

DOCKETED

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Ford Vehicle to Grid & Vehicle to Building Outlook

Desired Outcome for Discussion:

- **Outline EV market evolution**
- **Understand how Ford's BEV lineup supports V2L**
- **Case for exporting DC to support Vehicle to Building**

Electric Utility Perspective

Utilities continue to renovate the grid with investments in renewable energy technology.

40%

of all new electricity generating capacity added in the U.S. in Q1 2020 was Solar (3.6 GWdc of PV)

By 2025

33% of new residential solar systems and 25% of new non-residential solar systems will be paired with energy storage

Effects of Environmental Factors

Mismatched Energy Production & Demand

Renewable sources produce energy when the sun shines or wind blows.



Grid Disruption

Weather events temporarily disable/prevent grid to customer distribution.



Key Consideration

Continued renewable generation growth will drive a need for careful load management, and for energy storage



EV Consumers Perspective

Future Reality



Current State

EVs (e.g. MachE) have large batteries:
+70 kWhr

Solar



to capture
energy when
its available

Electrical Storage



to distribute
energy

Daily Commute

EV drivers will use only a small portion of their total battery
capacity 10%-15% for the average commute

Could Large-Capacity BEVs help support power needs via V2H, V2G?

Ford BEV Historical Lineup



Focus Electric (2009-2017)
 Range: 70-120 miles
 Battery Size: 23-33.5 kWh

Mach-E (2021-)
 Range: 230-300 miles
 Battery Size: 68-88 kWh

F-150 (2022-)
 Range: ? miles
 Battery Size: ? kWh
 Pro Power: ? kWAC

E-Transit (2022-)
 Range: ~126 miles
 Battery Size: 67 kWh
 Pro Power: 2.4kW AC

Daily driver/commuting



Commercial / Fleet customers

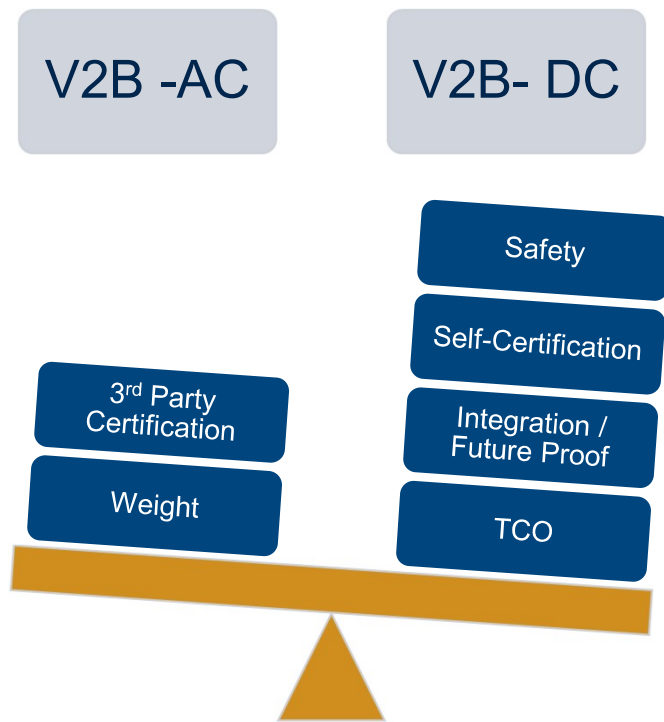
Power Export for Job Sites.

F-150 Hybrid : Pro Power Feature
 2.4KW Standard on PowerBoost™ / Outlets in bed: Dual 120V 20A
 7.2KW Optional on PowerBoost / Outlets in bed: Four 120V 20A,
 one 240V NEMA L14-30R

- Gradual increases in both range and available battery capacity
- Vehicle to Load historically unavailable



Considerations for Exporting Power (V2B)



Vehicle to Load AC Export

- Requires onboard mobile inverter for bidirectional flow
- Communication to grid could be handled by vehicle
- Requires further certification work for automakers
- Larger portion of costs attributed onboard the vehicle (Package, Thermal Mgmt)
- Ford does not recommend using AC for home backup
- Small local benefits to consumers

Vehicle to Building DC Export

- Uses stationary inverter on electric vehicle supply equipment (EVSE)
- Grid Monitoring and Communication managed off-board
- Already established devices in the market
- Larger portion of costs attributed offboard the vehicle
- Larger benefits to consumers and utilities
- Ford recommends DC for energy backups

Challenges with Vehicle to Building/Exporting Power

- Technology onboard vehicles needs development and uniform standards adoption
- Inverters are generally expensive (thousands of dollars)
- Warranty concerns surrounding added battery cycling
 - Differences between V2L vs. V2B
 - Battery Durability Requirements
- Certification and Regulatory authority over automobile electrical systems.
 - Need to develop complete certification structure for automakers
- Cost – Onboard Inverter cost is more expensive than Off board inverter.
 - Overall cost system cost dependent upon architecture.
 - Typical cost drivers : Inverter sizing > 10KW, Critical Load Sub panel, Transfer SW.



How can the CEC help ?

- Consider allowing automaker self-certification
 - Allows for more streamlined approvals
 - Limits unnecessary cost increases on vehicles
- Incentives for vehicle to grid adoption
 - CARB could consider a credit mechanism for GHG abatement
 - Incentives for automakers, customers, etc.
 - Warranty based on a mix of Amp-hrs / vehicle miles
- Help deliver a strong, consistent signal to the market for widespread deployment
 - Update Rule 21 to streamline interconnection.



Regulatory certainty will accelerate development and adoption of V2H technologies

Q & A

