

**DOCKETED**

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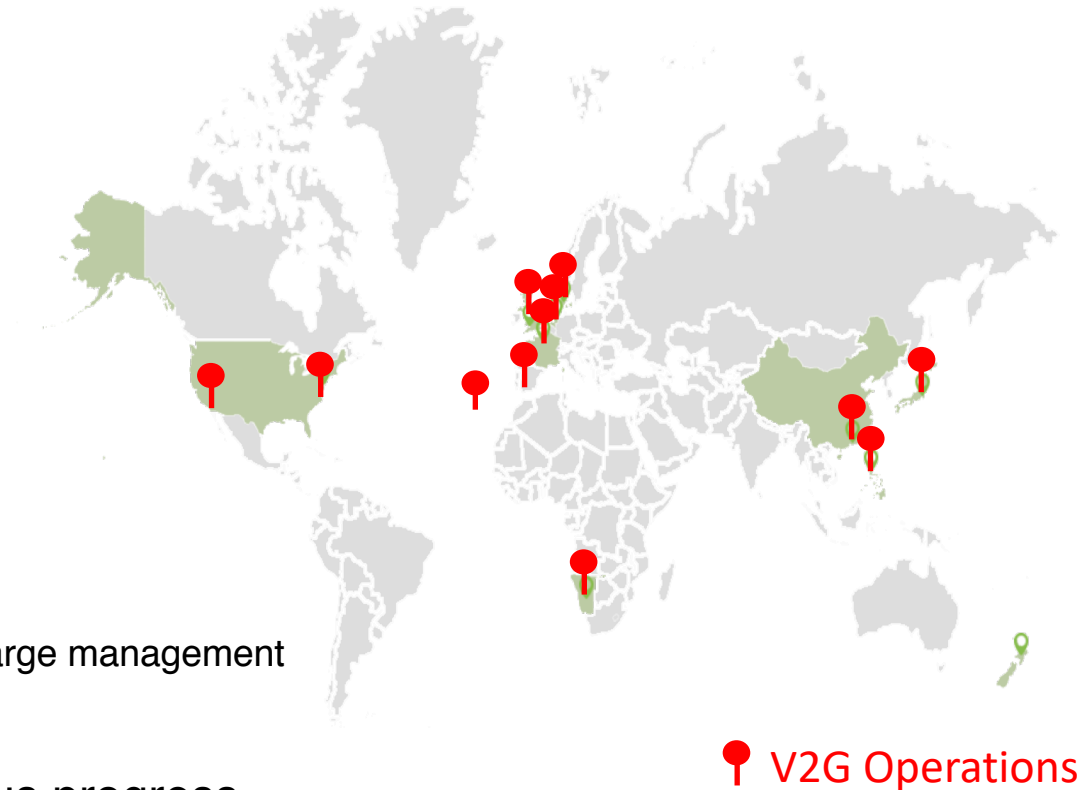
# CEC Workshop on V2B for resilient backup power

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# V2G World Overview: Markets developing

- Interest in bi-directional EVs around the world
  - EV markets
  - High DER penetration
  - Islands
- UK, France, Denmark, Japan, California:
  - UK: Demand response and rate optimization
  - Japan: Reactive power and demand response
  - Denmark: Frequency regulation
  - France: Wholesale and retail optimization
  - California: Experimenting with solar optimization, demand charge management
- Policy ricochets across the world, building on previous progress
  - Inverter standards
  - Baselineing
  - Market structures

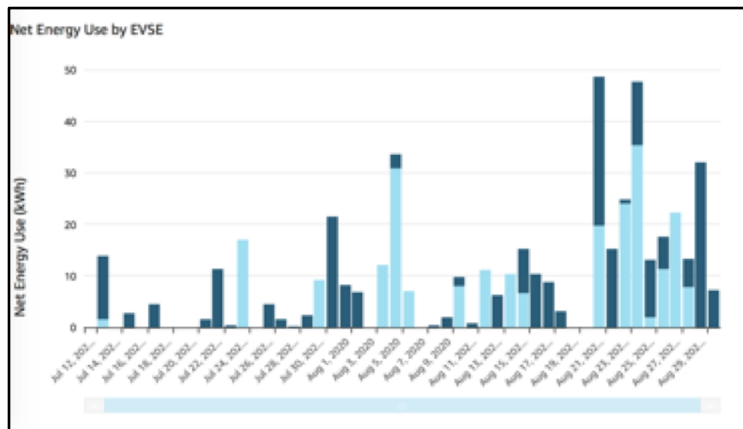


# Example School Bus Projects

## Franklin-McKinley SD



### Time of Use



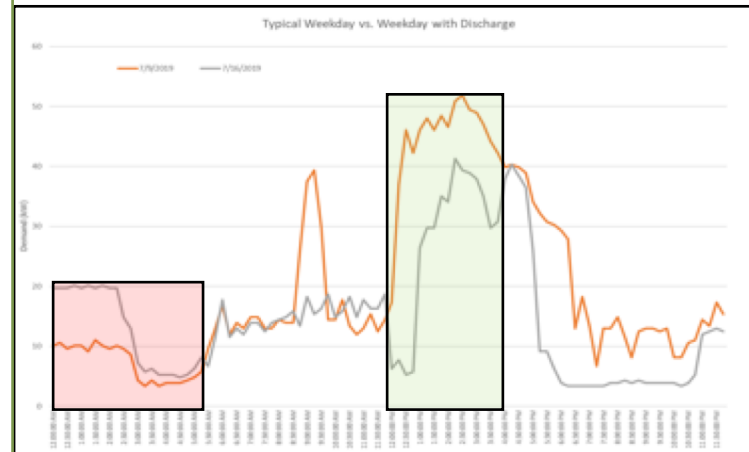
*Charge off-peak*

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## Torrance Unified SD



### Demand Charge Management



*Charge at night*

*Discharge at peak*

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## Con Edison V2G Pilot



### Demand Response



*Discharge with utility signal*


NUVVE

# Nuvve Commercial V2G Bus offer

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- Standard V2G School Buses are available

