ACT NEWS

Advanced Clean Tech News
FOR THE COMMERCIAL TRANSPORT SECTOR

# Regulations and Technology Considerations for Heavy-Duty Zero-Emission Vehicles

**Today's webinar will start at:**

**10 a.m. PT / 1 p.m. ET**

In Coordination With

PORT of SAN DIEGO

# Before we get started

## Q&A

Submit your questions to the host using the Q&A box in the upper right-hand corner.

## Presentations

A recording of today's webinar will be posted on the ACT News website, and you will be emailed a link by early next week.

## Survey

A 30-second survey will pop-up at the end. We appreciate your feedback!

## Technical Issues

Contact Stephane Babcock at Stephane.Babcock@gladstein.org or 424-363-0341 for assistance.

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# Regulations and Technology Considerations for Heavy-Duty Zero-Emission Vehicles

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# Advanced Clean Fleets Rule Drayage Trucks

California Air Resources Board

# ZEV Drayage Fleet Overview

Transition all Class 7 and & 8 trucks operating at California intermodal seaports and railyards to full ZE by 2035

How?

| | |
|---|---|
| Extend current Drayage Truck Rule/Registry mechanism to prohibit non-ZE truck access | Starting 1/1/24, all new trucks registered in the Drayage Truck Registry must be ZE |

# Drayage Fleet Details

Must be registered in the Drayage Truck Registry (DTR).

- All current drayage trucks must achieve MY 2010 engine standards by December 31, 2022
- They will not be DTR compliant unless they visit a California seaport or railyard at least once in 2024 (and annually thereafter)

**Starting January 1, 2024:**

- Only zero-emission trucks can be added to the Registry
- Beginning January 1, 2035, all drayage trucks must be ZEV

**Current MY 2010+ engine trucks in DTR must:**

- Report odometer annually, once engine model year is 13 years old
- Retire when either (whichever first):
- Mileage reaches 800,000 miles
  - 18 years old
- Remain active: visit a CA seaport or railyard at least 1x/yr in 2023+

# Exemptions to the Rule

**Several vehicle types are exempt from this rule:**

- **Dedicated Use Vehicles - unibody vehicles that do not have separate tractors and trailers or are vehicles using a power take-off unit, such as**
  - **Dedicated auto transport vehicles**
  - **Dedicated fuel delivery vehicles**
  - **Concrete Mixers**
  - **On-road Mobile Cranes**
  - **Vehicles requiring power take-off units to operate**
- **Emergency Vehicles**
- **Military Tactical Support Vehicles**
- **Vehicles subject to the Mobile Cargo Handling Equipment Regulation**

# Useful Life Estimates for Drayage Trucks

| Engine MY | Vehicle MY | First Mileage Reporting Date | Date Engine Will Exceed 800,000 Miles* | Date Engine Will Exceed 18 Years | Latest Truck Can Remain in DTR |
|---|---|---|---|---|---|
| 2010 | 2011 | February 15, 2025 | 2024 | 2028 | 2028 |
| 2011 | 2012 | February 15, 2025 | 2025 | 2029 | 2029 |
| 2012 | 2013 | February 15, 2025 | 2026 | 2030 | 2030 |
| 2013 | 2014 | February 15, 2026 | 2027 | 2031 | 2031 |
| 2014 | 2015 | February 15, 2027 | 2028 | 2032 | 2032 |
| 2015 | 2016 | February 15, 2028 | 2029 | 2033 | 2033 |
| 2016 | 2017 | February 15, 2029 | 2030 | 2034 | 2034 |
| 2017 | 2018 | February 15, 2030 | 2031 | 2035 | 2035 |
| 2018 | 2019 | February 15, 2031 | 2032 | 2036 | 2035 |
| 2019 | 2020 | February 15, 2032 | 2033 | 2037 | 2035 |
| 2020 | 2021 | February 15, 2033 | 2034 | 2038 | 2035 |
| 2021 | 2022 | February 15, 2034 | 2035 | 2039 | 2035 |
| 2022 | 2023 | - | 2036 | 2040 | 2035 |
| 2023 | 2024 | - | 2037 | 2041 | 2035 |

