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# Heavy Vehicle Decarbonization

## Our Expertise

AEROSim: Aviation Energy Research and Operation Simulator | ALTRIOS: Advanced Locomotive Technology and Rail Infrastructure Optimization System | DriveCAT: Drive Cycle Analysis Tool | FASTSim: Future Automotive Systems Technology Simulator | Fleet DNA: Commercial Fleet Vehicle Operating Data | Fleet Research, Energy Data, and Insights (FleetREDI) Analysis Pipeline | T3CO: Transportation Technology Total Cost of Ownership

## The Need

### A Sustainable Transition for the World's Most Difficult-to-Decarbonize Vehicles

Heavy-duty vehicles are responsible for transporting nearly everything our society needs—from food and fuel to consumer goods and electronics. We rely on them to harvest crops, construct buildings, mine ore, and travel the seas and skies. But these rugged vehicles are not just among the largest on Earth. They are also nearly entirely dependent on oil and diesel fuels.

Addressing the climate crisis will require the vast majority of specialized, heavy-duty vehicles to transition to low- and zero-emissions operations by 2050. That's where NREL comes in.

## The Solution

### Accelerating Transportation Decarbonization Through Analysis

NREL researchers fuse engineering, data science, modeling, simulation, and experimental methods to identify the fastest, most cost-effective paths to fleet decarbonization. Their expertise stretches across the aviation, marine, mining, and rail industries.

Bolstered by world-class computational science and high-performance computing capabilities, researchers first collect high-resolution data on commercial vehicle operations. Then, they match vehicle work requirements to clean energy technologies and systems that can fulfill the necessary duty cycles. By building detailed simulations and models, researchers can project the performance of these specialized vehicles, the energy they need to run, and the costs of associated charging and refueling infrastructure over the vehicles' entire life cycles.

## The Impact

### Lowering the Barriers to Cleaner, Cost-Effective Operations

NREL research has fueled the deployment of low- and zero-emissions vehicles for some of the nation's largest and busiest seaports, airports, and railways. Our researchers built the world's first comprehensive, open-source software for rail decarbonization; helped deploy one of Alaska's first low-emissions commercial fishing vessels; modeled the infrastructure needed for sustainable aircraft to fly passengers along regional routes; and provided the analysis that powered the single largest deployment of heavy-duty, zero-emissions terminal tractors in the eastern United States.

## Partners

Alaska Longline Fishermen's Association | BNSF Railway | Federal Aviation Administration | Komatsu | Parallel Systems | Southwest Research Institute | U.S. Agency for International Development (USAID) | U.S. Department of Energy's Energy Transitions Initiative Partnership Project

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