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<th><strong>Docket Number:</strong></th>
<th>19-AB-2127</th>
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<tr>
<td><strong>Project Title:</strong></td>
<td>Implementation of AB 2127 Electric Vehicle Charging Infrastructure Assessments</td>
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<tr>
<td><strong>TN #:</strong></td>
<td>236574</td>
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<td><strong>Document Title:</strong></td>
<td>Presentation - AB 2127 - 2-5-2021</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
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<td><strong>Filer:</strong></td>
<td>Spencer Kelley</td>
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<td><strong>Organization:</strong></td>
<td>California Energy Commission</td>
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<tr>
<td><strong>Submitter Role:</strong></td>
<td>Commission Staff</td>
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<td><strong>Submission Date:</strong></td>
<td>2/2/2021 1:27:04 PM</td>
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<td>2/2/2021</td>
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Opening Remarks
Commissioner Patty Monahan
• 1:00: Opening Remarks, Commissioner Patty Monahan
• 1:10: EVSE Deployment and Grid Evaluation, Micah Wofford
• 1:25: Vehicle-Grid Integration, Noel Crisostomo
• 1:40: Connector and Communication Standards, Jeffrey Lu
• 2:00: Questions and Answers
• 2:30: Break
• 2:35: Tailoring Charging Solutions to Local Constraints, Raja Ramesh
• 2:45: Workforce Training and Development, Larry Rillera
• 3:00: Questions and Answers
• 3:25: Closing Remarks, Commissioner Patty Monahan
• 3:30: Adjourn
Questions & Answers

Please raise your hand and the moderator will unmute you.
Thank you! Questions or comments?

Contacts:
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Noel.Crisostomo@energy.ca.gov
Jeffrey.Lu@energy.ca.gov
Raja.Ramesh@energy.ca.gov
Larry.Rillera@energy.ca.gov

Webpage:
https://www.energy.ca.gov/programs-and-topics/programs/electric-vehicle-charging-infrastructure-assessment-ab-2127
EVSE Deployment and Grid Evaluation (EDGE) Tool

Micah Wofford
Associate Energy Specialist
Overview

• Context
  • Background and Purpose
  • Objectives

• Design
  • Data sources
  • Structure
  • Analytical Relationships
  • Allocation Methodology

• Results
  • Statewide Capacity Analysis
  • Distribution of IOU Circuit Capacities
  • EVI-RoadTrip Case Study

• Conclusion
  • Limitations and Future Work
  • Need for stakeholder engagement
Background and Purpose

• **AB 2127** – Assess infrastructure necessary to support 5 million ZEVs on CA roads by 2030

• Need to identify geographic locations to sufficiently, economically host charging stations

• “Early warning system”; focus infrastructure deployments and investment planning

• Iterative process which requires ongoing analysis
Objectives

• Cyclic deployment process flow – infrastructure for all
• Objectives of the analysis:
  • Minimize/mitigate grid impact
  • Achieve air quality improvement goals
  • Meet EV travel demand
  • Equitable deployment
• EDGE domains:
  • Grid impact
  • Air quality
  • Travel demand
  • Equity considerations
Data Sources

- EVI-Pro and HEVI-LOAD infrastructure quantification results
  - Foundation on which to layer other analyses and data
- **G** – Grid impact
  - Regional distribution grid hosting capacity – Grid Needs Assessment (GNA), Integration Capacity Analysis (ICA)
- **A** – Air quality
  - Energy Assessment Division (EAD) GHG emission factors
- **T** – Travel demand
  - Statewide vehicle stock – EAD Zero-Emission Vehicle and Infrastructure Statistics
- **E** – Equity considerations
  - Disproportionality analysis – SB 1000 assessment
  - Auto ownership burden – Location Affordability Index
## Structure

### Input Data
- Quantitative Models
- Grid impact
- Air quality
- Travel demand
- Equity considerations

### Processing

### Output Domains

<table>
<thead>
<tr>
<th>Spatial Unit</th>
<th>G – Grid</th>
<th>A – Air quality</th>
<th>T – Travel demand</th>
<th>E – Equity</th>
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<tbody>
<tr>
<td>Block Group</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Census Tract</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Traffic Analysis Zone (TAZ)</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>County</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td>Air Quality District</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utility Territory</td>
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</table>

