Alternative Fuels & Fleets
The Future is Now!

The future of transportation in California will be characterized by a diversity of low-emissions fuels and high performance vehicle and engine technologies.

This toolkit is designed to prepare fleet operators in the North State California region for changes in the transportation sector by providing information about:

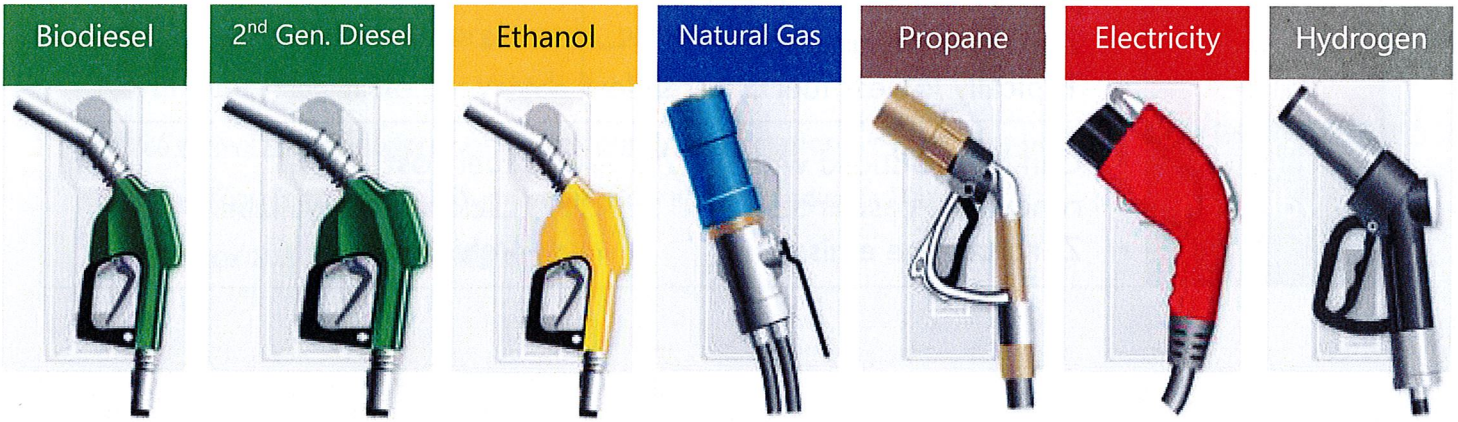
- Alternative fuels
- Clean vehicle technologies on the market
- Available state and federal incentives
- Fleet conversion impact and cost calculators
- Guidelines for developing a fleet conversion plan

The benefits of using alternative fuels include:

- Potential to reduce fleet operating costs: fuel, maintenance, and insurance
- Increased energy and price security through use of domestically produced fuels
- Compliance with current and future California air emissions standards

Alternative fuels are:

- Biofuels made from plants - biodiesel, renewable (2nd Gen.) diesel, & ethanol
- Domestic gaseous fuels - natural gas & propane
- Zero-emissions fuels - electricity & hydrogen



USEFUL CLEAN FLEET RESOURCES

1.) **U.S. Department of Energy Alternative Fuels Data Center**
http://www.afdc.energy.gov/
Contains tools including: fleet emissions and operating cost calculators, interactive maps showing fueling stations & truck stop electrification sites, listing of current state and federal laws and incentives, fuel properties comparison, fuel prices by state, and other transportation fuel related data.

2.) **U.S. Department of Energy Alternative Fuels Data Center: Alternative Fuel and Advanced Vehicle Search**
http://www.afdc.energy.gov/vehicles/search
User can select and see the types of alternative fuel vehicles on the market based on fuel type, vehicle class, and manufacturer.

3.) **California Air Resources Board Buying Guide for Clean and Efficient vehicles**
http://driveclean.ca.gov/Find_Special_Resources/Fleets.php
Search for clean vehicles on the market and sort for incentives by technology type and zip code.

4.) **West Coast Electric Fleets**
http://www.westcoastelectricfleets.com/
Provides case studies, tools, and technical assistance to help fleet managers reduce costs by incorporating electric and/or hydrogen vehicles into their fleets.

5.) **Trucking Efficiency**
http://www.truckingefficiency.org/
Information on all available efficiency technologies and best practices for tractor-trailer fleet operators.

6.) **Fleet and Fuels**
http://www.fleetsandfuels.com/
Links to current news articles and case studies for Biodiesel, Electric, Ethanol, Hybrids, Hydrogen, Natural Gas and Propane fuels.