*Based on average daily mileage of 238 miles operating 260 days per year

# Drayage Rule Extensions

- **Vehicle Delivery Delay**
  - **May be requested if ordered ZEV is delayed because of a reason beyond the operator's control**
- **Infrastructure Construction Delay**
  - **May be requested if construction of ZEV fueling/charging infrastructure is delayed because of a reason beyond the operator's control**
- **Site Electrification Delay**
  - **May be requested if there is a delay providing the power necessary for charging infrastructure**

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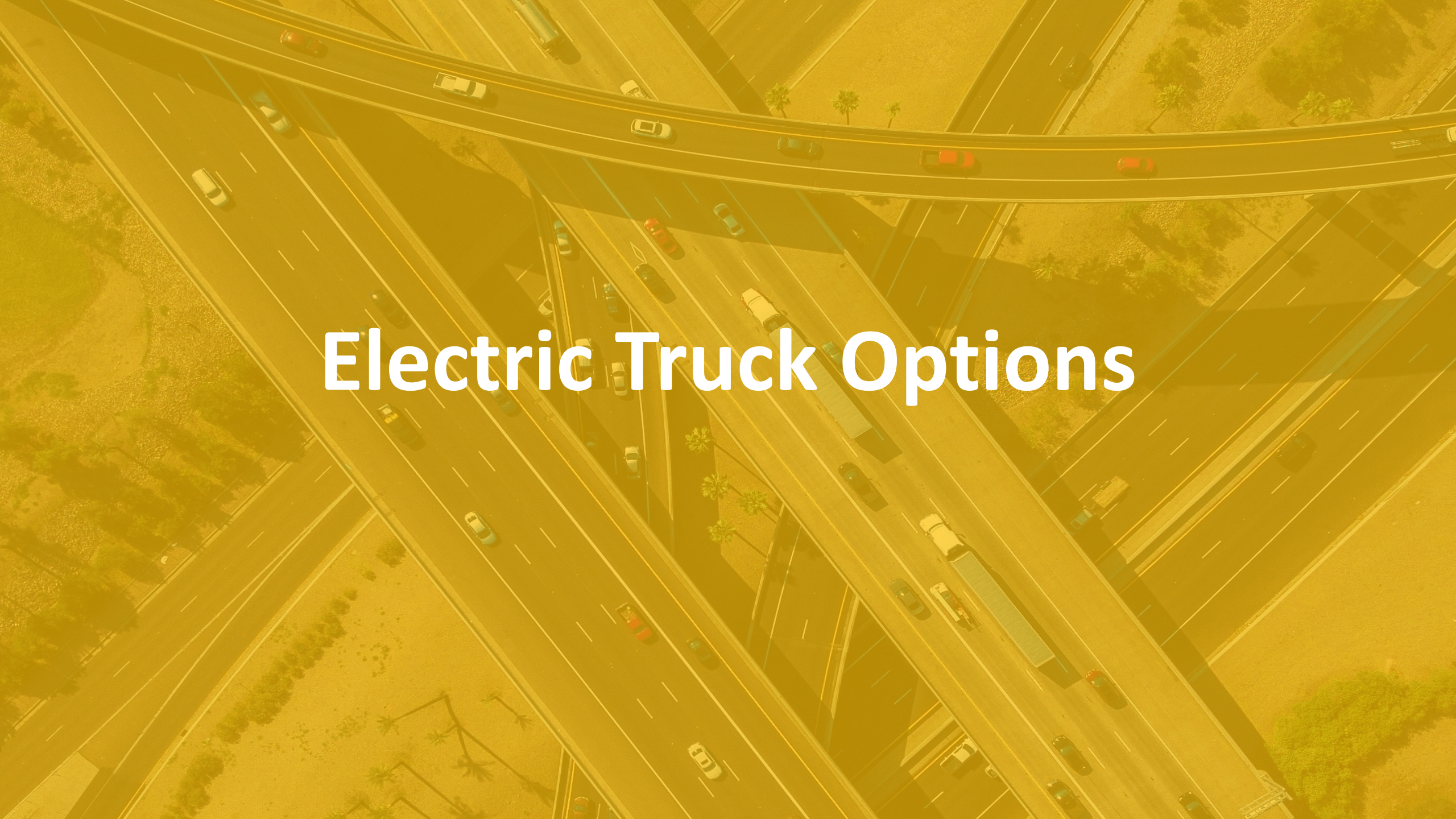
# Technology Considerations for Heavy-Duty Zero-Emission Vehicles



