# Deep Decarbonization of Commercial (On-Highway) Transportation

- Vehicles and Candidate Technologies
- Infrastructure Implications
- Business and Public Policy/Regulations

# Commercial Transportation Vehicles




te Action Symposium, February 25, 2020

# Candidate Power Technologies

- Battery Electric – Product credible up through Urban Class 7 tractors
- Fuel Cell Hybrid Electric – Bridge /Range extender where batteries cannot make a full shift / route
- Biofuels – Biofuels – includes alcohols, but “drop-in” important for Intercity Class 8 and legacy fleet (*and not “all or nothing”*)

# BEVs Being Introduced / Demonstrated Now




# Infrastructure Implications

- Grid capacity
- Grid $CO_2$
- Local charging infrastructure

# Grid Capacity and Transportation Demand (EIA Data)

- US Retail electricity delivery = 13 quads
- On-highway transportation consumption = 22 quads
- Assume electric vehicles are 3x as efficient vs gasoline (EERE) and 2-2.5x diesel (JCW) and setting aside intercity Class 8 —> 6.5 quads electricity demand
- **US Retail electricity bulk generation and delivery must increase 50%** (…ish, not accounting for battery charging losses…) **to support personal and urban commercial vehicle electrification**

# Grid Capacity and Transportation Demand (EIA Data)

- "Data plate capacity" of US grid ~ 1TW @ 24/7 → ~30 quads
- → ***So what's the problem?***
- Current grid is ~30% efficient (38 quads in → 13 out!!)
- 2/3 fossil, half that coal
- Gas turbine "peakers" less efficient than on-road diesels, even before transmission and battery in/out losses
- "Duck curve" defines charging schedule on "hot days"
- → ***That's* the problem**

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Grid-scale storage for "dispatchable intermittent renewables"

# Infrastructure Implications

- Grid capacity
- Grid $CO_2$
- Local charging infrastructure
- Fuel Infrastructure (especially Hydrogen)
  - CNG “Model”

# Business/Public Policy/Regulation

- Driving force cannot be purely business economics
- Good regulatory policy creates a “level playing field” for businesses and drives technology innovation and introduction
- ***Looking back*:** EPA, CARB, progressive businesses drove Diesel NOx and PM down 99% over two decades and created new jobs in the process
- **How to duplicate this going forward for “deep decarbonization” *across sectors?***