

**DOCKETED**

<b>Docket Number:</b>	19-AB-2127
<b>Project Title:</b>	Implementation of AB 2127 Electric Vehicle Charging Infrastructure Assessments
<b>TN #:</b>	243106
<b>Document Title:</b>	CEC V2G Inverter List Workshop Slides
<b>Description:</b>	***This Document Supersedes TN 243086 ***
<b>Filer:</b>	Spencer Kelley
<b>Organization:</b>	California Energy Commission
<b>Submitter Role:</b>	Commission Staff
<b>Submission Date:</b>	5/17/2022 8:29:38 AM
<b>Docketed Date:</b>	5/17/2022

# Vehicle-to-Grid (V2G) Inverter List Workshop

California Energy Commission



10:00 a.m. – 11:45 a.m.

May 17, 2022



# Welcome

V2G Inverter List Workshop  
We will begin at **10:02 a.m.**

**10:02 a.m.** | Jeffrey Lu, CEC  
Introduction and background + Q&A

**~10:15 a.m.** | Roger Salas, SCE  
Rule 21 and bidirectional chargers + Q&A

**~10:40 a.m.** | Jeffrey Lu, CEC  
Discussion: V2G Inverter List design

*Attendees are encouraged to participate in live discussion!*

**~11:10 a.m.**  
Other Q&A and public comment



# Inverters integrate distributed energy resources with homes and the grid

- Many distributed energy resources deliver direct current (DC) electricity
  - Rooftop solar photovoltaics
  - Stationary battery systems
  - An electric vehicle's onboard battery
- An **inverter** converts the DC electricity to alternating current (AC) electricity, which is compatible with household electrical systems and the local grid
- CEC maintains the [Solar Equipment Lists](#), which track inverter models that **meet minimum safety and performance standards**
  - These lists were established under Senate Bill 1
  - These lists do not include inverters used for bidirectional charging, or what we call **V2G inverters**





# CEC lists have been used to support interconnection processes

- CEC's Solar Equipment Lists primarily track two inverter parameters:
  1. **Safety and grid support** capabilities (that is, UL 1741 SA, SB)
  2. **Performance** (such as efficiency; determines incentive eligibility)
- Utilities determine interconnection requirements for generating devices (such as V2G inverters)
  - Requirements are described in **Rule 21** for California's investor-owned utilities
  - There is overlap between CEC listing parameters and Rule 21 requirements (notably, UL 1741 SA, SB)
  - CEC lists can be used to streamline interconnection processes
  - CEC does not determine interconnection requirements



# CEC intends to establish a V2G Inverter List

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- Stakeholders have asked CEC to track V2G inverters
- The new list would mirror existing CEC listing processes to the extent appropriate (similar forms, fields, and so on)
- **Today's discussion will help determine which parameters such a V2G Inverter List should track**
  - The design of the list will determine needed staff resources to review inverter applications and maintain the V2G Inverter List
  - No estimated launch date (yet)



# Key remaining questions

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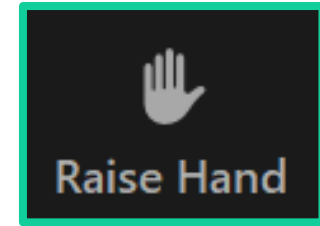
1. Which certifications should the V2G Inverter List track at launch? UL 1741, UL 1741-SA, UL 1741-SB, or a combination thereof?
2. To what extent should the V2G Inverter List attempt to accommodate onboard inverters (AC V2G) at launch, versus focusing on offboard inverters (DC V2G)?
3. Should the V2G Inverter List track the model numbers of chargers that contain inverters, or the model numbers of the inverters themselves?
  - If the former, how would the list accommodate onboard inverters?
  - If the latter, how would a charger manufacturer prove that a listed inverter is indeed used in a particular charger model?
4. Should any parameters besides UL certification be tracked as part of the V2G Inverter List? For example, connector type, communication standards, and so on?