# Electric Truck Options

# Examples of Class 8 EV Tractors

**Freightliner eCascadia**

438 kWh
190” WB
Curb Weight:
21,800 lbs (est)

**Volvo VNRe**

565 kWh
200” WB (est)
Curb Weight:
24,500 lbs (est)

**Peterbilt 579EV**

400 kWh
190” WB (est)
Curb Weight:
22,500 lbs (est)

**Kenworth T680E**

396 kWh
190” WB
Curb Weight:
22,500 lbs (est)

**BYD 8TT-ER**

563 kWh
167” WB
Curb Weight:
28,000 lbs (est)

**Lion Lion8T**

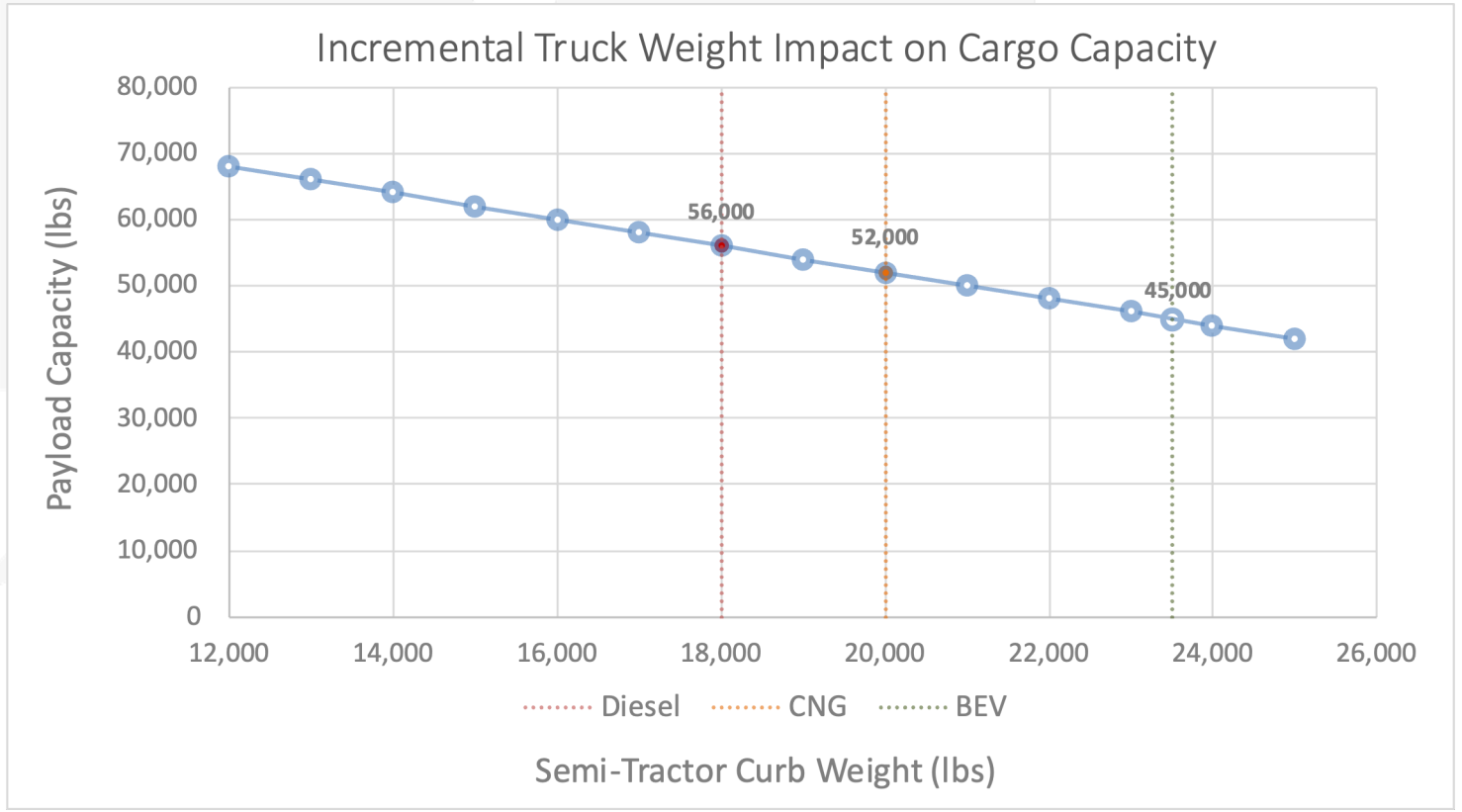
653 kWh
200” WB
Curb Weight:
26,000 lbs (est)

