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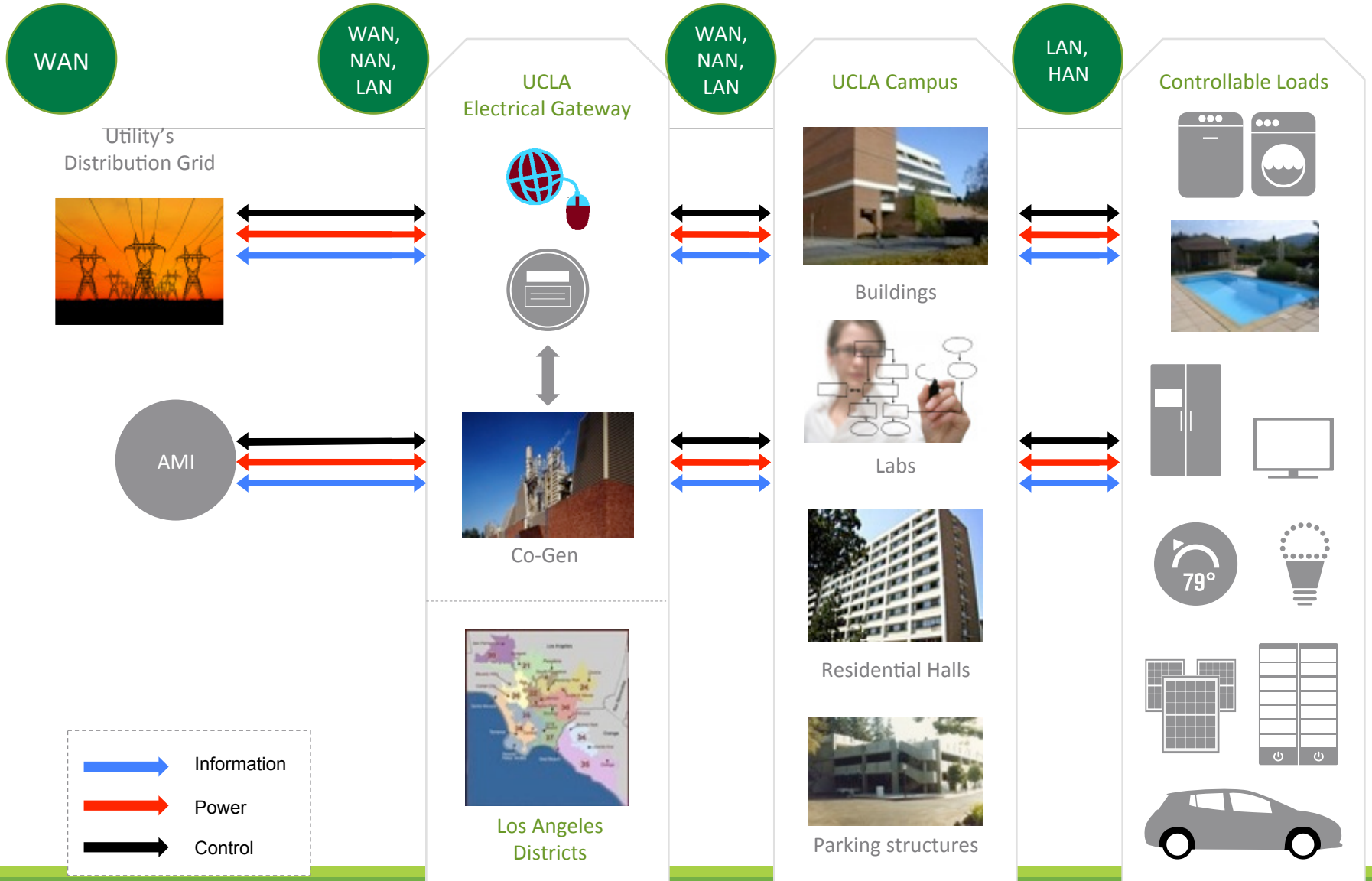
Regarding - CEC PON 14-301

