



2022 Medium-Duty and Heavy-Duty Forecast Inputs and Assumptions

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Outline

- Key Model Components
- Key Inputs
- Key Policies
- Summary of 2022 Updates



Key Model Components

Inputs

Estimate Base Year
Commodity & Service
Truck Stock

Economic and
Demographic Forecast

Truck Choice Model

Truck Attributes
(e.g., Price, Incentives,
Maintenance)

Outputs

Forecast Demand for
Truck Miles

Truck Stock Forecast
(& Resulting Energy
Demand)



Key Inputs



Base Year Truck Stock

1. DMV data for MDHD vehicles (with DataOne for additional vehicle details)

2. Vehicles with HVIP vouchers that are not in DMV data

3. Disaggregation by EMFAC's vehicle class proportions, where necessary

- For IEPR 2022, truck stock for 2021 will be processed and used for calibration of the forecast.



California Vehicle Use & Inventory Survey (CA-VIUS)

- CalTrans survey with sample of about 15,000 trucks in 2017
- CEC staff allocates freight to trucks using:
 - truck payload, a maximum legal load for each commodity group
 - truck loaded fraction, percentage of time a truck is carrying freight to account for deadheading



Freight Analysis Framework

- Provides projections for tonnage by regions of origin and destination, commodity type, and mode of transportation
- Aggregated tonnage from FAF is adjusted using the county-specific forecast of Gross State Product for the Transportation Sector from **Moody's Analytics**
- Disaggregated values are scaled in forecast years to retain the relative quantities as in FAF, but sum in aggregate to simulate the Moody's overall trend
- Tonnage from FAF, along with paired payload and loaded fraction from CA-VIUS, and average miles per truck from EMFAC are used to allocate truck stock
- Updated for 2022 IEPR with FAF version 5 data and Moody's Analytics forecast (from May 2022)



Truck Purchase Price

- Truck purchase price:
 - Based on a truck price forecast developed by ICF
 - Battery electric truck prices updated in 2022 using a revised CEC battery price forecast for plug-in vehicles, due to ballooning raw material prices
 - Currently evaluating observed prices from HVIP voucher data, as some of these observed truck prices were included in IEPR 2021
- Maintenance costs:
 - Based on values provided in [Total Cost of Ownership document](#) from ACF
- Comparisons between fuel types in the choice model are based on the incremental truck price, **relative to the base fuel type**, defined as the lowest truck price for a vehicle class in the base year



Incentives

- Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP)
 - Voucher amounts unchanged from 2021
 - In 2021 IEPR, model assumed incentive reduction beginning in 2025 and complete phase-out by 2036 for mid case
 - May be adjusted for 2022 IEPR
- Carl Moyer Low NOx Incentive
 - Ranging from \$10k - \$25k for natural gas vehicles
- **Inflation Reduction Act**
 - Incremental cost of vehicles covered in Classes 6 & 7 only
 - Infrastructure cost covered in all truck classes

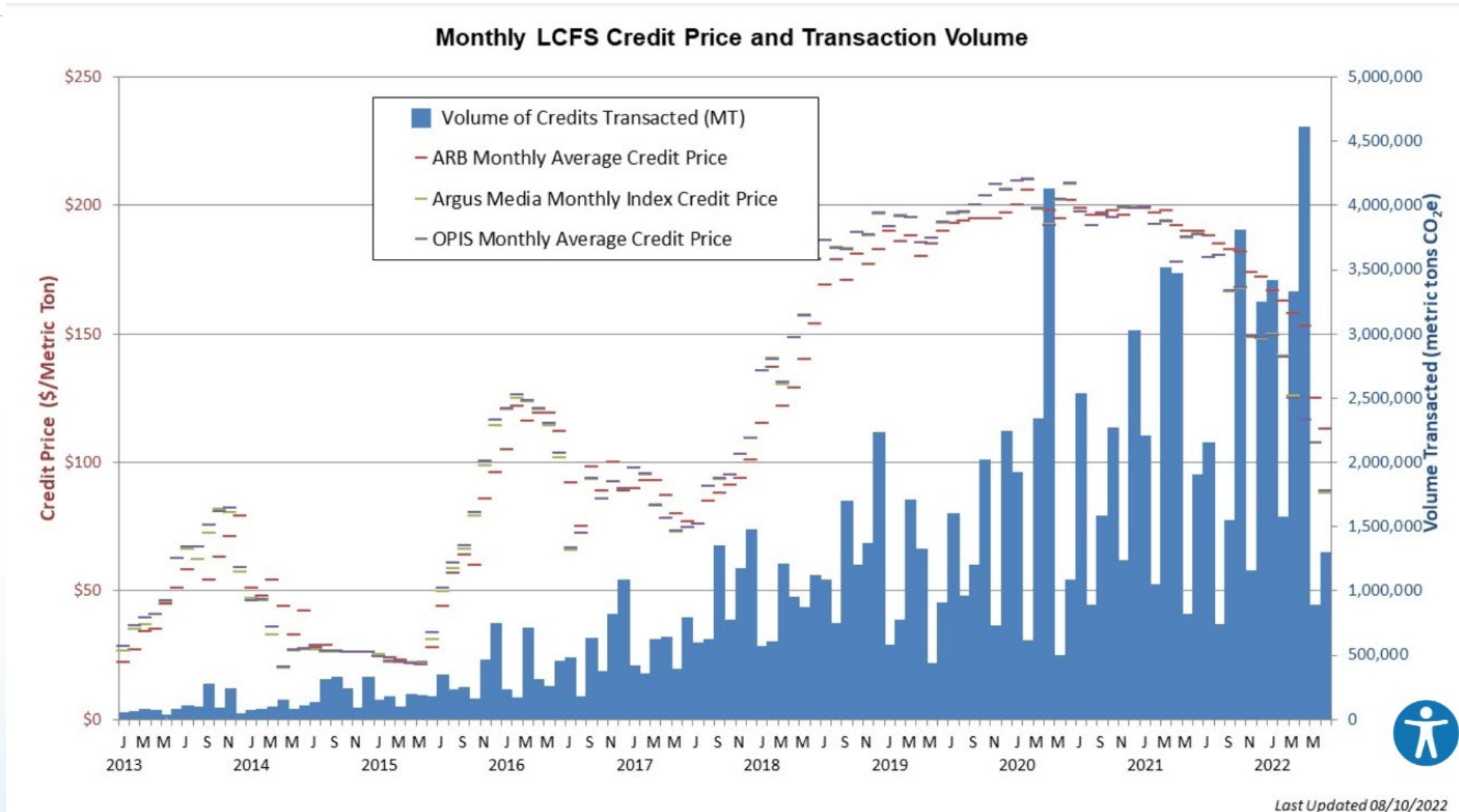
Zero-Emission Vehicle (ZEV) Voucher Table