÷ 2.0 kWh per mile  x 75% usable SOC  x 80% EOL Capacity

| | Freightliner eCascadia | Volvo VNRe | Peterbilt 579EV | Kenworth T680E | BYD 8TT-ER | Lion Lion8T |
|---|---|---|---|---|---|---|
| Max Range (miles) | 219 | 283 | 200 | 198 | 282 | 327 |
| Typical Range (New) | 164 | 212 | 150 | 149 | 211 | 245 |
| Typical Range (EOL) | 131 | 170 | 120 | 119 | 169 | 196 |

# Curb Weight Impacts

- **EV tractor weights range from approximately 22,000 – 28,000 lbs**
- **Chart shows cargo capacity (trailer + container) vs curb weight**
- **BEVs are granted a 2,000 lbs weight exemption (up to 82,000 lbs GCW)**
- **Example:**
  - 23,500 lbs curb weight BEV
  - Max cargo weight is 45,000 lbs
  - Max container weight is 38,000 lbs
  - Plus 2,000 lbs weight exemption allows hauling 40,000 lbs containers.
  - Versus diesel capable of up to 49,000 lbs containers.

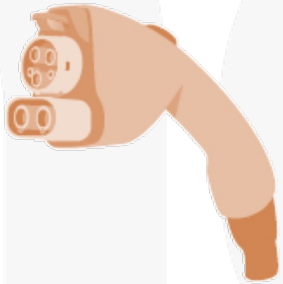


# Charging 101

# Charging 101


Diesel fueling deals in relatable units and fueling times are consistent.

The terminology for EVs is new to fleet managers/buyers.



EV Charging Standards are evolving.