DEMONSTRATION OF PEV SMART CHARGING AND STORAGE SUPPORTING GRID OBJECTIVES

SMERC BACKGROUND - WINSmartGrid™

Power and Information Flow

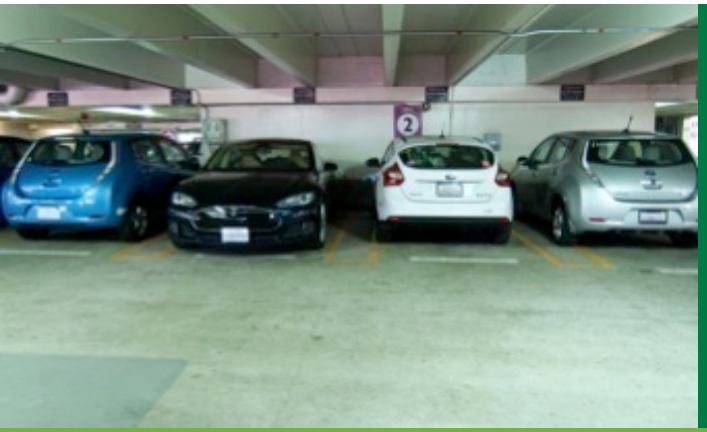


SMERC BACKGROUND - EV Smart Micro Grid Optimization / Integration:

Fundamental Approach

EV Operator

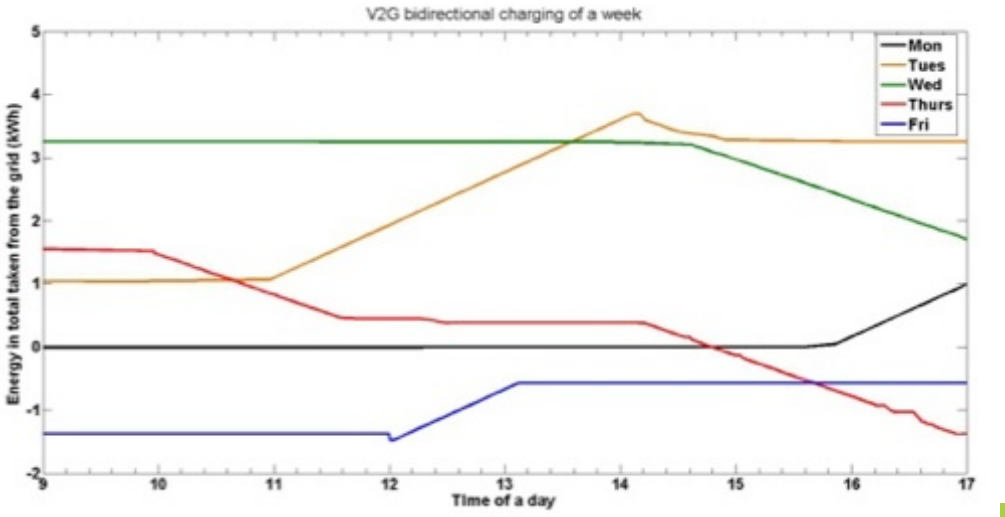
Grid Operator



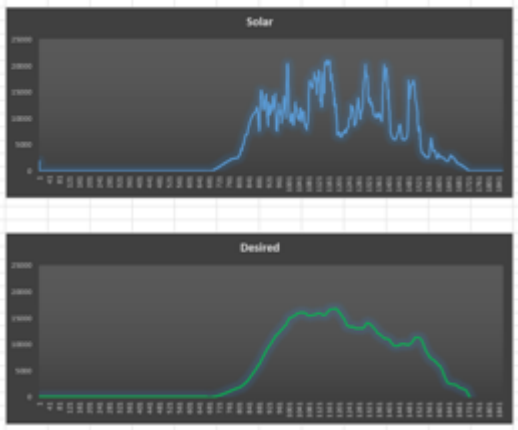
Garage Operator

Smart Charging within a Smart Grid

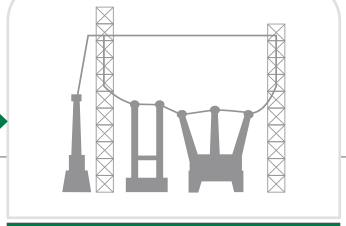
SMERC BACKGROUND - Vehicle to Grid (V2G)