EDGE
Analytical Relationships

Flow chart of related analyses
Allocation Methodology

Example EDGE output

Note: Charger data sourced from AFDC, not actual CEC analysis results
Example EDGE output

Note: Charger data sourced from AFDC, not actual CEC analysis results
Example EDGE output

Note: Charger data sourced from AFDC, not actual CEC analysis results
Results: Statewide Capacity Analysis
Distribution of IOU Circuit Capacities

Utility Territories
- Pacific Gas & Electric Company
- San Diego Gas & Electric
- Southern California Edison
- Data gaps (POUs and other IOUs)

Load ICA (MW)
- -6.3 - 0
- 0 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 8
- 8 - 9
- 9 - 10
- 10 - 35

Share of circuit segments

Capacity of circuit to integrate additional load (MW)

PG&E  SDG&E  SCE
Results: EVI-RoadTrip Case Study (SCE)
Limitations and Future Work

• Analytical Limitations
  • Gaps in available utility data
  • Currently no temporal component
  • Utility data integrity
  • Confidentiality concerns

• What is next for EDGE?
  • Include Grid Needs Assessment (GNA) and Distribution Deferral Opportunity Report (DDOR) datasets into grid impact analysis
  • Explore other domains
  • Develop use cases
Stakeholder Engagement

To improve upon EDGE’s development, we welcome stakeholder input:

• Additional data sources?
  • Travel volumes between origins and destinations
  • Grid capacity estimation and validation

• Use cases:
  • Smart charging
  • Air quality attainment
  • Carbon emissions intensity
  • Equitable deployment of infrastructure

• User interfaces – what features would be most user friendly?

• Working with utilities
  • Using the proper data for this work
  • Securing grid infrastructure data
Vehicle-Grid Integration

Noel Crisostomo
Air Pollution Specialist
Overview

• Charging Infrastructure Load Profiles
  • EVI-Pro 2 Business As Usual, 2030 and 2035
  • EVI-Pro 2 Alternative Futures, 2030
  • EVI-RoadTrip, 2035
  • HEVI-LOAD, 2020-2030

• Integration Objectives and Measures
  • Utility rate and grid management, via smart vehicles & equipment
  • Energy resiliency and new applications, via bidirectional charging
EVI-Pro 2 BAU – 5M ZEVs Midnight Time-Of-Use, 2030

Power (MW)

Hour of Day

Residential Level 1
Residential L2
Work Level 2
Public Level 2
Public DCFC
EVI-Pro 2 BAU – 15M ZEVs (CARB)
Charge By Departure, 2035

Power (MW)

Hour of Day

- Residential Level 1
- Residential Level 2
- Work Level 2
- Public Level 2
- Public DCFC
# Alternative Futures Overview

<table>
<thead>
<tr>
<th>Values for Year 2030</th>
<th>Core Forecast Scenarios</th>
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<tbody>
<tr>
<td></td>
<td>Low (1.9M ZEVs)</td>
</tr>
<tr>
<td>Business as Usual</td>
<td>~375k chargers</td>
</tr>
<tr>
<td>Unconstrained</td>
<td>N/A</td>
</tr>
<tr>
<td>No TOU Participation</td>
<td>N/A</td>
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<tr>
<td>Gas Station Model 40% w/ residential access</td>
<td>N/A</td>
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<tr>
<td>Level 1 Charging Enabled at work &amp; public</td>
<td>N/A</td>
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<tr>
<td>PHEV eVMT Maximization Charge at every stop</td>
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EVI-Pro 2 Alternative Future Unconstrained, 2030

Power (MW) vs. Hour of Day

- Residential Level 1
- Residential Level 2
- Work Level 2
- Public Level 2
- Public DCFC
EVI-Pro 2 Alternative Future Gas Station Model, 2030

Power (MW)