This creates new capabilities but increases decision making complexity

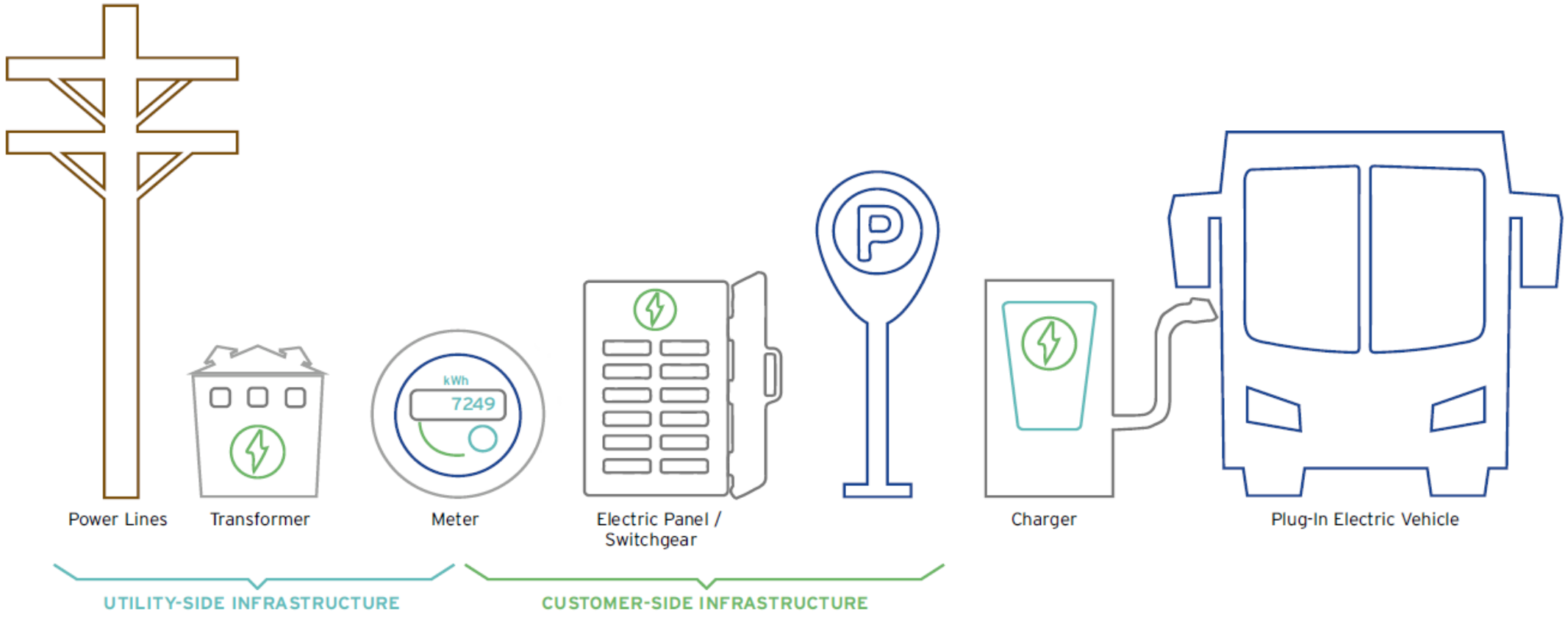
Fleets are built around diesel fueling, where price is independent of fueling time and speed.

When, where, and how fast electricity is delivered affects price significantly.

Fleets are not static. Customers and requirements change over time.

Flexible infrastructure solutions are key for large scale fleet adoption.

# Infrastructure Components




Source: SDG&E Power Your Drive for Fleets Charging Guidebook

# Charging Terminology

| Term | What is it? | Similar in concept to: |
|---|---|---|
| Kilowatt-hour (kWh) | A unit of electrical energy | Gallons of fuel |
| Kilowatt (kW) | A measure of electrical power | Gallons per minute |
| Electric Vehicle Supply Equipment (EVSE) | An EV charger | Fuel pump |
| Combined Charging Standard (CCS-1) | The most common high power charging standard for EVs in the US | USB-C plug |
| Time of Use (TOU) | A utility rate structure that increases costs during peak periods | Surge or congestion pricing |
| Demand Charge | A fee charged by the utility for the maximum power (in kW) used | Paying for “faster” internet service |

# Utility Resources

- SDG&E Power Your Drive Fleet- https://www.sdge.com/business/electric-vehicles/power-your-drive-for-fleets
  - Fleet Electrification Program Explainers
  - Rebate and EV Rate Plan Information
  - ZE Regulations Fact Sheets
  - **EV Charging Guidebook**

