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| **Description:** | Presentation by Noel S Crisostomo, CEC |
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Outline

• Motivations for Vehicle-Grid Integration
• Activities that Parallel and Inform the VGI Roadmap Update
• Progress upon Four Tracks: Policy, Economics, Technology, Customers
• Rising to the Opportunities of Vehicle-Grid Integration
• Accelerating Forward
Motivations for Vehicle-Grid Integration (VGI):
Widespread Transportation Electrification Requires VGI

Overarching VGI goals

• Reduce barriers to EV adoption:
  • saving drivers operational costs
  • reducing grid impacts to electricity users and utilities
  • creating opportunities for innovators to provide new customer services

• Hasten decarbonization and clean air benefits:
  • reducing electric sector GHGs by integrating renewable energy
  • Cutting harmful air pollution, especially in disadvantaged communities

Timeline of State Actions

• 2012: Executive Order B-16-2012 states “By 2020 EV charging will be integrated with the electricity grid”


• 2018: CEC initiates process to update roadmap
Activities that Parallel and Inform Roadmap: Inter-Agency Activities

Utility Interconnection Rule 21
- V2G – DC (Stationary Inverter)
- V2G – AC (Mobile Inverter)

Research & Analysis
- Electric Program Investment Charge (EPIC) Program
- Distributed Energy Resources (DER) Research Roadmap
- Working Group on Value
Activities that Parallel and Inform Roadmap: Inter-Agency Activities

**Rulemakings**
- Mobile Source Strategy + Regulations
- Transportation Electrification Framework
- Load Management Rulemaking
- Energy Storage & DER (ESDER) Initiatives

**Investment**
- CALeVIP
- Utility Programs
The Four Tracks: Policy, Economics, Technology, Customers

2014 Roadmap identified 3 tracks
- Policy – Interactions, barriers, and gaps in planning and determine interventions needed
- Economics – Compare benefits of charge management to facilitate business models
- Technology – Identify needs, delineating areas of commercialization vs. research

2020 Roadmap adds a new track
- Customers – Expand equitable access to VGI, simplifying smart charging “for all”
Progress upon Track 1: Policy

Source: CEC, CARB

CARB Regulation Begins Phase-In
Transition to Full ZEVs Required
Partial transition to ZEVs Envisioned
Executive or Legal Target

GHG Emissions relative to 1990
- Equal
- 40% below
- Net zero

Electricity Grid
- Zero carbon retail electricity: 33%, 50%, 60%, 100%

Charging infrastructure
- Ready for 1M EVs
- 250k 10k DCFC

Transportation System
- Light-duty: 1M, 1.5M, 5M
- Medium- and heavy-duty: 100k

Source: CEC, CARB
Progress upon Track 1: Policy

Transportation System
Ocean-going vessels at berth
- CARB Regulation Begins Phase-In
- Transition to Full ZEVs Required
- Partial transition to ZEVs Envisioned
- Executive or Legal Target

Source: CEC, CARB
Progress on Track 2: Economic Potential

Figure 5. Levelized Costs and Benefits for High Value Scenario Under Utility Control

Source: https://www.osti.gov/pages/servlets/purl/1557041
Progress on Track 3: Technology Development
Progress on Track 4: Customer Behavior

**Transportation cost burdens**

- Very low-income drivers in rural areas can spend 40-50% of their income on automobiles (left).
- The most burdened of very low-income transit riders in urban areas can spend over 10% of their income on transit (not shown).
- Cost savings from VGI could help these Californians the most.

*Source: U.S. Housing and Urban Development Department*
Rising to the Opportunities of Vehicle-Grid Integration

- Improve health and air quality in frontline communities
- Microgrids following the deployment of diesel generators
- Reliability amidst Public Safety Power Shutoffs
- DR during coastal heat grid overloads
- Resilience to drought and wildfire risks
- California’s commitment to below 2°C
- Prospective withdrawal from Paris Agreement
- Automaker transformations post-Dieselgate
- EVs warranted for V2G/X discharging
- 500-mile passenger EVs
- Million-mile batteries with plans for second lives
- Megawatt+ chargers for medium & heavy vehicles
- Wireless, mobile, off-grid, and service-based charging
- Mass, low-cost production of photovoltaics and clean generation
- Rapid scale-up of battery energy storage
- Increasing value of flexibility for high renewables
- Solid-state batteries without conflict materials
- Building electrification
- PV and load management within new construction
- Challenges in energization and interconnection
- Diversified investments from utility, oil, and gas companies
- Electric utility investment in charging
- Smaller, less costly charger power electronics
- Low-latency communication + onboard computing
- First-cost EV parity with combustion engines by mid-2020s
- Automation and sharing of vehicles
Accelerating VGI Forward: Today’s IEPR workshop

**Objective: Widespread Transportation Electrification**
- Learning from recent charging infrastructure programs (Panel 2)

**Enabler: Technology Capabilities and Dispersion**
- Facilitating advanced functions (Panel 1) and scaling to more drivers (Panel 3)

**Enabler: Diverse Market Opportunities**
- Encouraging new business models for infrastructure investments (Panel 4)
Accelerating VGI forward: Timeline to complete Roadmap Update

- Comments on workshop
  (July 15)
- Revisions incorporating related activities
- Draft Roadmap: Workshop + Stakeholder Comments
  (September TBD)
- Final Roadmap: Publication and Business Meeting Consideration
  (Anticipated November)
Thank You!

Questions?

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