Hour of Day

- Residential L1
- Residential L2
- Work L2
- Public L2
- Public DCFC
EVI-Pro 2 Alternative Future Level 1 Charging, 2030

- Residential Level 1
- Residential Level 2
- Work Level 2
- Public Level 2
- Public DCFC
- Work Level 1
- Public Level 1

Power (MW) vs Hour of Day
EVI-RoadTrip, 2035
Surges Soak the Sun; Seek Storage

Network-wide Charging Load (MW) Profiles

2035 High ATO
2035 High TPM

Intra-Hour Variation of Network-wide Charging Load (MW) Profiles

Hour of Day
charging pattern by vehicle types (results_HCD_MSS_2020)

- Medium-Duty Truck
- Agriculture Truck
- Other Freight Truck
- Construction Truck
- Utility Truck
- Tractor-trailer
- Drayage truck
- Refuse truck
- Bus
Smart Charging for Reliability, Cost, and Greenhouse Gas Savings

Manage System or Circuit Capacity

Integrate Renewable Energy

SCE T018-EV1

SDG&E TOU18
Increase Energy Resiliency

• August 27, 2020: 2/3 of portable gasoline generators <18 kW noted online at Home Depot sold out

• September 2-9, 2020: -37% in CAISO solar generation (v. 2019) due to wildfire smoke

• Need zero-emission alternatives during emergencies that are also extensible for other vehicle-grid integration benefits
Bidirectional Charging: Vehicle-to-Home, Building, Grid

2.0 Kilowatts

<table>
<thead>
<tr>
<th>Task</th>
<th>1.00kW</th>
<th>2.00kW</th>
<th>Usage</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>Fencing</td>
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</tr>
<tr>
<td>Landscaping Crew</td>
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<tr>
<td>Football Tailgating</td>
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2.4 Kilowatts

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<th>2.00kW</th>
<th>Usage</th>
<th>Notes</th>
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<tbody>
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<tr>
<td>Masonry Crew</td>
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<td>Neighborhood Drive-in</td>
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7.2 Kilowatts

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<th>Task</th>
<th>1.00kW</th>
<th>2.00kW</th>
<th>Usage</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>Framing a House</td>
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<tr>
<td>Metal Shop Crew</td>
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<tr>
<td>Day at the Park</td>
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Vehicle-to-Grid Recommendations

- Support bidirectional charging by confirming paths for inverters designed for mobile energy storage
- Possibly leverage the CEC’s Solar Equipment Lists
- Streamline interconnection pathways that accommodate AC and DC discharge

- Unlock greater revenue generating opportunities with bidirectional technologies
  - Alleviate local congestion
  - Switching from grid to V2B during extreme demand

- More to come in the 2021 Vehicle-Grid Integration Roadmap Update…
Subpar Existing Conditions

Lots of siloes
  Multiple **connectors**
  Physical **keycards**
  Lots of **apps**

At best, **not maximally convenient**
At worst, **confusing and discouraging**

---

*I can use any charger, right?*
*Can’t I just get a universal adapter on Amazon?*

*All I need to do is plug in?*
*Wait, do I have to download another app?*
Multiple Fast Charge Connectors

Similar primary purpose, three different implementations

Fragmentation will necessitate **even larger charger network size**
- More money, more time, no tangible climate or air benefits!
The Market Has Decided

By MY 2022, **51 of 59 EV models** available in California will use **CCS**

→ Align technical requirements with **market** and **CARB rulemaking**
Emerging MD/HD Standardization

• Early adopters complain of widespread incompatibility
• Some repurposing of light-duty connectors (such as CCS)

• Standards for different form factors
  ▪ Conductive – Megawatt Charging System
  ▪ Pantograph – J3105
  ▪ Wireless – J2954

→ Prioritize chargers which conform to existing and pending standards
Ensure Hardware Readiness for Future Charger-Vehicle Communication

LOW-LEVEL COMMUNICATION

• Widely used today
• No authentication, billing, departure time, or grid signals
• Driver responsible for baseline knowledge and manual inputs

HIGH-LEVEL COMMUNICATION

• Growing use of ISO 15118
• Broad market direction
• Plug and Charge in near term
• Supports smart, bidirectional, wireless charging too

Prioritize charger hardware readiness for ISO 15118 communication
Widespread VGI is **predicated on the ability of vehicles and/or chargers to receive information** about driver needs, electricity rates, power availability, demand response, carbon intensity, and so forth.

