

Freight Rail & Climate Change

Key Takeaway: As the most fuel-efficient way to move freight over land, freight railroads actively invest in infrastructure, equipment, and technology and deploy sustainable business practices to reduce their carbon footprint and build a more resilient network for a future shaped by climate change.

As cumulative global emissions and CO₂-attributable warming continue to rise annually, immediate emissions reductions and smart policies to transition toward a net-zero economy are critical. Railroads remain a responsible partner capable of delivering sustainable transportation solutions in the near term and for the long haul.

With an eye trained on that goal, freight railroads are developing and implementing new technologies, refining operating practices, and working with their suppliers, customers and supply chain partners to reduce GHG emissions. Every North American Class I railroad has an approved target with the Science Based Targets initiative, an organization driving ambitious climate action in the private sector and working to curb temperature rise and mitigate climate change-related impacts.

In 2023, railroads made significant progress as they embraced innovative solutions, from hydrogen-powered locomotives to more electric cranes in intermodal yards. Below are just a few examples.

Recyclable Ties

[Union Pacific](#) replaced three million traditional wooden rail ties with recyclable composite materials. The new ties have a 50-year lifespan and divert 90,000 tons of plastic from landfills for every million composite ties laid.

Hydrogen Hub

[BNSF](#) partnered with Bakken Energy to design the Heartland Hydrogen Hub, exploring clean hydrogen production and distribution using rail transport.

Electric Cranes

[Norfolk Southern](#) swapped 22 of its 68 diesel cranes with hybrid or fully electric, aiming to eliminate all diesel cranes within the next decade. Each hybrid crane slashes emissions by 75%, preserving 22,000 gallons of diesel fuel and curbing 225 tons of emissions annually.

AC Locomotives

[Canadian National](#) modernized 60 locomotives, converting them to AC-powered traction, which reduces GHG emissions by enhancing fuel efficiency, reliability and pulling power.

Hydrogen Engines

[CPKC](#) ordered 12 additional hydrogen fuel cell engines to further decarbonize its switching and freight service locomotives in Alberta. The engines should be in service by late 2024.

Biodiesel Testing

[CSX](#) is finishing up testing a 20% soybean oil-based fuel blend (B20 biodiesel) in its Tampa locomotive fleet. With over 200,000 gallons burned, the initiative has achieved nearly 20% GHG reduction.

Reducing Locomotive & Yard Emissions

Fuel consumption is directly tied to GHG emissions. According to the EPA, freight railroads contribute only 0.5% to total U.S. GHG emissions and 1.7% to transportation-related GHG emissions while cars contribute 58.5% and trucks 23.4% (Chart). In fact, freight rail is the most fuel-efficient way to move goods over land and one train can move nearly 500 tons on one gallon of fuel while also removing hundreds of trucks off the highway. Moving freight by rail instead of truck lowers GHG emissions by up to 75%, on average.

Despite its small share of transportation-related GHG emissions, freight rail has made significant strides in decarbonization. Investments in fuel-efficient locomotives, aerodynamic railcars, fuel management systems, and automated gate systems have all contributed to reduced emissions. Railroads are also exploring alternative fuels and hybrid propulsion technologies for locomotives, as well as employing hybrid and electric cranes to further mitigate environmental impact. These efforts underscore the industry's commitment to sustainability.

Building Resiliency

Freight railroads invest approximately \$23 billion annually to fortify their nationwide network against climate-related disasters like floods, wildfires, and storms, ensuring uninterrupted supply chain operations. These private investments have earned rail infrastructure top ratings in recent American Society of Civil Engineers' Infrastructure Report Cards. Strategies include clearing rights-of-way to prevent wildfires, deploying specialized "fire trains," using seismic and weather detectors, replacing wood with concrete or steel, constructing raised tracks, and adjusting timing of maintenance projects to minimize heat-induced track-buckling.

Evolving Operations

With a commitment to sustainability ingrained in their culture, railroads harness the collective power of their skilled workforce to drive eco-friendly practices. Each railroader plays a vital role in environmental protection, whether through developing fuel-saving software, sharing best practices, or promoting overall environmental stewardship. In addition to emission reduction efforts, freight railroads actively engage in various sustainability initiatives such as recycling, resource management, office efficiency improvements, electricity conservation, and landscape protection along their routes.

For instance, CSX's multimillion-dollar water reuse project in Baltimore collects stormwater for washing locomotives, while BNSF implemented spill-prevention measures following an analysis of fuel and lubricant leaks at busy yards. Canadian National repurposes steel mainline tracks into secondary lines and rail yards, while CPKC reduced the size of its data center in Wyandotte, KS, and installed more efficient cooling and lighting systems. Furthermore, Union Pacific significantly reduced energy consumption in 2020, equivalent to powering more than 239 U.S. homes annually, and Norfolk Southern remanufactures locomotives at its Juniata locomotive shop in Altoona, PA, to emit fewer emissions.

Climate Change Policies

As cumulative global emissions and CO₂-attributable warming continue to rise annually, the need for immediate emissions reductions and smart policies to transition toward a net-zero economy is critical. Railroads remain a responsible partner capable of delivering sustainable transportation solutions in the near-term and for the long haul. In its report, the industry offers eight policy suggestions. Below are the topline actions, download the PDF to read more.

1. Support ongoing research at the U.S. Department of Energy (DOE) to develop technologies to accelerate the commercial viability of low- and zero-emission locomotives.
2. Help Class I railroads' partners, including locomotive manufacturers, rail suppliers, and short line railroads, transition to the net-zero economy.
3. Allow railroads to transition their locomotive fleets when zero-emission technologies are commercially viable and operationally safe and reliable.
4. Encourage policies that recognize the value of rail as a low-carbon transportation solution.
5. Empower railroads to make operational decisions to maximize fuel efficiency and meet growing freight transportation demand.
6. Further promote a broad-based, economy-wide transition to net-zero emissions.
7. Streamline agency requirements to encourage the testing and incorporation of new safety technologies that will improve the resiliency of the rail network.
8. Ensure timely delivery of rail infrastructure projects through permitting reform