EPIC Policy+Innovation Coordination Group
Transportation Electrification Workstream Meeting #1

SCE EPIC Project: Distributed Plug-in Charging Resources

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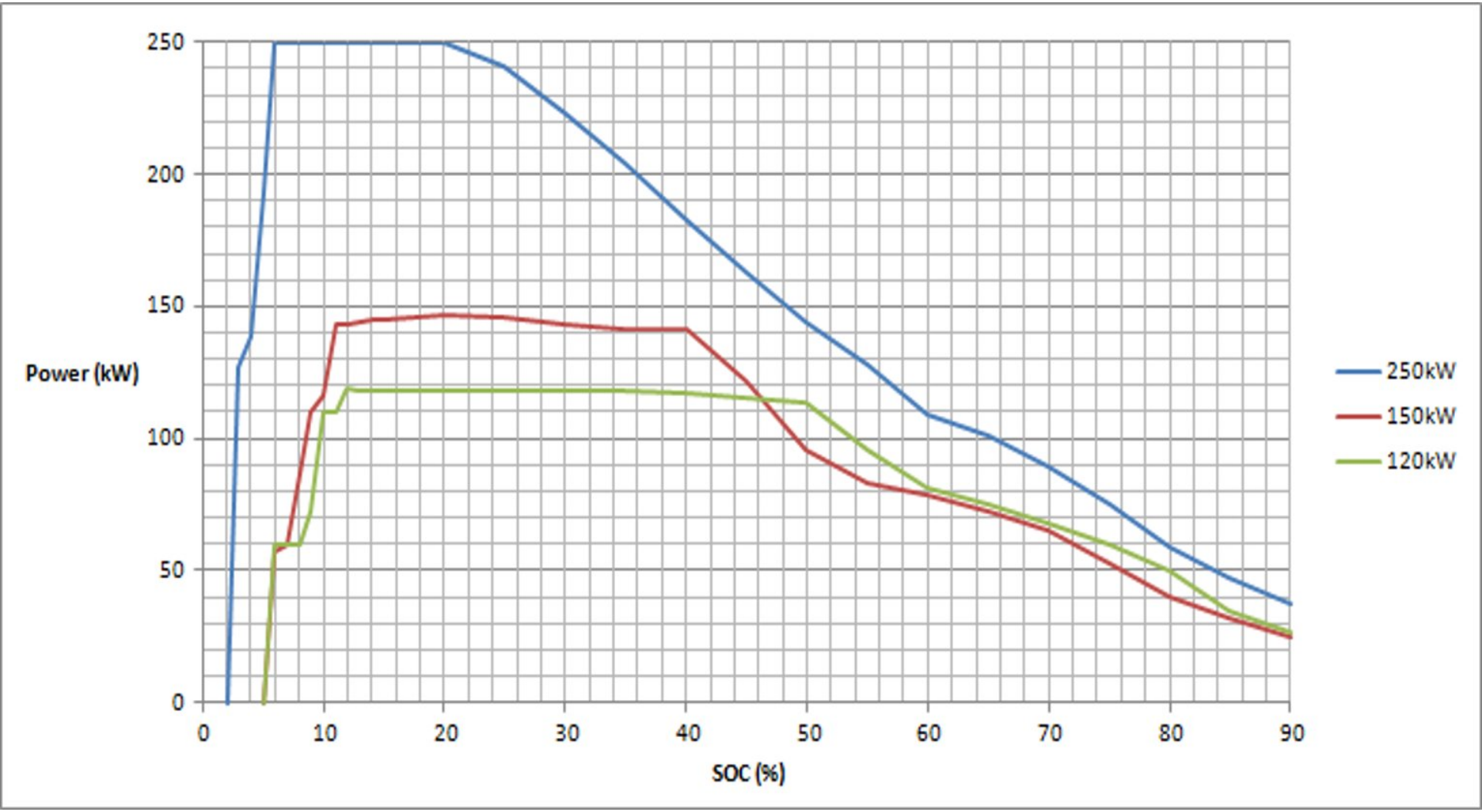
Current SCE EPIC Transportation Electrification Projects

Three current EPIC III projects involve transportation electrification with technical implementation of various use cases

