



The greening of the railroads—and why it matters

It's good for the environment. It's sound business practice. And it's a strong argument for keeping railroads deregulated.
By William C. Vantuono, Editor

Railroads have long been recognized as “Conservers of Energy, Protectors of the Environment,” to quote the title of a *Railway Age* cover story from several decades ago. That story continues to be a work in progress.

Evidence abounds that a “Green” railroad industry is good for America:

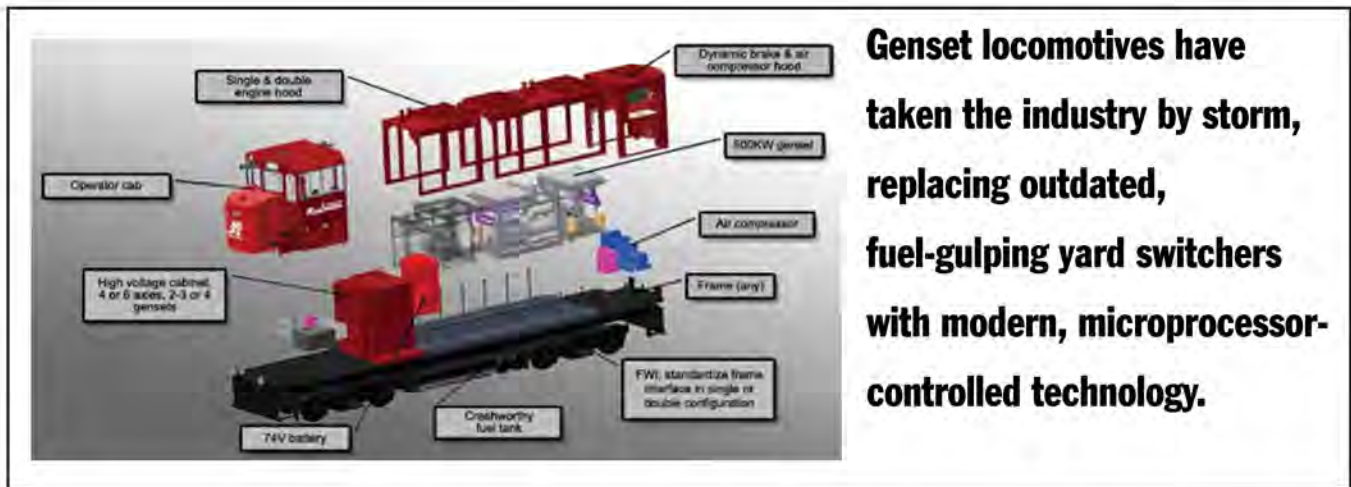
- Railroads are four times as fuel efficient as trucks. A study conducted for the Federal Railroad Administration found that if railroads handled just one-tenth of the freight now hauled by trucks, one billion gallons of fuel a year would be saved and annual greenhouse gas emissions would fall by some 12 million tons.
- According to Environmental Protection Agency data, freight railroads account for just 0.6% of U.S. greenhouse gas emissions from all sources, and just 2.4% of emissions from transporta-

tion-related sources.

- Railroad fuel efficiency is up 106% since 1980. From 1980 through 2009, U.S. freight railroads emitted 617 million fewer tons of carbon dioxide thanks to their fuel efficiency gains.
- In recent years, railroads have nearly doubled their freight volume from 1980 levels, but they did so using virtually the same amount of fuel. Today’s freight trains move one ton of freight an average of 480 miles on a single gallon of fuel.
- A single doublestack intermodal train can carry the loads of 280 trucks, equivalent to 1,100 automobiles.
- Railroads help clean the air. Because greenhouse gas emissions are directly related to fuel consumption, railroads have a lower carbon footprint. Switching freight to rail from truck for the long haul—a move in which truckers like J.B. Hunt and Schneider National are enthusiastic participants—cuts green-

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Genset locomotives have taken the industry by storm, replacing outdated, fuel-gulping yard switchers with modern, microprocessor-controlled technology.

house gas emissions by up to 75%. Economists figure that moving 10% of long-distance truck shipments to rail would be equal to taking two million autos off the highways.

- North America's "big seven" Class I's—BNSF, CSX, Norfolk Southern, Union Pacific, Kansas City Southern, CN, and Canadian Pacific—have all joined the Environmental Protection Agency Office of Transportation and Air Quality's voluntary SmartWay Transport partnership, which is aimed at improving fuel efficiency and reducing greenhouse gas emissions.

- Many railroads offer training programs in which locomotive engineers offer suggestions to their colleagues on ways to save fuel.