7.) **California Air Resources Board Draft Technology Assessment: Medium-and Heavy-duty Battery Electric Trucks and Buses (2015)**
http://www.arb.ca.gov/msprog/tech/techreport/bev_tech_report.pdf
Report includes: transit buses, school buses, medium-duty trucks, shuttle buses, and heavy-duty trucks. Covers electric vehicle component specifications, charging system requirements, vehicle costs and payback periods, emissions benefits and optimal duty cycle.

8.) **Regional Zero Emissions Vehicle Readiness Plans:**

Mendocino County Zero Emissions Vehicle (ZEV) Regional Readiness Plan -

http://www.mendocinocog.org/reports_projects.shtml

North Coast Plug-in Electric Vehicle Readiness Plan -

http://www.redwoodenergy.org/index.php/transportation/ev-readiness-planning

Siskiyou County (Upstate) Plug-in Electric Vehicle Readiness Plan -

http://www.siskiyoucounty.org/pev/

Overview of Alternative Fuels

Fuel	Advantages	Disadvantages
Biodiesel	• Domestically produced • Can be blended in most diesel engines • Reduced emissions of some criteria pollutants • Biodegradable, non-toxic	• Lower energy content than diesel • More expensive • B100 not suitable in low temperatures • Potential engine issues if not used properly
Renewable Diesel	• Drop-in fuel for all diesel vehicles at all blend levels up to 100% • Can be domestically produced from renewable resources • Reduced emissions	• Availability • Potential land use impacts, although currently most feed-stocks are waste products such as cooking oil or beef tallow
Ethanol	• Domestically produced from renewable resources • Fuel cost comparable to gasoline • Lower emissions of some air pollutants	• Flex-fuel vehicle required for higher blends above 15% for 2001 model years or later • Lower energy content • Land use impacts, over 90% of ethanol produced from corn
Natural Gas	• Domestically produced • Relatively cheap fuel • Fewer emissions of some criteria pollutants	• Non-renewable fuel • Potentially higher greenhouse gas emissions from leaked methane
Propane	• Domestically produced • Reduced emissions of some criteria pollutants	• Non-renewable fuel • Few commercially available vehicles
Electricity	• Fuel can be produced everywhere • The most energy efficient powertrain option available • Zero tailpipe emissions • Typically lowest fuel cost / mile	• Limited driving range • Battery recharge time
Hydrogen	• Can be produced with renewable resources • Zero tailpipe emissions	• Fuel cost • Lack of fuel availability • Vehicle cost

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USEFUL CALCULATORS AND FLEET CONVERSION MODELS

1.) **U.S. Department of Energy Alternative Fuels Data Center: Vehicle Cost Calculator** 🟢
http://www.afdc.energy.gov/calc/
User can compare light-duty vehicles of all makes, models, and fuel types. User selects vehicles to compare and daily and annual driving distance. Output includes: annual fuel use, annual fuel cost, cost per mile, and annual CO_2 emissions for each vehicle.

2.) **Argonne National Labs Alternative Fuel Life-cycle Environmental and Economic Transportation Tool (AFLEET)** 🟡
https://greet.es.anl.gov/afleet
Useful for comparing fleet conversion options for light-duty and heavy-duty vehicles fueled by gasoline, diesel and most alternative fuels. User inputs include: number of vehicles, years of planned ownership, and loan terms. Model contains default values for annual vehicle mileage, fuel economy, vehicle purchase price, fuel cost, and fuel feedstock; these values can also be customized. Output includes: payback period, total cost of ownership, criteria air pollutant emissions and greenhouse gas emissions.

3.) **Petroleum Reduction Planning Tool** 🟡
http://www.afdc.energy.gov/prep/
Users can create a plan for reducing petroleum use by using several savings methods including: replacing vehicles, using alternative fuels, reducing idling, and changing driving habits. Calculator includes most car sizes, pickups, vans, SUVs, medium-duty trucks (14,000 – 26,000 lbs.), and heavy-duty trucks. Does not include: refuse trucks, buses, or other vehicles such as fire engines, ambulances, street sweepers etc. Input includes: petroleum reduction goal, number of vehicles, vehicle type, annual mileage, and idle time. Output includes: petroleum reduction / year, greenhouse gas emissions reductions / year, fuel cost savings / year, and impact on your fuel reduction plan.