SMERC BACKGROUND - Renewable Integration in Microgrids



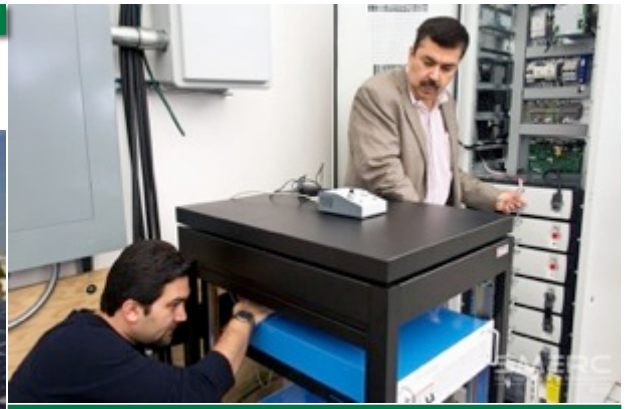
Control Center



Electric Grid

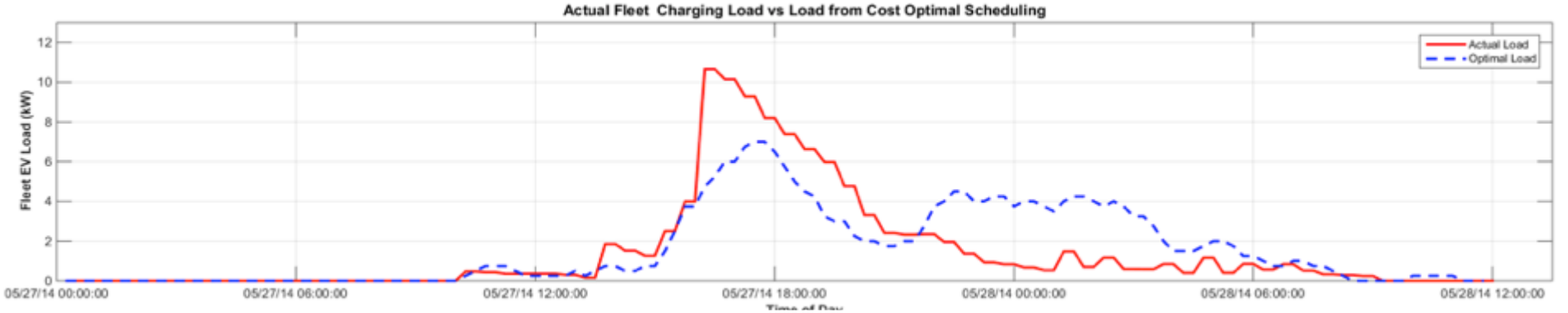
Electric Vehicles Supporting Microgrid

35 kW PV

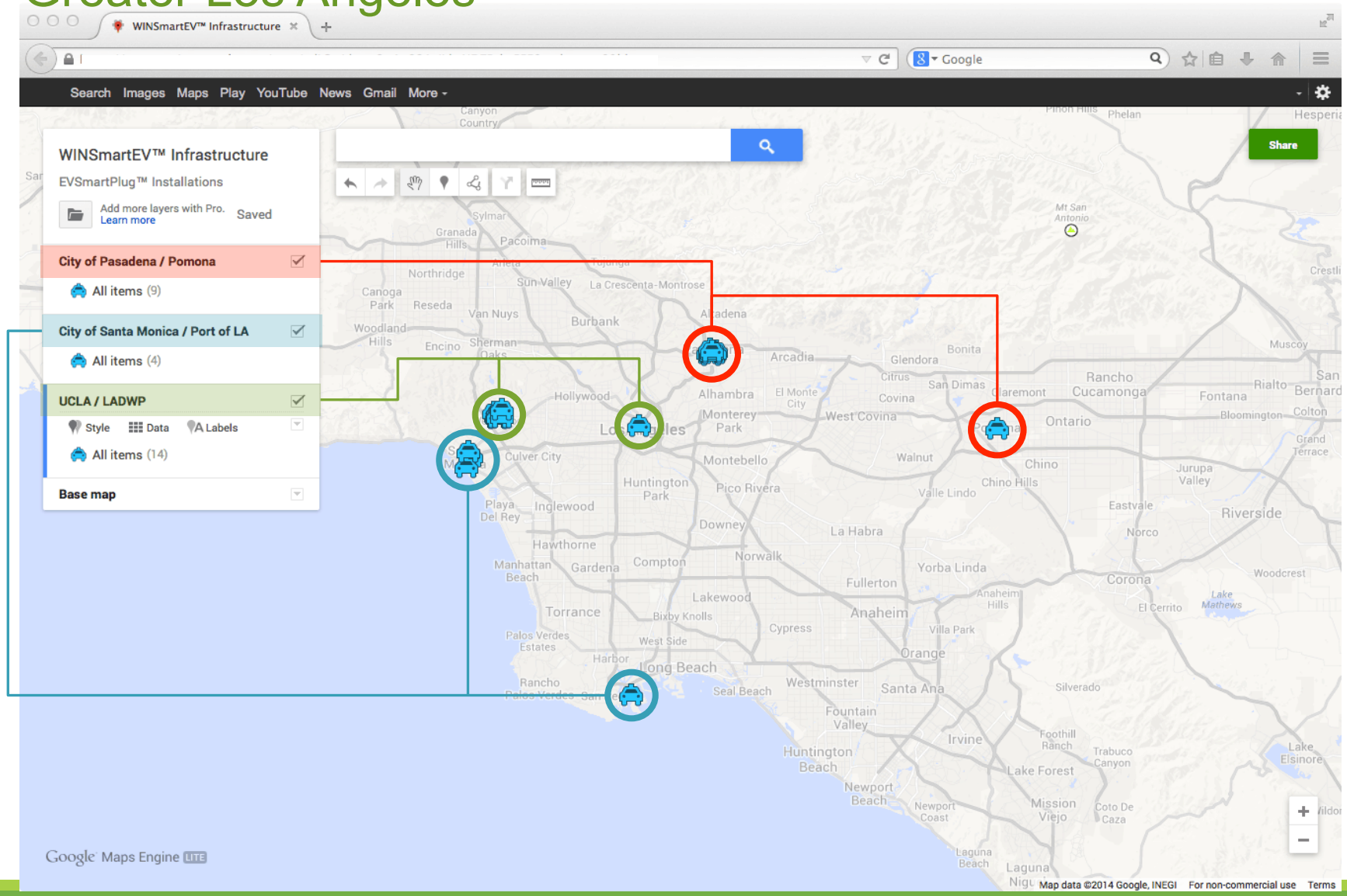


75kWhr Storage

SMERC BACKGROUND - UCLA Fleet @ Sunset Village Parking *(V1G via aggregator)*



SMERC BACKGROUND - WINSmartEV™ Infrastructure: Greater Los Angeles

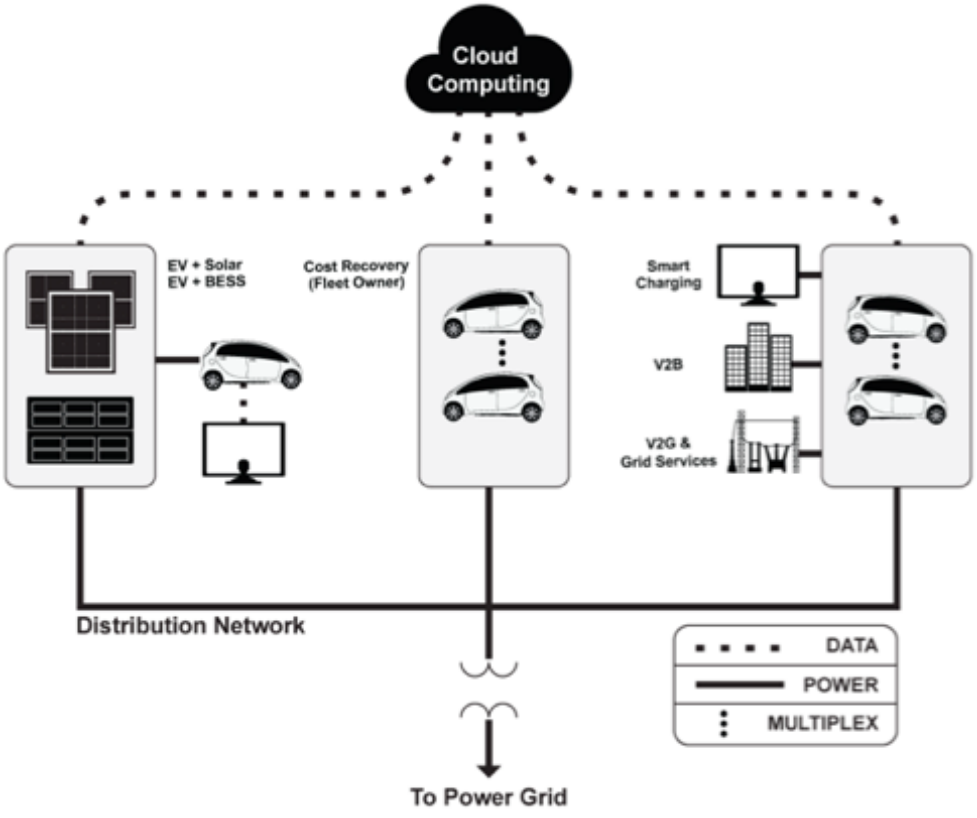


Project Objectives

Develop disruptive and innovative technology for a smart network of EVs:

- Develop and demonstrate technologies for integration of EV, BESS and Solar PV into the grid.
- Create a network of edge devices to collect data and send signals to control power flows into and out of EVs.
- Collect key data:
  - State of charge
  - Power usage in kW
  - Voltage
  - Amperage
  - Power quality– active/reactive power, frequency
- Controls to connect and disconnect a charger based on
  - Grid capacity
  - User preferences
  - Time of use
  - Demand response events
- Develop artificial intelligence-based algorithmic control system to determine the optimized charging and/or backfill operations based on
  - EV profiles
  - User preferences
  - Grid-related events
  - Grid capacities.