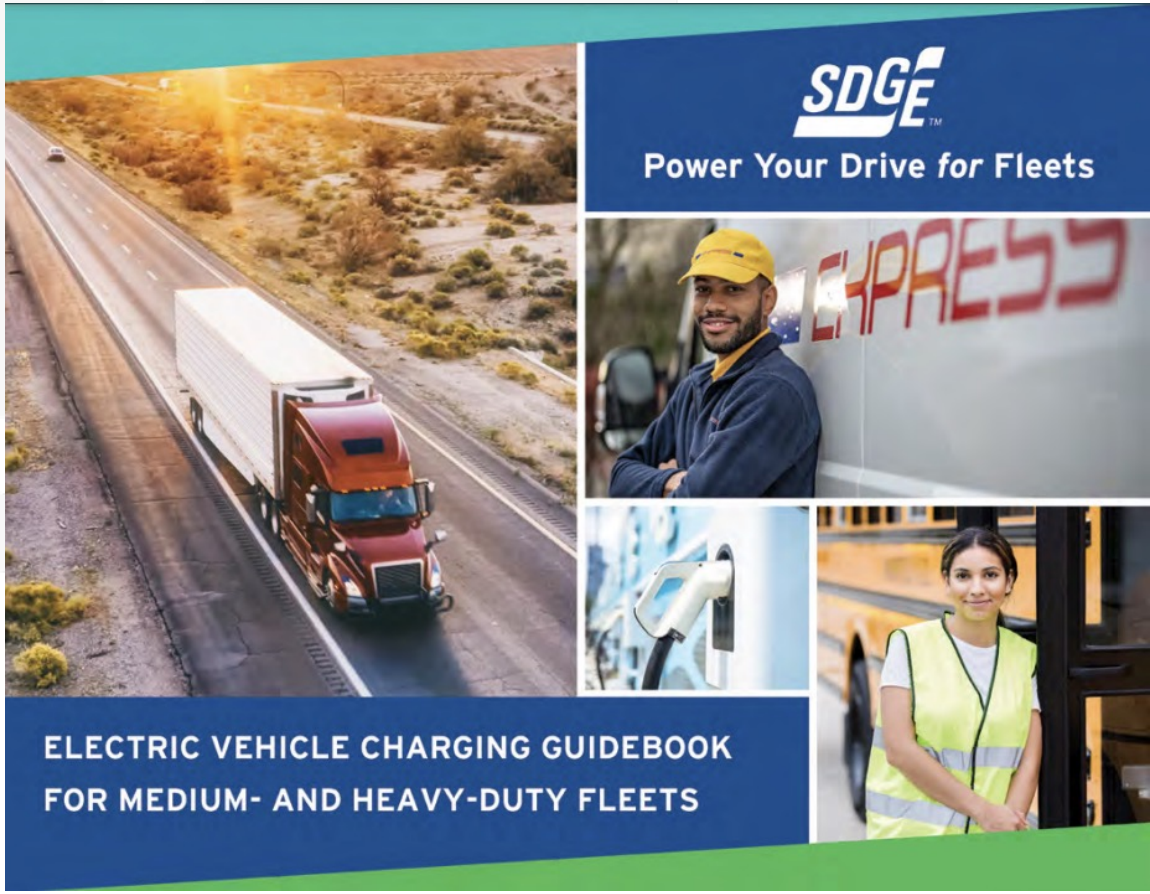
# EV Charging Guidebook

## Purpose

- Charging 101 for fleet operators
- Focus on MD/HD Commercial fleets, but applicable to many MD/HD fleet applications

## Goal

- Estimate fleet's energy needs and charging time requirements.
- Identify the charging equipment options.
- Evaluate charging station configurations that work with existing space, support current and future operations, maximize equipment lifecycles, and control costs.
- Identify which entities to engage for project design, permitting, and construction.
- Discuss important details of the fleet's electric service and electricity price bands with your utility.