4.) **CNG VICE 2.0: Vehicle Infrastructure Cash-Flow Evaluation Model** 🔴
http://www.afdc.energy.gov/vice_model/
This model can be used to evaluate conversion of fleet vehicles to compressed natural gas (CNG) vehicles. Vehicle types include: transit buses, school buses, refuse trucks, shuttle buses, delivery trucks, gasoline pickup trucks, and taxis. User inputs include: project type (vehicles only or vehicles + fuel infrastructure), vehicle data, and investment data (incentives, acquisition timeline, and number of vehicles converted by type). Output includes: payback period, quantity of petroleum fuel displaced, reduced greenhouse gas emissions, incremental cost increase, and total infrastructure investment.

5.) **Argonne National Laboratory Energy Systems GREET Model** 🔴
https://greet.es.anl.gov/carbon_footprint_calculator
Calculator for evaluating total fleet fuel use and greenhouse gas emissions for On-Road and Off-Road fleet vehicles using a variety of petroleum and alternative fuels. On Road vehicles included in model are: School bus, transit bus, shuttle, para-transit bus, refuse truck, street sweeper, delivery step van, transport freight truck, medium-duty / heavy-duty pick-up truck, and maintenance utility vehicle. Off-road vehicles included in model are numerous and include: Forklift, front-end loaders, excavator, bulldozer, grader, and concrete mixer etc. User input includes: number of fleet vehicles by type and fuel, and annual fuel used. Output includes: annual petroleum usage and GHG emissions for entire fleet.

Ease of use key:

🟢	Easy to use, higher level analysis
🟡	Moderately technical, requires some fleet-specific data, mid level analysis
🔴	Very technical, requires detailed fleet data, detailed analysis

California Clean Transportation Policies

CA Low Carbon Fuel Standard (LCFS)

- 10% reduction in carbon intensity of CA fuel mix by 2020

Zero Emission Vehicle (ZEV) Action Plan

- 1.5 million ZEVs and near-zero emission vehicles on the roads in California by 2025

Zero Emission Vehicle (ZEV) Production

- 20% of new light duty vehicles sold in CA in 2025 will be ZEVs

Zero Emission Medium and Heavy-Duty Vehicle Program

- Funding for zero and near-zero emission heavy-duty vehicles, including vocational trucks, short- and long-haul trucks, buses, and eligible off-road vehicles and equipment. The Program is expected to provide $12 million to $20 million in funding annually through January 1, 2018

Mobile Source Emissions Reductions Requirements

- CA Air Board policy to reduce emissions from heavy-duty diesel vehicles
- Vehicles with a GVWR >14,000lbs are required to install emissions control devices
- By 2023 all heavy-duty trucks must have 2010 engines or newer

Heavy-duty Vehicle Greenhouse Gas Emissions Regulations

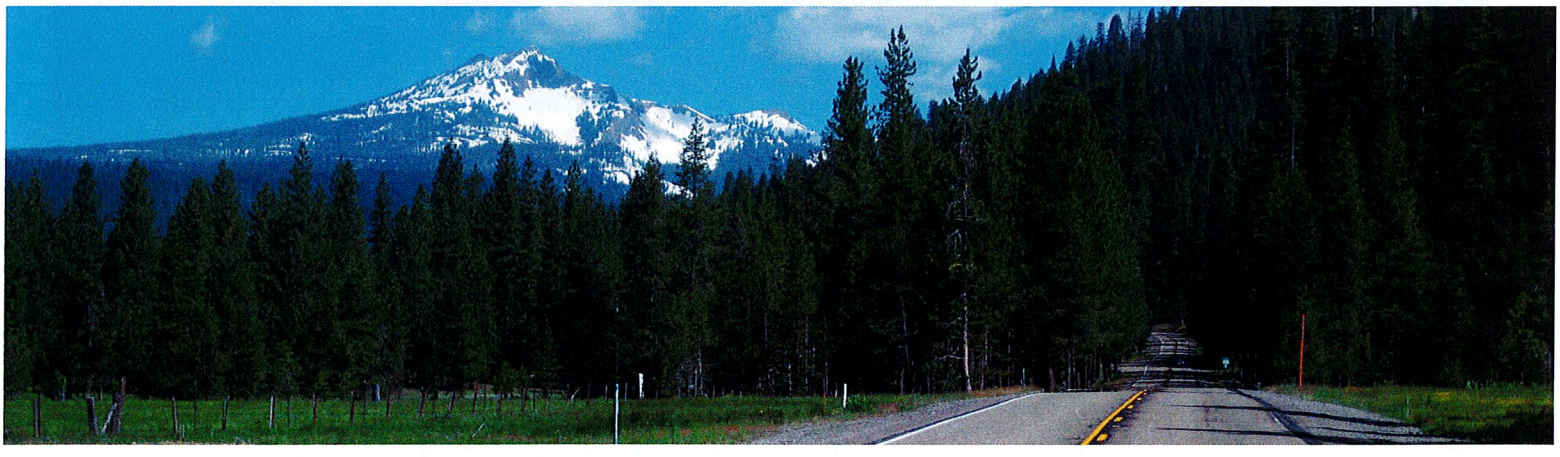
- Box trailers >53' and tractors that pull them must be equipped with fuel efficient tires and aerodynamic trailer devices to improve fuel economy and reduce greenhouse gas emissions