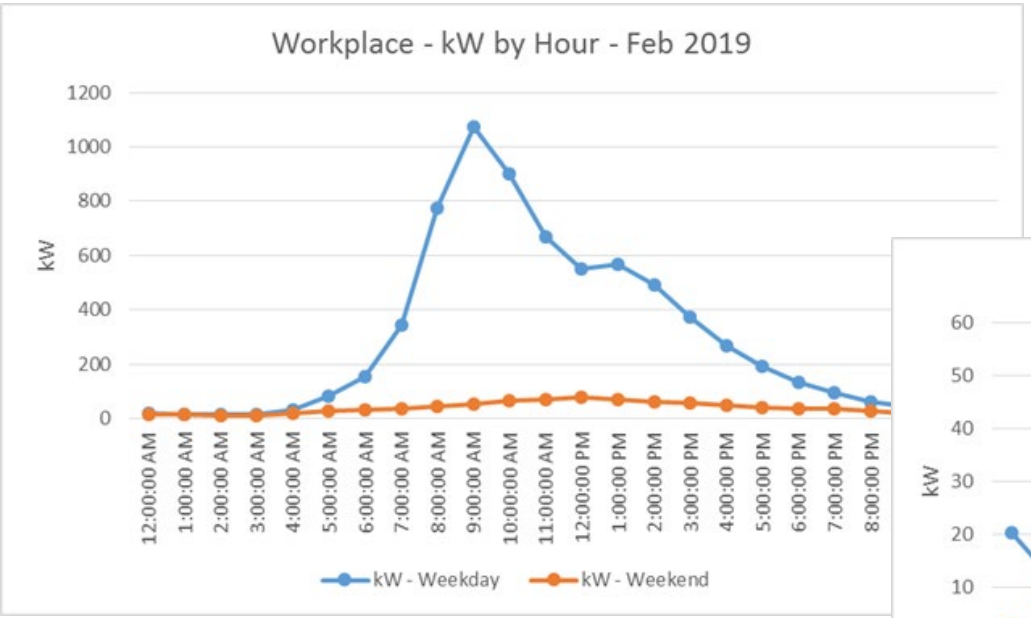
- All three moved into execution earlier this year

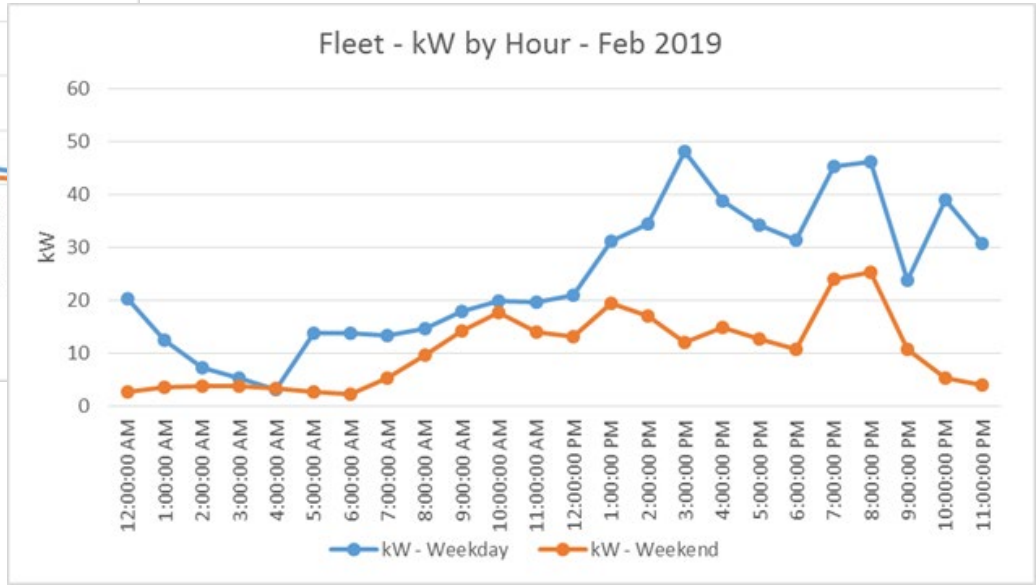
1. Service Center of the Future
   - Fleet and building electrification at facility level, storage, PV, FMS, GMS, DERMS
2. Vehicle to Grid Integration – V2G, light duty, heavy duty
3. Distributed Charging Resources
   - Batteries connected with fast chargers, EV Energy Management System
   - Operated by SCE for grid services
   - Collaborate with automakers on second life EV batteries in stationary application

Uncontrolled High Power Chargers – Example of Grid System Impact



Uncontrolled Systems: Flexibility of EV Charging for Grid Impact Management





Primer: Energy Management Systems - EVEMS

Type 1

➢ Connected load does not exceed capacity

- Broadly available from EVSPs and other vendors
- System is configured to save customer energy costs while maintaining operations
  - Utility tariffs
    - TOU
    - Demand
- Charge scheduling
- Charge sequencing
- Peak shaving with batteries; solar PV

Type 2

➢ Connected load exceeds capacity

- Novel – 2017 in California
- Potential for significant cost reduction and avoidance of major construction/upgrades by utilizing existing capacity to largest extent
- Can be applied at various circuit, site levels
- Function and Safety dependent on proper operation of EMS
- Violation can result in infrastructure failure
- No standard exists for implementation