These are the points the Association of American Railroads hammered home last year in a campaign that seasoned lobbyists say was instrumental in derailing legislation that would have taken away some of the industry's hard-won freedom from excessive regulation.

Railroad/supplier partnerships

Railroad suppliers are active and innovative partners in developing Green technologies and practices.

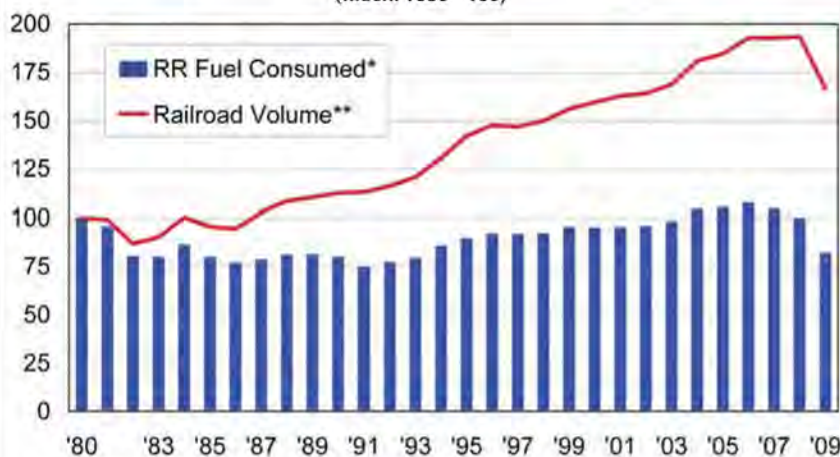
As the AAR points out, railroads have acquired thousands of new energy-efficient locomotives, including hybrids and gensets. The latter have two or three independent engine/traction alternator sets that automatically cycle on and off depending on load factor. Pioneered by the Union Pacific and National Railway Equipment Company, gensets are now available from several locomotive builders—RJ Corman Railpower, Motive-Power Division of Wabtec, Progress Rail Services, Brookville Equipment Corp., Railsolve, and NREC. UP alone has more than 160 gensets from various builders in service.

Norfolk Southern is testing a 100% battery-electric switcher and is evaluating, in cooperation with Electro-Motive Diesel, biodiesel fuel (*RA*, Nov. 2010, p. 19).

Union Pacific and Progress Rail Services recently completed one year of operation for the first of five ultra-clean diesel locomotives being tested in intermediate linehaul service in Southern California. The PR30C-LoNOx locomotive has been repowered with a single 3,005-hp, low-emission, Caterpillar clean-diesel engine. Equipped with aftertreatment, the unit met EPA Tier 4 NOx (nitrogen oxide) and Tier 3 PM (particulate matter) standards during testing. The aftertreatment uses SCR (selective catalytic reduction) technology "to reduce emissions, improve overall fuel efficiency, and allow the engine to function at higher, more optimal combustion temperatures," UP says. SCR technology requires the use of diesel exhaust fluid (DEF), a clear, non-toxic, biodegradable and non-flammable solution primarily composed of urea.

Railroad freight volume rose sharply after deregulation, but fuel consumption remained about the same.

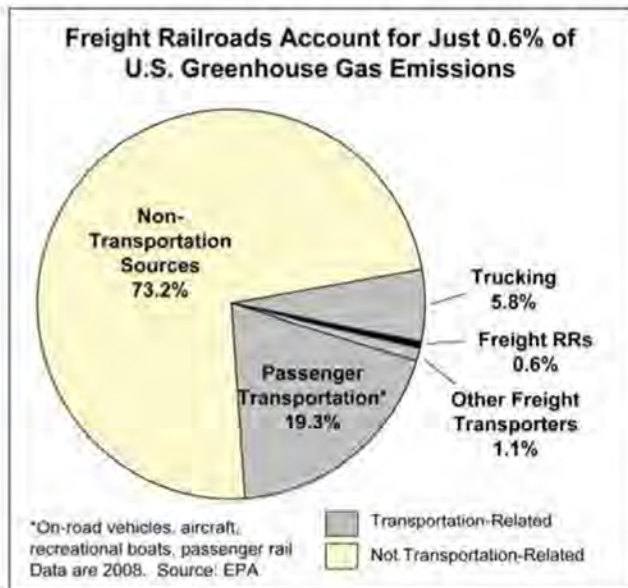
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*in freight service **revenue ton-miles Data are for Class I railroads. Source: AAR

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Freight Railroads Account for Just 0.6% of U.S. Greenhouse Gas Emissions



DEF is induced into the diesel engine's exhaust chamber to reduce emissions.

