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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

Solar

to capture energy when its available

Electrical Storage

to distribute energy

Current State

EVs (e.g. MachE) have large batteries:

+70 kWhr

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

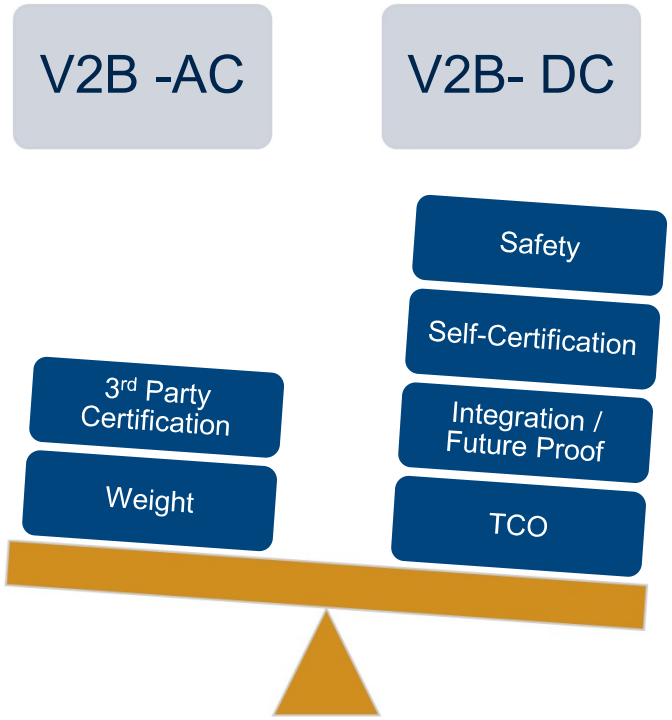
Commercial / Fleet customers

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