Vehicle Weight Class	Base Vehicle Incentive
Class 2b	\$7,500
Class 3	\$45,000
Class 4-5	\$60,000
Class 6-7	\$85,000
Class 8	\$120,000

Source: [HVIP 2022 Implementation Manual](#)



Low Carbon Fuel Standards Credit



Source: <https://ww2.arb.ca.gov/resources/documents/lcfs-data-dashboard>



EMFAC (EMission FACtor) 2021

- CARB emissions inventory model for on-road vehicles
- IEPR 2021: CEC vehicle classes were reclassified to align with new vehicle classes in EMFAC2021
- CEC model uses the following from EMFAC2021:
 - Base year truck stock to align CEC stock for interstate GVWR8 trucks
 - Vehicle survival rates to inform retirements through time, and be consistent with policies tracked in EMFAC
 - Impacts demand for new trucks
 - Annual vehicle miles traveled (AVMT) per vehicle



Key Policies



Advanced Clean Trucks (ACT)

- A regulatory schedule for introducing zero-emission trucks (ZET) with a manufacturer sales requirement, a ZET credit trading market, and a reporting requirement
 - Manufacturer sales requirement begins in 2024, and by 2035, zero-emission truck/chassis sales would need to be:
 - 55% of Class 2b – 3 truck sales,
 - 75% of Class 4 – 8 straight truck sales,
 - and 40% of truck tractor sales.
 - Refer to <https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks>
- Every new truck counts as a single deficit, and ZETs earn credits weighted by class
 - Fleets must earn or buy credits to comply by maintaining a positive credit balance
- Since CEC model is *demand-side*, the baseline forecast incorporates ACT compliance in aggregate by tallying new truck additions and calculating net credits statewide, compared to the schedule



Advanced Clean Fleets (ACF) Requirements

- Applies to most medium- and heavy-duty bus and truck classes
- 100% Zero Emission Vehicle (ZEV) sales beginning with 2040 model year
 - From 2040, vehicles over 8500 pounds gross weight delivered for sale in California, plus delivery vehicles under 8500 pounds gross must be ZEVs
 - Authorized emergency vehicles exempt
- High Priority and Federal Fleets – two compliance options
 - 100% of new purchases from model year 2024 are ZEV, or
 - Meet ZEV milestones as a percentage of fleet in specified years
- Public Fleets (state, county, local)
 - 50% of vehicle additions must be ZEV in 2024-2026, 100% in 2027 (three-year exemption for low population counties)
- Drayage Fleet
 - Additions to the port drayage registry must be ZEVs starting in 2024
- Refer to <https://ww2.arb.ca.gov/our-work/programs/advanced-clean-fleets/about>



Advanced Clean Fleets (ACF) Exemptions

- High Priority and Federal Fleets:
 - Fleet size less than 50 and revenue less than \$50 million/year
- High Priority, Federal, and Public Fleets:
 - School buses, military tactical vehicles, snow removal
 - Authorized emergency vehicles
- Vehicles below 8500 pounds gross weight, except delivery
- No exemption for RNG vehicles (as of May 2022 posted language)



Baseline Forecast: Zero Emission Truck (ZET) Inputs & Assumptions

DEMAND CASE	BASELINE
REGULATIONS	California Regulations
CARB Regulations	Innovative Clean Transit Rule, Zero-Emission Airport Shuttle Regulation, Advanced Clean Trucks
SCAQMD Regulations	Implicit for refuse trucks and urban transit buses
INCENTIVES	Incentives
HVIP (all years)	Current HVIP voucher plus stacked incentives, TBD% of vehicle incremental cost in all years
FUEL PRICES	Fuel Prices
Hydrogen Price	NREL mid price
Electricity Rates	Commercial Rates, High
ATTRIBUTES	Attributes
BEV Truck Prices given battery pack price in 2030	BEV prices based on battery price declining to ~\$100/kilowatt hour (kWh)
Miles Per Gallon (conventional / alternative)	Mid / Mid



Summary of 2022 Updates

- Economic and demographic forecast
 - Goods movement from FAF version 5
 - Economic forecast from Moody's Analytics
- Incentives
 - HVIP
 - Inflation Reduction Act
- Fuel Price Forecast
- Low Carbon Fuel Standards (LCFS) Credits Projection
- Battery Price Forecast

Thank you!

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