Distribution Network with NEVs and DERs

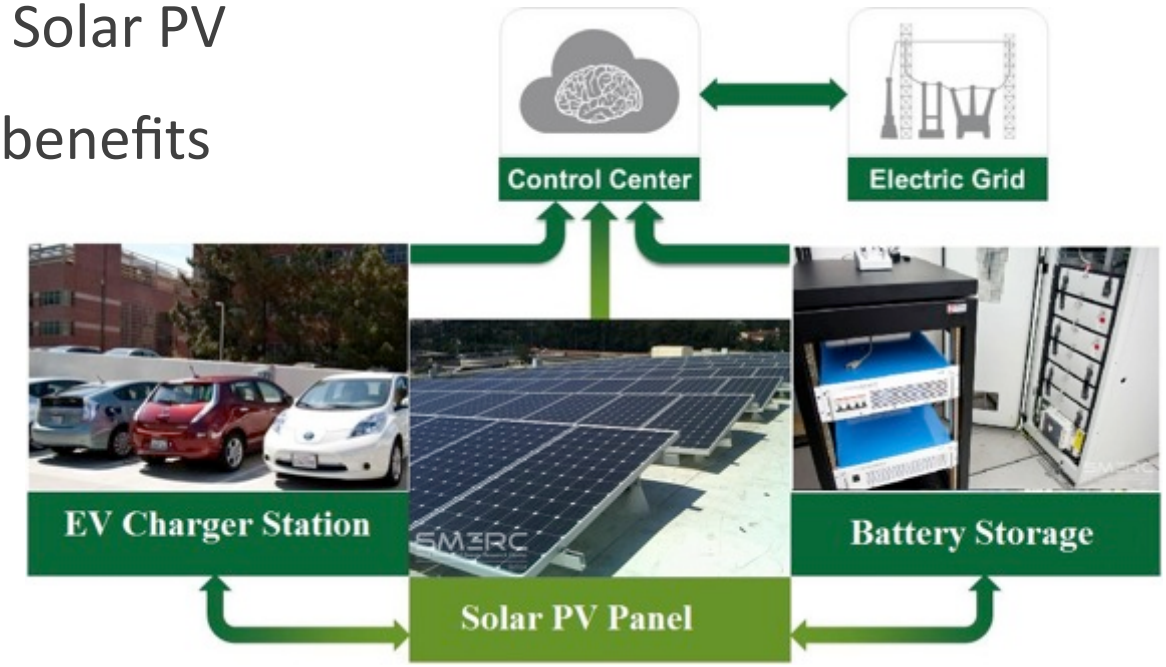


Project Demonstration Objectives

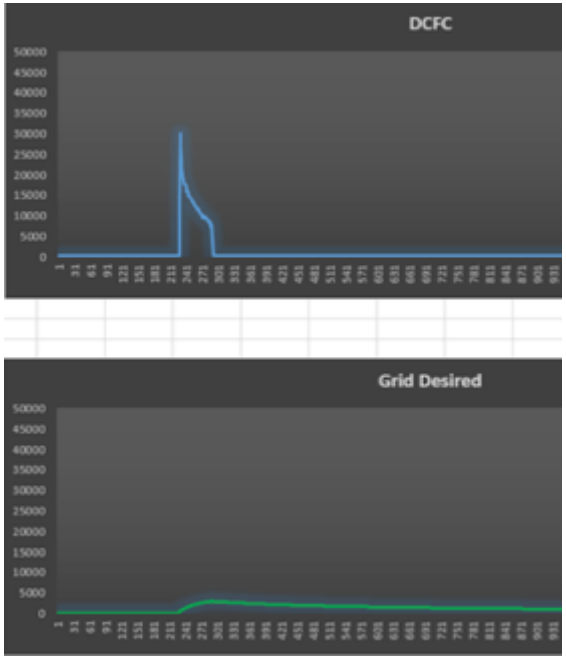
Demonstrate smart charging technologies, including:

