batteries 2000 cycles	2000 cycles 80% DOD, Flow Batteries 2500 cycles	>10.000 cycles 80% DOD, Flow Batteries 3000 cycles
		Safety	conform with material and cell safety tests	conform with material and cell safety tests	conform with material and cell safety tests
		Cost	< 0.1 euro/kWh/cycle, Flow batteries 0,12euro/kWh/cycle	< 0.1 euro/kWh/cycle also for Flow batteries	< 0.05 euro/kWh/cycle, Flow batteries <0,08euro/kW/cycle
		LCA & recycling	developed	fully established	fully established
		Demo installed	kW-MW scale (de)centralized	kW-MW scale (de)centralized	MW scale (de)centralized