# Any clarifying questions?

Please raise your hand to share your thoughts

- Phone: \*9 to raise/lower hand, \*6 to unmute/mute
- Zoom: Click **Raise Hand** and we will enable your audio



Questions about **V2G Inverter List**:

- Jeffrey Lu, [jeffrey.lu@energy.ca.gov](mailto:jeffrey.lu@energy.ca.gov)
- Adeel Ahmad, [adeel.ahmad@energy.ca.gov](mailto:adeel.ahmad@energy.ca.gov)

Questions about **existing CEC listing processes**:

- Solar Equipment List team, [SolarEquipment@energy.ca.gov](mailto:SolarEquipment@energy.ca.gov)
- Current list and request forms: <https://www.energy.ca.gov/programs-and-topics/programs/solar-equipment-lists>



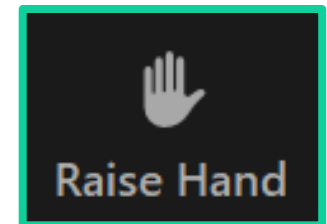


# Discussion

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*Attendees are strongly encouraged to participate!*

- We will discuss each of the questions posed earlier
- Please raise your hand to share your thoughts
  - Phone: **\*9** to raise/lower hand, **\*6** to unmute/mute
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# Question 1: UL 1741 versions

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Which certifications should the V2G Inverter List track at launch? UL 1741, UL 1741 SA, UL 1741 SB, or a combination thereof?

Considerations:

- UL 1741 SA is required for grid support inverters today (Rule 21).
- UL 1741 SB will be required for grid support inverters soon.
- UL 1741 is allowed for Emergency Load Reduction Program participation.



## Question 2: Planning for AC V2G

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To what extent should the V2G Inverter List attempt to accommodate onboard inverters (AC V2G) at launch, versus focusing on offboard inverters (DC V2G)?

Considerations:

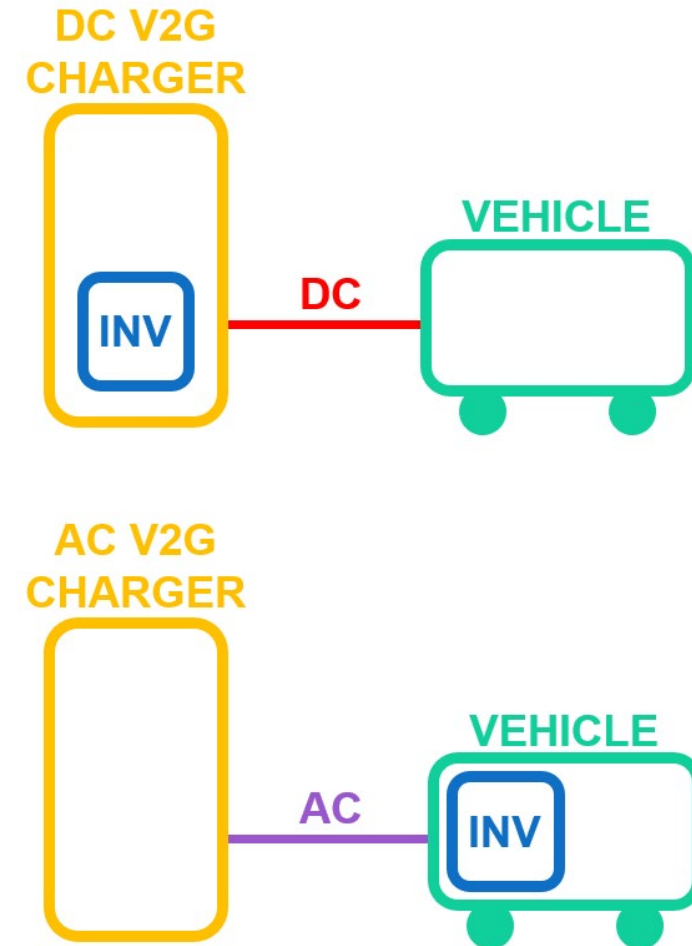
- No standard interconnection pathway exists for AC V2G today.
- Offboard chargers for DC V2G are available and choices are growing.



# Question 3: Model numbers

Should the V2G Inverter List track the model numbers of chargers (that is, electric vehicle supply equipment) which contain inverters, or the model numbers of the inverters themselves?

- If **charger** models, how would the list accommodate future onboard inverters?
- If **inverter** models, how would a charger manufacturer prove that a listed inverter is indeed used in a particular charger model?





# Question 4: Other parameters

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Should any other parameters besides UL certification be tracked as part of the V2G inverter list? For example, connector type, communication standards, and so on?

Considerations:

- Housing all information in centralized list could be useful.
- On the other hand, parameters such as connector type do not affect interconnection. The list's primary goal is to streamline interconnection.



# Other feedback and questions?

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**Anything else you'd like to discuss?**

Please raise your hand to share your thoughts or ask questions.

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- Adeel Ahmad, [adeel.ahmad@energy.ca.gov](mailto:adeel.ahmad@energy.ca.gov)

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- Current list and request forms: <https://www.energy.ca.gov/programs-and-topics/programs/solar-equipment-lists>