Agenda for ARPA-E's
Crash-Safe Energy Storage Systems for Electric Vehicles Workshop
Denver, CO
Monday & Tuesday, November 12 & 13, 2012

DAY 1: Topic Introductions

12:00-1:45pm	Registration	Nancy Hicks
1:00-1:10	Introduction	Dr. Pramod Khargonekar, ARPA-E
1:10-1:30	Crash-Safe Energy Storage Systems For Electric Vehicles	Dr. Ping Liu, ARPA-E
1:30-3:00	Participant 3min Personal Introductions	All Participants
3:00-3:15	Break	
3:15-3:40	xEV Vehicle Designs	Dr. Alvaro Masias, Ford Motor Co.
3:40-4:05	Battery Pack Designs	Dr. John Warner, Magna E-car
4:05-4:30	Mechanical Properties of Li-ion Cells	Dr. Elham Sahraei, MIT
4:30-4:45	Break	
4:45-5:10	Multifunctional Energy Storage	Prof. Leif E. Asp, Swerea SICOMP
5:10-5:35	Solid State Cell Chemistries and Designs	Prof. Se-Hee Lee, CU-Boulder
5:35-6:00	Aqueous Cell Chemistries and Designs	Phil Black, EOS Energy Storage
6:00-	Primer Comments for DAY 2 activities	
6:45pm	No Host Event	

DAY 2: Brainstorming

8:00am	Breakfast	Nancy Hicks
8:30-8:40	Opening Comments	Dr. Ping Liu,
8:45-11:00	Breakout #1: Future of Abuse Tolerant Electrochemical Cell Chemistries and Designs	Dr. Ilan Gur, ARPA-E
8:45-11:00	Breakout #2: Moving the Pack Out of the Box	Dr. Bryan Willson, ARPA-E
8:45-11:00	Breakout #3: Multifunctional Energy Storage/Vehicle Structures	Dr. Pramod Khargonekar, ARPA-E
11:10-Noon	Report out	
Noon-	Lunch & Closing Comments	Dr. Ping Liu

Workshop Motivation: Batteries will not only be made safe during a crash, they will contribute to the vehicle's safety; saving weight, volume, cost, and extending range.

I. **Future of abuse tolerant electro chemistries:** Intrinsically safe chemistries, cells and designs

Li-ion –

- Can traditional cell components be improved upon to enhance safety that will positively impact system-level design and realize reductions in cost, weight and volume? (e.g. advanced separators, additives, fire retardants, redox shuttles, etc…)
- Can a safe cell enable a simpler and lower cost balance of plant?
- If a lithium ion cell is made free of any combustible material, will that be considered "intrinsically safe"?
- Are there any unique aspects of a vehicle environment, e.g. size and shape, that could enable alternative battery architectures to traditional formats and lead to safer energy storage while reducing cost?

Non Li-ion –

- What are the options of cell chemistries that offer comparable or superior performance to Li-ion while being free of combustible materials? What are the implications on cost? If the chemistries have been known, what makes us believe breakthroughs can be expected now?
- Should we consider searching for new battery reactions? How should we pursue this research?
- If a system has a lower energy density than lithium ion, how much of a reduction are we willing to take and why?

- How do we best quantify the system benefits and/or success criteria?

II. **Moving the pack out of the box:** Vehicle/energy storage integration to optimize protection of the battery, vehicle, or driver.

- How much weight and volume are consumed by battery packs in small vehicles versus large vehicles?
  - Can we do better than surrounding batteries with protective metal plates? (lighter plates, different materials, structural designs)
- Is a distributed battery pack a potentially viable solution? How about disintegratable battery packs or separating the battery pack from the vehicle during impact?
- Can a battery, either being conformal or integral to the structural body, be a safer and viable solution?
- How do we best quantify the system benefits and/or success criteria?

III. **Multifunctional energy storage/vehicle structures:** Multifunctional energy storage systems that enhance vehicle and driver safety (battery protecting driver)

- In what scenarios can battery packs contribute to vehicle safety? Are there example systems today?
- What are the potential multifunctional designs: energy absorption, deflection? At what level should these designs be considered: materials, devices, and/or subsystems?
- Can lithium ion based systems be designed to be safe enough for consideration in multifunctional designs?
- How do we best quantify the system benefits and/or success criteria?