

ARPA-E “Rapid Electric Vehicle Charging” Workshop
March 28, 2012
Washington, DC

Objective

Identify technological whitespace, new research directions, and opportunities that could enable rapid charging battery packs with the following characteristics:

1. Ability to achieve a charging rate of >30 driving miles/min charge
2. Inherent stability of system during charging and interaction with grid and charger

Agenda - Wednesday, March 28, 2012

8:00 AM – 8:15 AM	Continental Breakfast
8:15 AM – 8:30 AM	Welcome and Opening Remarks (David Danielson, ARPA-E)
8:30 AM – 8:45 AM	Workshop Overview and Objectives (Amul D. Tevar, ARPA-E)
8:45 AM – 10:00 AM	Morning Presentations
10:00 AM – 10:15 AM	BREAK
10:15 AM – 12:00 PM	Discussion #1- System approaches
12:00 PM – 12:45 PM	Lunch and review Discussion #1
12:45 PM – 1:00 PM	BREAK
1:00 PM – 2:45 PM	Discussion #2- Battery approaches
2:45 PM – 3:00 PM	Coffee Break
3:00 PM – 3:30 PM	Review Discussion #2 and Wrap Up

Ground Rules

In the interest of time, the following topics will not be discussed:

1. Battery swapping
2. Regulations and policy
3. Charger port specifications
4. Demonstration projects with existing technologies

Broad Questions

1. Where is the ARPA-E white space? Are there new technologies that can put us on new learning curves? Long term, why might this be successful?
2. What advances/breakthroughs (if any) have there been in the last 10 years that might make this possible now? What are the most promising classes of materials, battery systems, coatings, and designs?

Discussion #1: System Level

ARPA-E's goals are to:

1. Validate or improve our strawman metrics to be technically audacious but possible with sufficient stretching for the system around a battery that would enable rapid charging
2. Identify and understand potential new designs, materials, and processes that could result in dramatically faster charging 5-10 years from now.

Discussion #1 Questions

1. What are smaller overlooked areas that are minor issues in systems at lower rates that may become major roadblocks at higher rates?
2. Could infrastructure issues negate system advances? How would a system interact with the grid?
3. What novel/unique approaches could be enabling for this technology? What materials and engineering challenges, if overcome, would make this possible?
4. What would the ideal system be? How would the ideal system to overcome thermal issues? Other issues? Would new sensors be needed for rapid charging?
5. What type of efficiency could be achieved? Where do the limitations originate from?
6. Would communication between cell-pack-grid be necessary? What are possible approaches and would they need uniformity?
7. What would the cost of a possible charging station be? Would energy storage be needed?
8. What are the major technical and economic barriers?
9. How would system *value* change with the addition of rapid charging? Is it worth it?
10. Would a rapid charging EV system enable new infrastructure? How would a potential utility approach it?
11. Summary Questions- What are the high level techno-economic metrics necessary for commercial adoption? What fundamental materials and process performance metrics are necessary for success?

Discussion #2: Battery Level

Discussion #2 Questions

1. Can this be solved with existing systems? What are the current limitations? What modifications are needed? What will the effects be?
2. Are there new systems or non-traditional approaches that could enable rapid charging? Would they have new or different fundamental limitations? What approaches offer the greatest opportunity?
3. What novel/unique approaches could be enabling for this technology? What materials and engineering challenges, if overcome, would make this possible?
4. What would the ideal battery be? What would its performance, lifetime and cost be?
5. What safety steps are necessary to allow >30 miles/min charge? Could the same system rapidly and safely discharge for use and emergencies? Is rapid charging radically different than rapid discharging?
6. Could one battery allow both high energy density and high charging rates? Are there fundamental limitations?
7. What are the technical and economic barriers?
8. Does it have to be rechargeable many times? Could it be battery that is easily changed or recycled?
9. Summary Questions- What are the high level techno-economic metrics necessary for commercial adoption? What fundamental materials and process performance metrics are necessary for success?