# Key Recommendations

- **Understanding your daily use** of the trucks (average and peak mileage, dwell time and location, max cargo weight, etc) is critical to evaluating how EVs will fit in your fleet.
- If possible, **demonstrate an EV** in your fleet so that you understand its practical fit in your operations.
- **Maximizing utilization** of chargers usually minimizes total costs.
- Charging speeds are limited by the slowest link (grid supply, charger, vehicle, battery). Ensure you **know what performance to expect** from your vehicle and infrastructure combination.
- Not all vehicles charge at the same voltage, even if they meet the same charging standard (e.g. CCS-1). **Your chargers must match or exceed your vehicle requirements**.
- Utility supply can have long timelines. **Get started as soon as possible**.

# Cost Considerations

# Total Cost of Ownership

- EVs are almost always more expensive initially compared to diesel.
- Total cost of ownership (TCO) looks at the purchase and operating costs of the vehicle over its lifetime. EVs can be less expensive on a TCO basis.

| TCO Cost Element | Diesel | EV |
|---|---|---|
| Purchase Price | **Lower** | Higher |
| Residual Value | **Understood** | Uncertain |
| Infrastructure Cost | **Low** | High |
| Infrastructure Monitoring | | |
| Fuel Cost | Higher | **Lower** to Higher |
| Maintenance | Higher | **Lower** |
| Insurance | **Lower** | Higher |
| Purchase Incentives | None | **Often Significant** |
| Carbon Credits | None | **Significant** |
| Operational Impacts | **Baseline** | Few to Significant |

# Cost Component Examples – Class 8 EV Tractor

## Purchase Price

- $350,000 to $450,000 pre-tax
- Sales tax and Federal Excise Tax add ~21 percent to purchase price

## Residual Value

- Typically understood for diesel. Finance/leasing companies may assign zero residual value to EVs due to uncertainty.

## Infrastructure Cost

- Varies based on use case and site. Overnight charging typically requires a 50-60 kW charger.
- Hardware costs of $35-40k are typical. Installation costs of $40-$75k per charger are realistic.

# Cost Component Examples – Class 8 EV Tractor

## "Fuel" Costs

- Varies based on time, power level, utilization, and utility rate. $0.15-$0.30 per kWh is realistic.

## Maintenance

- 25-50% cost reductions are realistic, assuming battery pack lasts the life of the vehicle.

## Insurance

- Increased insurance costs primarily attributed to higher vehicle repair/replacement costs. Varies by fleet.
- 3% of the incremental vehicle cost per year is a reasonable starting point for estimating incremental insurance premiums.

# Cost Component Examples – Class 8 EV Tractor

## Purchase Incentives

- Can be very significant. HVIP program offers ~$120,000 or more. Federal tax credits of ~$40,000.