- Standardizing around ISO 15118 **maximizes VGI opportunities**
- ISO 15118 can also **complement** other technical implementations!

> Prioritize ISO 15118-ready chargers for **all drivers in all communities**
Networked Chargers with OCPP Maximize Choice and Management Features

Open Charge Point Protocol avoids lock-in and enables greater choice
- Site host can pick mix of chargers to use with their management solution
- Site host can pick management solution to use with their mix of chargers

Networking enables rich management features
- Access and priority
- Billing and payment
- Reservations
- Grid signals

Prioritize OCPP-compliant chargers
Questions & Answers

Please raise your hand and the moderator will unmute you.
Break

Return at 2:35
Tailoring Charging Solutions to Local Constraints

Raja Ramesh
Air Pollution Specialist
How do we ensure charger deployment is equitable and effective?
‘Best Fit’ Approach
Community- and Equity-Centric Planning

- Greenlining Institute’s Participatory Budgeting
- CARB’s Community Outreach Guidance
- CEC’s EV Ready Community Blueprints
What Tools Can We Use to Achieve this Vision?

- Building Codes
- Streamlining Permitting
- Public Funding

Streamlined Jurisdictions
(Numbers of cities and counties)

Streamlined: 123
Streamlining in Progress: 155
Not Streamlined: 262
Workforce Training and Development

Larry Rillera
Air Pollution Specialist
1.5 million chargers are needed to support the nearly 8 million ZEVs required under the new Executive Order.

157,000 chargers are needed to support 180,000 medium- and heavy-duty vehicles needed in 2030.
Clean Transportation Program: Workforce Portfolio

Workforce Portfolio
- Approximately $35 M invested
- State Workforce Partners
- Over 20,000 trainees: transit agencies, municipal fleets, independent repair shops, car dealerships, freight sector, schools, Electric Vehicle Infrastructure Training Program, and charger infrastructure contractors
- Equity

Manufacturing Portfolio
- Approximately $55 M invested
- About 14,000 jobs across 34 ZEV-related companies
- Electric vehicle infrastructure manufacturers
AB 2127: Workforce

- Develop workforce to support charging infrastructure deployment
- The State must seek to align PEV charging with renewable energy generation
- Growing electrification of the medium- and heavy-duty sectors
- Planning for California’s local and community charging infrastructure needs
- Consider whether any incremental workforce training is needed to support the scale of transportation electrification infrastructure installation

Photos: KIGT Inc.
AB 2127: Workforce (cont.)

**Project Milestone Activities**

- Site Design / Engineering
- Project Review / Approval
- Demolition / Construction
- Installation
- Commissioning
- Operation
- Maintenance

**Key Occupations**

- Private Engineer
- Municipal Engineer
- Project Contractor
- Construction Apprentice
- Electrician
- Electrician Apprentice
- Technician
- Environmental Planner
- Land Use Planner
- Building Code Enforcement
- Utility Engineer
- Inspector
Workforce Considerations

- Equity: Geographic, Population, Economic, Environmental
- AB 841: Electric Vehicle Infrastructure Training Project
- CARB Clean Transportation Regulations
- Putting California on the High Road: A Jobs and Climate Action Plan for 2030
- Just Transition Roadmap
- Market and Technology Advancements
Questions & Answers

Please raise your hand and the moderator will unmute you.
Submit Comments to Docket 19-AB-2127

Electronic Commenting System

Comment by E-mail
E-mail: docket@energy.ca.gov
Subject Line: “Workshop on Assembly Bill 2127 Electric Vehicle Charging Infrastructure Assessment”

All comments due by 5:00 pm on February 26, 2021

* If answering or providing comments on a specific matter included in this presentation, please reference the workshop session (date) and slide number.