Railroads are adopting innovative new technologies, such as (in AAR's layman's terms) "hyper-intelligent computer systems." Among these are New York Air Brake's LEADER

(Locomotive Engineer Assist Display/Event Recorder), Invensys Rail's Locomotive Fuel Optimizer (LFO), EMD's Smart-Consist Fuel Management System, and GE Transportation's Trip Optimizer. Such systems calculate the most fuel efficient operating parameters for a train, helping the engineer achieve what is commonly called a "Golden Run."

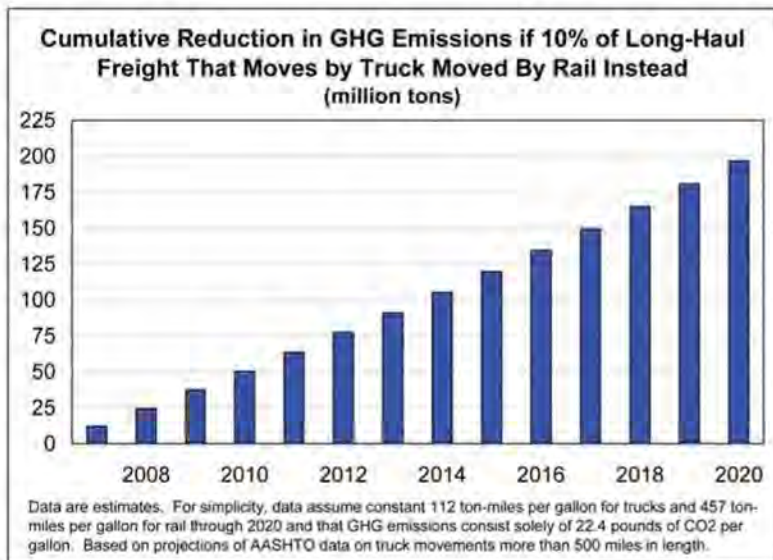
"Green Run" would be a more accurate name.

Invensys Rail's LFO is currently being tested on the UP, where the railroad's Fuel Conservation Group is conducting fuel validation tests. The LFO system, which works without input from the engineer, is designed to maximize fuel efficiency in a multiple-unit consist by automatically making individual throttle adjustments to redistribute power among trailing units while the engineer is selecting notches on the lead unit. LFO continuously monitors and selects the most fuel-efficient throttle setting without compromising power, rail adhesion, or safety.

Companies like MIRATECH offer a number of cost effective exhaust emission reduction systems such as diesel particulate filters to oxidation catalysts, including EPA-certified products for EMD engines.

Some suppliers have embarked on joint ventures to further Green technology. Invensys Rail and NYAB are collaborating on locomotive systems that combine the fuel economy benefits of LFO and LEADER. Together, the systems seek to optimize fuel economy and train handling in multiple-unit locomotive con-

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sists. LEADER prompts engineers to apply optimal throttle and brake settings for a given train consist and track profile. LFO then automatically makes individual throttle adjustments among the locomotives in the consist to optimize fuel efficiency, based on total power demand. LEADER has produced fuel savings in

the range of 8% to 12%; LFO has delivered average fuel savings of 3% to 4% in tests.

Under the EPA's SmartWay program, Hotstart Manufacturing and ZTR Control Systems worked with Union Pacific and regional Wisconsin Southern on the Chicago Locomotive Idle Reduction Project. The installation and use of a Hotstart DDHS (Diesel Driven Heating System) and ZTR's SmartStart technology on a yard locomotive "reduced overall idling times by 80%," EPA reported at the project's conclusion. "This resulted in an annual reduction of 12,738 gallons of diesel fuel over 298 in-service days, or 42.7 gallons per day. If a railroad's average locomotive availability per year is 92% or 335 days (the industry average), annual fuel savings would be 14,339 gallons. At \$1.00 per gallon of diesel fuel [average historical cost per gallon at the time of this study], the combined savings from the idle reduction technology has a reasonable pay-

back of about 2.5 years.

"In addition to fuel savings, the technology reduces noise, oil consumption, and maintenance costs, and extends engine life. If these savings could be accurately calculated, the payback would be less than 2.5 years. Over the same 298-day in-service time, the NO_x emissions from this locomotive dropped by 2.1 tons, and PM emissions dropped by 0.06 tons. If the locomotive had been in service for the industry average, the NO_x emission reduction would have been 2.4 tons per year and the PM emissions would have been 0.07 tons per year. At a capital cost of \$35,500 for the idle reduction technology, with a conservative life range of 10 years, the up-front cost to reduce one ton of NO_x is \$1,420. This does not include the cost savings from reduced fuel consumption that accrue to the locomotive owner. Remote monitoring can also be done via Internet and satellite link to access reports any time and to determine locomotive location. This information can be used to validate that the emissions reductions were achieved in a non-attainment area."