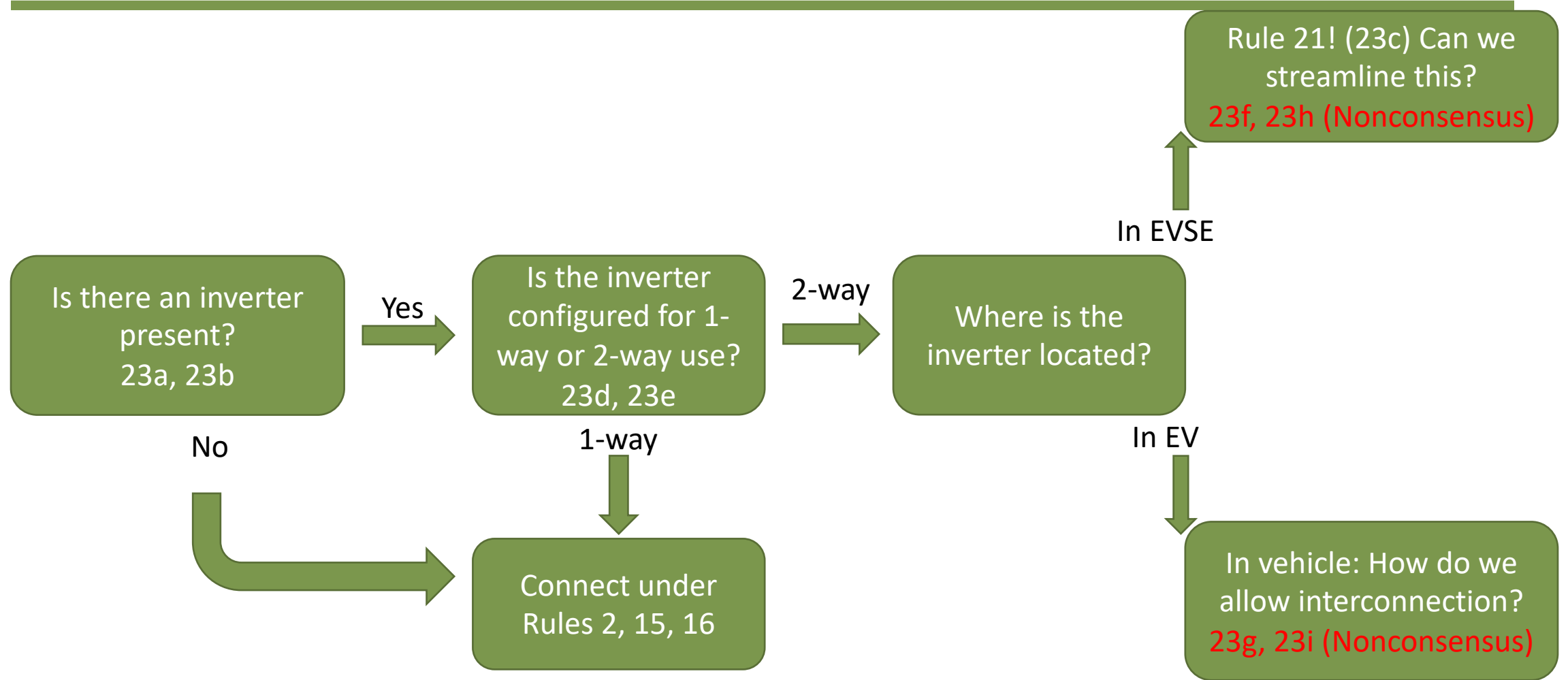


- Certified UL1741 SA V2G chargers are available 
- Nuvve is proposing complete offers for V2G installations today that include:

- Installation
- Chargers
- Buses
- Financing



# California Interconnection



# Where are we now

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- Regulatory structure for interconnection is being set
  - Yay!
  - CAUTION: We cannot ignore the practical questions once we have technical approval
- Pilots in a variety of use cases
  - DANGER: Death by pilot
    - How do we spread experience without starting from zero every time
- Commercialization requires contextualization
  - See next slide...

# Where are we now continued...

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- Business case is complex because systems and business structures are still designed around centralized generation and largely uncontrolled loads
- TOU rates, transportation electrification programs, net metering, demand response programs
  - Not designed to account for or exploit this type of device/capability
- Transmission level: FERC 2222
  - FERC cannot complete the job without PUCs doing their part
  - Wholesale design can be perfect, retail disincentives can still prevent access
- Solar optimization
  - INVENT is showing that the value to the customer does not reflect the value to the system
  - Example of lack of incentive to engage in V2G activities



# V2H:

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- Not really an on-ramp
- Interconnection:
  - “Can we hide behind the house load?”
    - No: If it’s not interconnected, you can’t use it as a charger, or optimize anything
  - “If it is interconnected, can we then switch the grid-forming for back-up?”
    - Utility questions around changing from grid-integrated to grid-forming mode?
    - How to island in an orderly manner
  - Goldilocks scenario: Use as a charger when grid is up, don’t do grid study for interconnection because EV will only be bi-directional for back-up power
    - The switch from uni-directional to bi-directional can’t currently be done in this way
    - Even with UL PCS CRD 2019, firmware change require to change modes (van roll)?
- Emergency back-up
  - Logical? Yes
  - Best fit? Not necessarily
  - CAUTION: This should not be the marquee application for this technology
    - The place of Evs and V2G in the energy ecosystem is much larger than this one application

# Thank You

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