## Carbon Credits

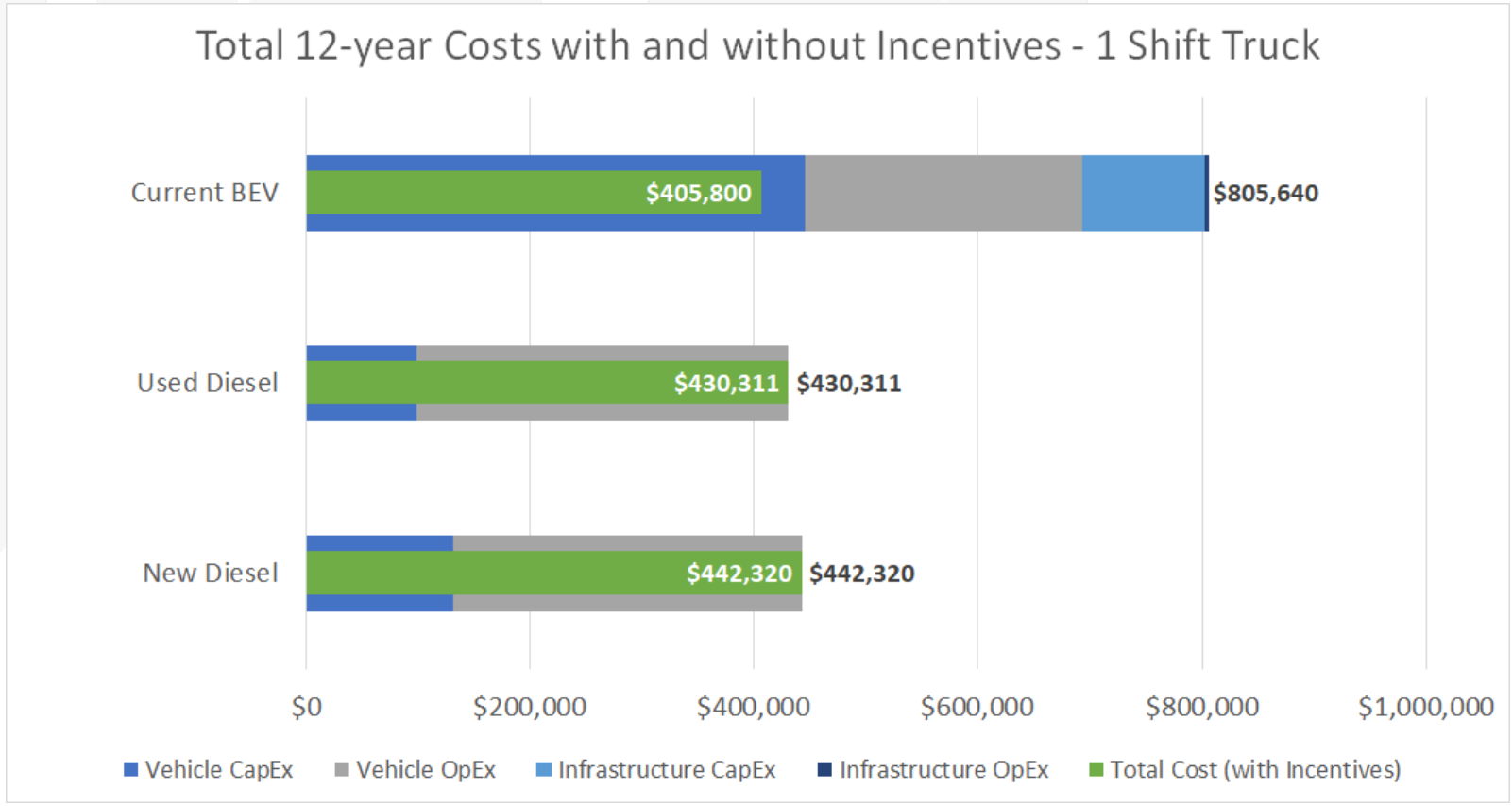
- Primarily via the California Low Carbon Fuel Standard (LCFS) program. Currently worth ~$0.08 to $0.10 per kWh ($0.16-$0.20 per mile)

## Operational Impacts

- Can range from negligible to substantial, depending on fleet operations.
- Cargo weight impacts –Roughly 20% reduction in maximum cargo weight.
- Charging time impacts – Most trucks will require 2-4 hours to recharge at maximum power. Mid-shift/opportunity charging may reduce impacts.

# Example TCO Results

- Example considers a single shift truck
  - 190 miles per day
  - Overnight charging
  - $0.15/kWh electricity cost
- EV truck TCO is almost twice that of diesel without incentives. On par with diesel with incentives
- Some incentives will not be available once EVs are required!




Source: San Pedro Bay Ports: 2021 Update to Feasibility Assessment for Drayage Trucks

# Questions and Answers

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