A similar project was conducted in Vancouver, Wash., with BNSF, for the Southwest Clean Air Agency. The results were favorable in terms of both emissions reduction and cost effectiveness, as ZTR describes in a final report:

"Assuming that switchyard operations do not change drastically over a 10-year period, and an average life of 10 years for this idle reduction technology, the total tons of emissions reduced over a 10-year period would be 154.5 tons. Capital cost of the equipment for this project is estimated at about \$125,000. Average cost effectiveness on this basis alone is approximately \$809/ton of emissions.

"Over a 10-year average period, fuel savings are projected to be 477,300 gallons of diesel fuel. Fuel savings over a 10-year period are projected to be \$477,300. The value of this savings is expected to increase over the next 10-year period as the cost of diesel and other fossil fuels are experiencing a considerable increase in cost and are forecast to go higher."

SmartStart is described by ZTR as "a microprocessor technology that automatically manages the shutdown and restart of

locomotive engines while parked idling. It continually monitors existing conditions against a preprogrammed set of values. This system monitors the following operating conditions: reverser and throttle position, air brake cylinder pressure, engine coolant and ambient air temperature, and battery voltage and charging amperage.” In the Vancouver project, the SmartStart system was configured to start and stop the DDHS as needed to keep the locomotive batteries charged and the engine above 100 degrees F.

The latest edition of SmartStart is SmartStart SAVER, which has an additional feature whereby data can be automatically uplinked via satellite connection on a real-time basis to monitor system status.

Sophisticated remote monitoring systems from suppliers like IONIX, Lat-Lon, Railhead, and Wi-Tronix work in tandem with engine health monitoring systems and AESS (automatic engine start-stop systems) to provide real-time information on how such systems are functioning.

For example, the Wi-Tronix Wi-FuelSaver can provide information on the operational efficiency of a locomotive. Detailed information is collected onboard, transmitted wirelessly, and processed against customizable rules that define fuel efficient operations for that particular unit; feedback is customized based on business needs. Wi-FuelSaver utilizes automated email, text messages, and Web-based crew “trip report cards.” Timely feed-

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back is targeted directly to where it can have “the most immediate and positive impact to operations,” Wi-Tronix says. “The collected mobile asset data and Wi-FuelSaver generated reports can be directly integrated into existing enterprise systems and processes or hosted by the Wi-Tronix information technology infrastructure and accessed via a secure website using industry-standard data exchange protocols.” Wi-FuelSaver, a component of Wi-Tronix’s integrated architecture, utilizes an onboard

Wi-PU (Processing Unit) combined with Wi-FuelSensor to incorporate ultrasonic fuel level sensing technology in use throughout the transportation industry. Using Differential Global Positioning System (DGPS) location technology, Wi-FuelSaver “pinpoints the exact time and place for logged events. The Wi-Tronix Wi-PU provides the hardware foundation for interfacing with other onboard systems to capture the required operational data for processing. For our railroad industry cus-

tomers, Wi-FuelSaver interfaces with existing solid-state event recorders to minimize system application time and overall system complexity while increasing reliability.” The Wi-FuelSensor interfaces with an AESS to monitor whether the AESS is performing as intended.

Wi-Tronix currently has an installed base of approximately 2,300 units on BNSF and RailAmerica (specifically, California Northern, San Diego & Imperial Valley, Indiana & Ohio, and Kentucky & Indiana) locomotives. For BNSF, this technology is critical to the railroad’s compliance with a memorandum of understanding signed in 1999 with CARB (California Air Resources Board) that targets emission levels for road and yard locomotives operating in the South Coast Non-Attainment Area (Los Angeles Basin), and how these emissions levels are calculated; 2010 was the first year for reporting data to the state. The system monitors fuel burn, and generates the required CARB reports for BNSF. Compliance carries a financial incentive in the form of state tax credits. Such cooperative agreements, says Wi-Tronix President Fred Cozzi, “are much better than legislation.”

For railroads like RailAmerica, which uses the system to monitor APU (auxiliary power unit) performance, “there’s a substantial amount of grant money available,” Cozzi notes. Carl Moyer Crants, administered by CARB through local air pollution control and air quality management districts, are among the many sources of “philanthropic assistance,” as Cozzi calls it.