Heavy-duty Truck Idle Reduction Requirements

- A driver of a diesel-fueled vehicle with a gross vehicle weight rating of more than 10,000 pounds may not idle the vehicle's primary engine for more than five consecutive minutes, and is not allowed to operate a diesel-fueled auxiliary power system (APS) on the vehicle for more than five minutes when located within 100 feet of a restricted area.

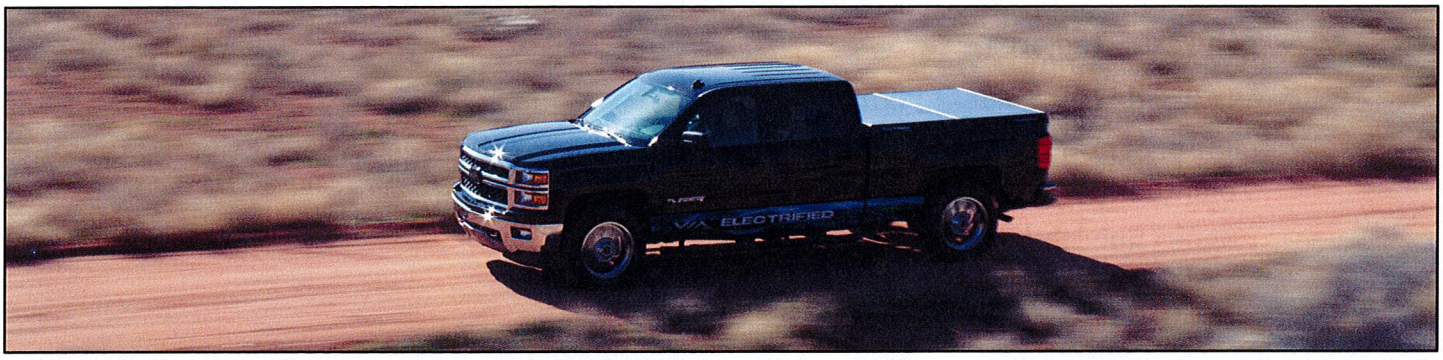
California Road User Charge Pilot

- Pilot program to test 5 mileage reporting methods proposed to replace gas tax
- Volunteer participants needed to determine best method



How to Make the Transition to a Clean Fleet

1. Advocate for a CA North State Clean Cities Coalition!
    a. Clean Cities Coalition can help fleet managers:
        i. Perform fleet conversion analyses using online calculators
        ii. Organize trainings for mechanics and drivers
        iii. Provide guidance on fueling infrastructure options
2. Join West Coast Electric Fleets and make a formal pledge to incorporate electric and/or hydrogen vehicles into your fleet: http://www.westcoastelectricfleets.com/fleet-pledge/
3. Assess fleet vehicles in need of near-term retirement and replacement and consider replacing them with alternative fuel vehicles and/or clean vehicle technologies
4. Use the Clean Vehicle Buyers guides to identify fleet vehicles that match your operational needs (included in this toolkit)
5. Use online calculators to assess changes in:
    a. Total cost of ownership
    b. Emissions reductions
    c. Fuel infrastructure costs
    d. Fuel cost
6. Review state and federal mandates and incentives (included in this toolkit)
7. Develop a fleet conversion plan:
    a. Identify fuel and vehicle types that match operations
    b. Assess fueling infrastructure needs and ownership options
    c. Identify staff training needs
    d. Develop budget and schedule of purchases
8. Apply for incentives
9. Make vehicle purchases!
10. Provide training for drivers and maintenance staff.



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SISKIYOU COUNTY ECONOMIC DEVELOPMENT

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