- Bi-directional charging (G2V & V2G),
- Integration with BESS (Battery as Energy storage System)
- Integration with Solar PV

and quantify their benefits



BESS for modulation of DCFC



Project Scope – major tasks

1. General Project Tasks – reports and meetings
2. Software and Algorithm Development – SM, UCLA fleet
3. Modeling and Simulation
4. Developmental Testing in the UCLA Micro-grid
5. Field Installations - City of Santa Monica & UC hospital
6. Field Demonstration
7. Evaluation of Project Benefits
8. Technology/Knowledge Transfer Activities

Project Progress

2. Software and Algorithm Development

Plan:

- User Friendly Fleet Management Interface
- Personalized EV Charging/Discharging Management

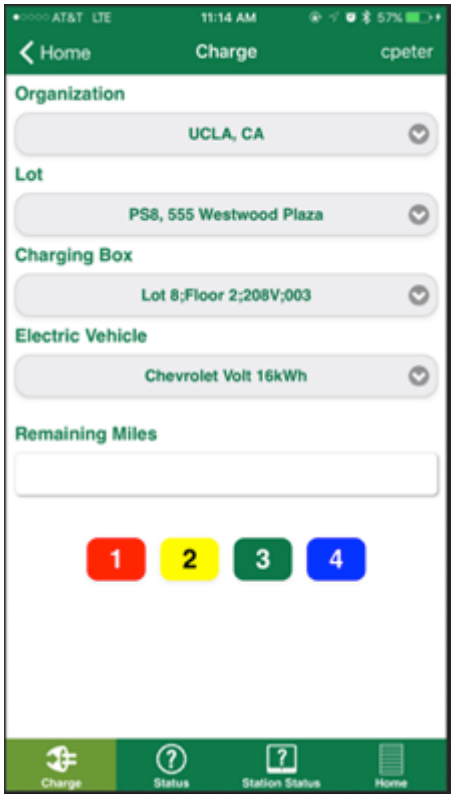
Control Center

iOS app

Project Progress

2. Software and Algorithm Development

Control Center



iOS app

Project Progress

3. Modeling and Simulation

Plan:

- Grid-Scale Impacts, Opportunities and Predictions
- Scale Up Emulation of EV Use Cases to Benefit Fleet Owners in IOU Territories

Project Goals

4. Developmental Testing in the UCLA Micro-grid

Plan:

- V2G and V2B technologies based on SAE 1772 and CHAdeMO standards
- Safety and Reliability Analysis of the V2G and V2B system
- API Deployment of V2G/V2B System Integrated into the control center
- User incentives for SC, V2G and V2B
- Communication Network for EV fleet
- Integration of IEC 61850 Standard into Distributed Energy Resources System
- Demand Response Participation with Bi-Directional EV Fleet Infrastructures
- Battery Energy Storage System Integrated Level 3 Charging Infrastructure

Project Progress

4. Developmental Testing in the UCLA Micro-grid
   - ✓ Accomplished Open ADR VEN 2.0a and 2.0b and SSL interface with control center.
   - ✓ Developing the control method for level 3 charger.
   - ✓ Implementing the control method for the level 3 charger based on the communication protocol.
   - ✓ Developing battery energy storage system control methodology.
   - ✓ Designing battery storage system configuration.
   - ✓ Reviewing quotations for current V2G and PMU technology and choosing available products for the project.

Project Progress

Designing the battery storage system configuration at SMERC lab

Project Progress

Developing control method for the level 3 charger at UCLA facilities

Project Progress

5. Field Installations - City of Santa Monica

- ✓ First pilot level 2 EV charger installed in Santa Monica Civic Center Parking lot
- ✓ Various software and hardware installs in progress

Project Progress

5. Field Installations - City of Santa Monica. Plan:

Project Progress

5. Field Installations - City of Santa Monica. Plan:

Project Progress

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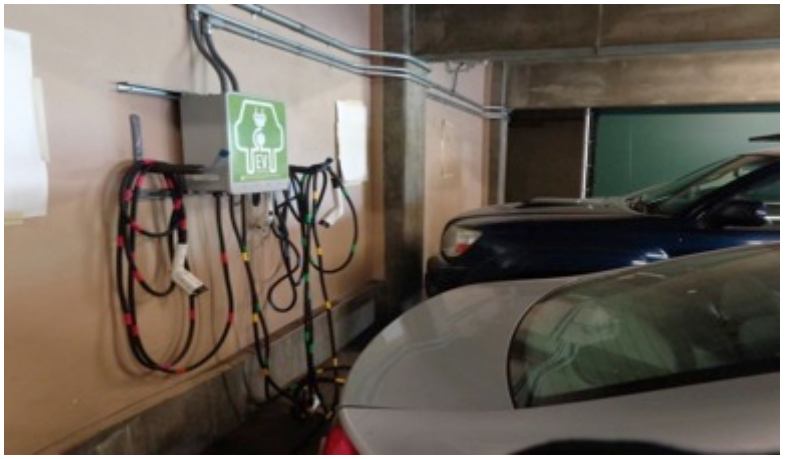
Project Progress