Evaluation of Type 2 Energy Management Systems

Potential to lower customer and utility cost by accommodating more vehicles on existing capacity

- Consider potential value metric for infrastructure investment: **$ per mile electric drive enabled**
- Standards emerging UL 916, CSA 22.2 EVEMS
- General function from a user's perspective
- Power flow validation to ensure load limits are maintained
- Metering validation for each node
- Fail safe function tests in a loss-of-network or loss of control scenario
- Cyber security
- Demand Response execution and recovery
- Site Commissioning

EPIC DCR – Project Deliverables, Objectives

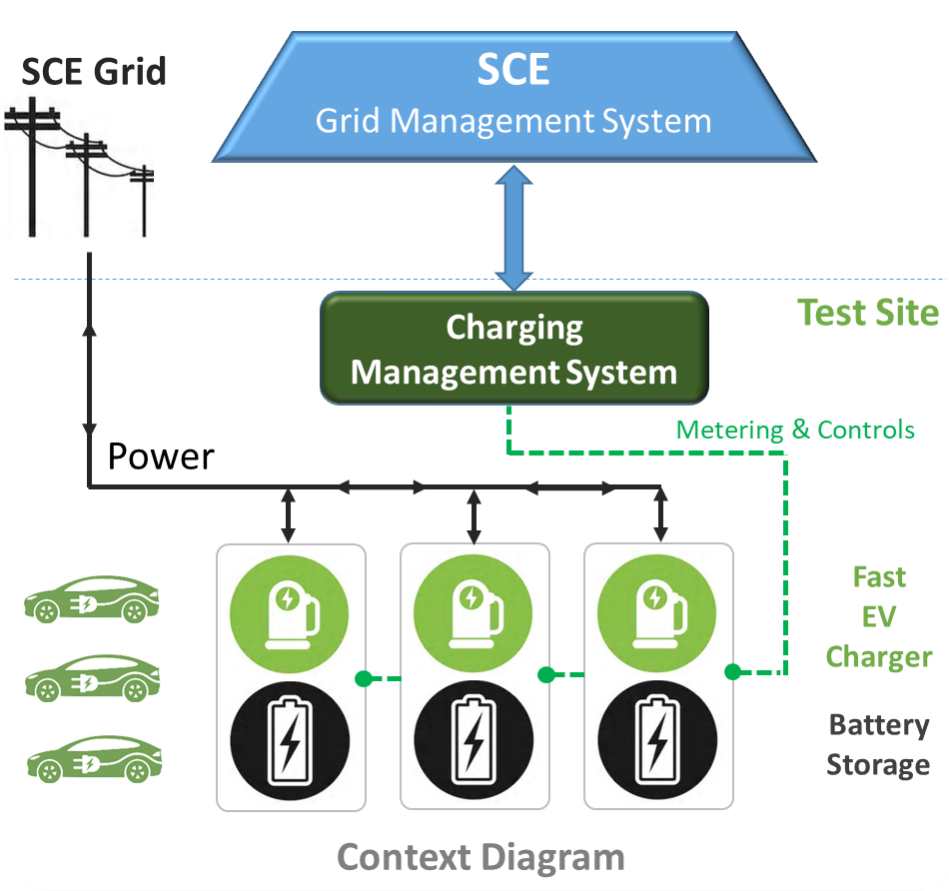
Deliverables:

- Specification recommendations for integrated fast charger / energy storage systems including potential options for incorporation of second-use batteries; interconnection
- Test data measuring performance of close-coupled fast charging / energy storage systems for functions including but not limited to:
  - Peak shaving
  - DR program participation
  - Volt/VAR support
  - Resiliency

SCE strategic objective:

- **Strategic Pillar: Customer Energy Choices**
- Objective 1): Removing barriers to customer adoption of transportation and building electrification technologies
- Capability 3): Industry standards supporting electrification in-place (e.g. fast charging EV)

System and Use Cases



Context Diagram

USE CASE 1: Demand Charge Mitigation

Show use of IEEE 2030.5 as an event-based protocol and control signal

Demo Charge Management System (CMS) to meet EV charging requirements

USE CASE 3: Rate-based Charging Management

CMS detects charging event at high cost time periods as defined by TOU rates

CMS limits power from grid by replacing charging with power from battery

USE CASE 3, 4: Demand Response & Voltage Support

DR event signal causes CMS to be place battery into grid support mode

Test CMS to manages battery to supply or absorb reactive power to control voltage

USE CASE 5: Resiliency

After simulated unplanned outage, battery will continue to support EV charging

When battery reaches lowest-allowed SOC, it stops discharging