A green public face

The railroads, once regarded as a “stealth industry,” now see the value in publicizing their environmental friendliness. They have been aggressively promoting their green initiatives to the public. Union Pacific, for example, in the Environmental section of its website, offers a four-part

mission statement:

- “• Prevention: Prevent the causes of environmental damage that result from railroad operations.

- “• Preparedness: Develop partnerships with internal and external customers to prepare for effective emergency response and tomorrow’s environmental issues.

- “• Response: Respond to emergencies involving environmentally sensitive materials to minimize health, environmental, operational, and financial impact to Union Pacific Railroad.

- “• Recovery: Clean up contamination for which Union Pacific is responsible.”

UP’s environmental mission statement is closely aligned with its environmental policy:

“At UP, we are committed to protecting the environment now and for future generations. Our employees, customers, shareholders, and the communities we serve can expect our full compliance with all laws and regulations. Union Pacific is developing and investing in new technologies that provide for cleaner air and water, including a locomotive fleet that’s the greenest in the industry. Our employees understand that protecting the environment is part of every job, and they are creating and implementing world-class energy conservation techniques that are helping us to move more freight with less fuel. We will continue our leadership in caring for the environment while delivering the goods that America needs.”

Norfolk Southern has a website, Footprints (<http://nssustainability.com>) solely dedicated to its environmental initiatives, and where users can download the railroad’s Sustainability Reports. The 2010 sustainability report, NS’s third, “thoroughly describes progress toward our corporate objective to achieve transportation industry leadership in fuel conservation, emissions reduction, efficient energy use, recycling, use of renewable materials, and environmental partnerships,” says CEO Wick Moorman (*Railway Age’s* 2011 Railroader of the Year). “A highlight of the 2010 report is our first-ever goal for reducing our carbon footprint. We have committed to a 10% reduction in greenhouse gas emissions per revenue ton-mile by 2014, using 2009 as the base year. After measuring our carbon footprint for the first time in 2009, establishing a measurable and attainable goal for carbon emissions reduction is the logical next step in our sustainability progression. We plan to achieve the goal through continuing investments in more fuel-efficient locomotives and technology, innovative information systems, and public-private partnerships to meet the rising demand for freight transportation services that keep America’s economy competitive while reducing fuel consumption and greenhouse gas emissions.” The 2010 sustainability report details how NS people “have embraced responsible business practices that will help ensure the ongoing strength of our company, the livability of their communities, and the quality of their lives. At Norfolk Southern, working toward sustainable economic, environmental, and social performance is more than a corporate goal: It’s a way of living.”

According to Newsweek magazine, which annually compiles and publishes environmental rankings on the nation’s 500 largest publicly traded, NS’s score in 2010 improved to 71.28 of 100 points, and its ranking improved to 233. “The evaluation

reflects NS’s worldwide environmental footprint, based on more than 700 separate metrics; an assessment of the company’s green initiatives; and a poll of CEOs, environmental officers, and other green experts,” according to Newsweek. Companies in the report were included by virtue of their revenue, market capitalization, and number of employees. The NS numbers compared with 67.61 points and 338 overall in 2009.

Likewise, CSX is touting its environmental programs. “CSX’s long-standing commitment to continual improvement has allowed the company to improve its fuel efficiency through new technology and conservation efforts,” the railroad says on the “Responsibility-Environmental Leadership” area of its website (www.csx.com/index.cfm/responsibility/environmental-leadership). “CSX has invested \$2 billion over the past decade to improve its locomotive fuel efficiency and reduce greenhouse gas. To reduce fuel consumption and greenhouse gas emissions during idling, CSX has invested in two separate pieces of idle-reducing technology, Auxiliary Power Units (APUs) and Automated Engine Start Stop (AESS). APUs provide auxiliary power to a locomotive, allowing the larger diesel engine to be shut down. AESS acts similarly by automatically shutting the locomotive down when not in use and automatically starting it when needed. In addition to these systems, CSX invests heavily in training its employees on proper locomotive shutdown rules to eliminate unnecessary idling.

“CSX is committed to implementing technology that optimizes train operations. This real-time energy management technology uses GPS, track grade and curvature data along with train information to identify the most fuel-efficient throttle settings for each trip as the train moves across the system. In addition, methods of rail lubrication are being explored to reduce rail-to-wheel friction and increase fuel efficiency.

The CSX Police Department has an Environmental Crimes Unit that investigates and prosecutes environmental crimes committed on CSX property. Since the ECU’s inception, 1,020 incidents have been investigated, resulting in 52 prosecutions, with a conviction record of nearly 100%.

Indeed, Green is now the industry’s most desirable color. The brighter the shade of Green, the better. **RE**