5. Field Installations - City of Santa Monica. Plan:

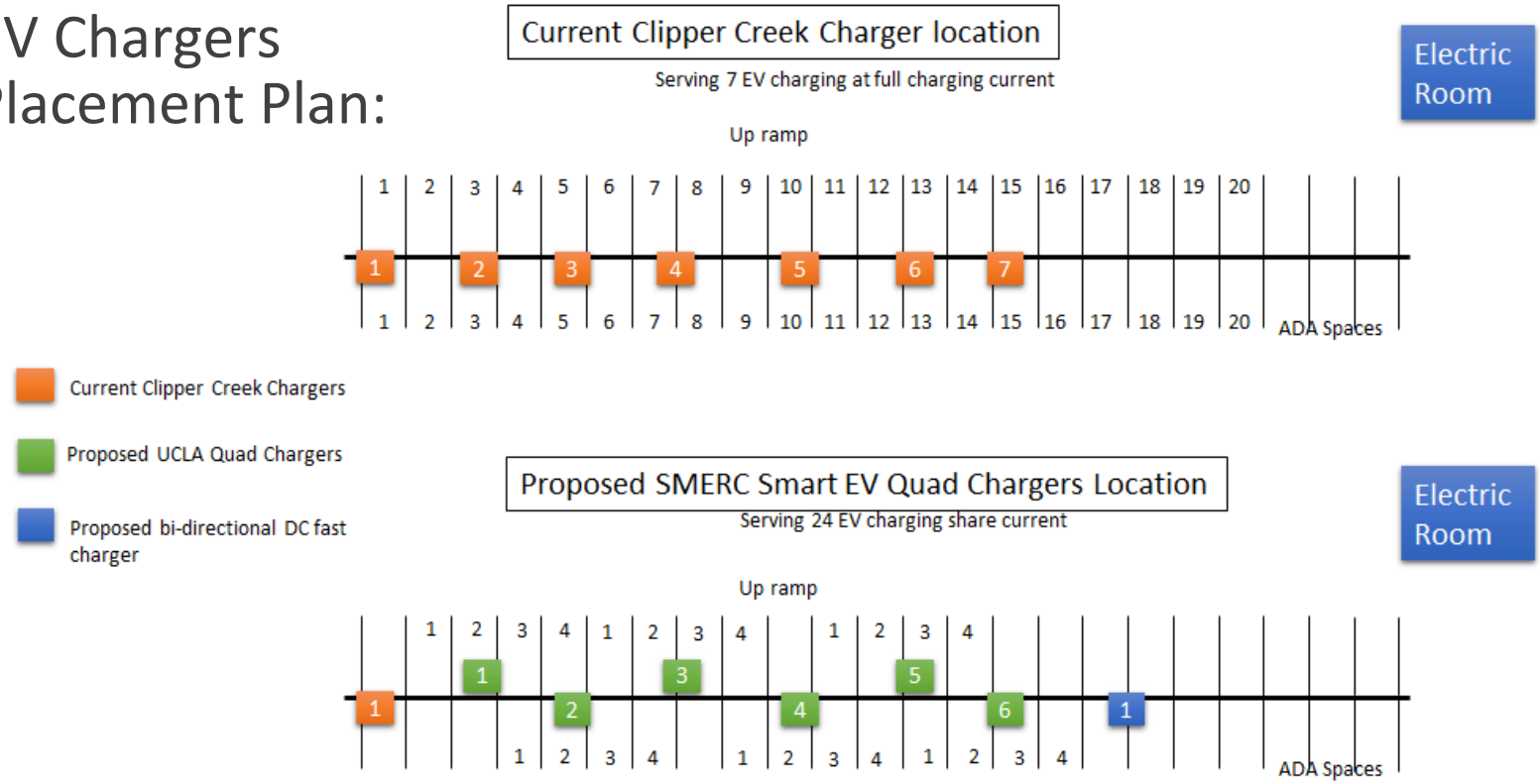


Project Progress

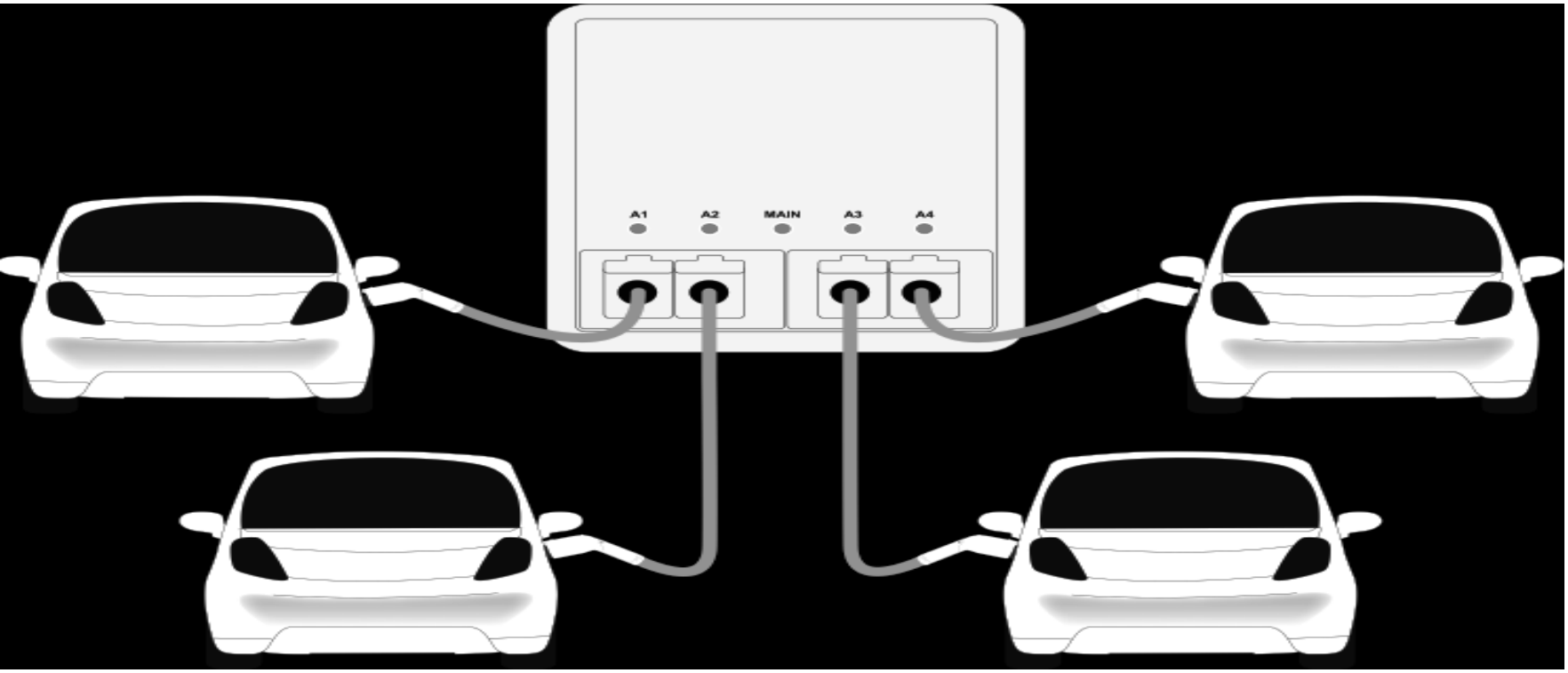
5. Field Installations - City of Santa Monica. Plan:

Project Progress

EV Chargers Placement Plan:



Optimized capacity utilization - 4 EVs charged at a time



Project Progress

6. Field Demonstration

Plan :

- Demonstrate advanced smart and bidirectional vehicle charging in a regional network
  - Vehicle-to-grid, with focus on two-way communication and energy flow.
  - Vehicle-to-Building test bed at UCLA utilizing EV fleet to support building loads.
  - Grid services - peak power to mitigate the California duck-curve.
  - Grid services - Automated Demand Response demonstration.
  - Grid services - Load leveling for level 3 charging with BESS.
  - Grid services - Bi-directional charging infrastructure with renewable solar generation and battery.
  - Grid services - peak shaving.
  - Grid services – congestion minimization.
  - Cost recovery - to maximize the fleet owner's benefits by enabling the SC, V2B, V2G and/or grid-service technologies.
- Collect 12 months of operational technical and economic data

Project Progress

7. Evaluation of Project Benefits

Plan:

(1) *Kick-off Meeting Benefits Questionnaire*;

(2) (2) *Mid-term Benefits Questionnaire*; and

(3) (3) *Final Meeting Benefits Questionnaire*

Project Progress

8. Technology/Knowledge Transfer Activities
   - ✓ Technology development in progress