

Working On the Railroad

MAKING THE BEST OF
A TOUGH ECONOMY
UNION PACIFIC HAS
HARNESSED INGENUITY
AND 'GREEN' INNOVATION
TO BOOST PRODUCTIVITY
— AND EARNINGS.

Reduce, Reuse, Recycle.....

Union Pacific's comprehensive waste reduction and recycling program touches nearly every part of the company. We make a concerted effort to address high-volume items such as wooden track ties, used oil and e-waste.

Whenever possible, track ties that are no longer needed are refurbished for use elsewhere in the system. In addition, Union Pacific has been using concrete ties for nearly 20 years. Concrete ties require less maintenance than wood and last longer, generating less waste.

We use automatic fuel-nozzle shutoffs to prevent overflows during locomotive fueling, drip pans to catch oil spills, separators to recover oil from industrial wastewater, and on-board retention tanks to capture residual oil from locomotive engines for proper disposal.

In terms of e-waste, Union Pacific has recycled nearly 150,000 pounds of electronic equipment and nearly five million pounds of batteries since 2004.

WHEN THE AMOUNT OF DIESEL fuel your company annually consumes surpasses that of the U.S. Navy, it's easy to understand why fuel efficiency is top of mind across your entire organization.

That is exactly the case at Union Pacific Railroad, which consumes up to 41 gallons of diesel fuel per second. The railroad used 1.2 billion gallons of diesel in 2008, so a 1-percent savings in 2009 would be 12 million gallons. With an average price to Union Pacific of \$3.15 per gallon of diesel in 2008, that's a potential positive impact of nearly \$38 million to our bottom line.

All told, we have improved our fuel efficiency by 20 percent since 1994 and generated significant environmental benefits in the process. For example, one of our locomotives can move one ton 830 miles on a single gallon of diesel, which would be the same as your automobile getting 400 miles a gallon. In addition, Union Pacific's freight trains are almost four times more fuel efficient and produce fewer greenhouse gas emissions than over-the-road trucks. One UP intermodal train can take up to 300 trucks off America's congested highways.

Innovation and ingenuity have been at Union Pacific's core since President



Serving the U.S. and the World

Following completion of the transcontinental railroad, the first freight train to head east from California carried Japanese tea. Today, Union Pacific accesses 14 ports, six Mexican and two Canadian gateways and hauls products such as automobiles and auto parts, grain, frozen meat and poultry, coal and plastics for import or export.

Abraham Lincoln directed the company in 1862 to connect the nation by building the transcontinental railroad, widely considered one of the greatest achievements of the 19th century.

Lincoln never saw the completion of the transcontinental railroad but his vision for it transformed the nation. For example, what once was a perilous, month-long journey from New York to San Francisco took less than a week.

Today, Union Pacific continues to transform the freight transportation industry. By utilizing technology, such as GPS-equipped refrigerated boxcars that tell its shippers the precise location of their produce and alert the railroad to even a two-degree variance in the cargo's temperature, or by employing the industry's newest and most environmentally friendly freight locomotives, we provide our customers with a truly green freight transportation solution.

PIONEERING LOCOMOTIVE TECHNOLOGY

Union Pacific for decades has been the industry pioneer in identifying and adopting new locomotive technologies, including the ultra-low emitting Genset switcher used in rail yards to switch trains and sort freight cars. The Genset reduces emissions of oxides of nitrogen (which form smog) by up to 80 percent and particulate matter by up to 90 percent while using up to 37 percent less fuel than older switching locomotives. The 37 percent fuel reduction also means 37 percent lower greenhouse gas emissions. Union Pacific has more than 160 Gensets in service with plans to add more in the near future. Several other North American and foreign railroads have followed our lead in using Genset switching locomotives.

With more than two-thirds of our approximately 8,400 locomotives certified under EPA Tier 0, Tier 1 and Tier 2 standards, Union Pacific boasts the greenest locomotive fleet of any North American railroad and continues to invest in fuel-efficient locomotives. Since 2000, we have added more than 3,300 new fuel-efficient, long-haul, high-horsepower locomotives to our fleet.

Training also plays a key role in the company's fuel efficiency efforts. Union Pacific uses advanced locomotive simulator software as part of our ongoing training for engineers. This software program allows engineers to learn how and when to throttle up or down for maximum fuel efficiency

based on factors such as the length and weight of the train, and the uphill and downhill grades of the tracks.

The company's Fuel Masters program is an employee-driven effort to improve fuel efficiency that rewards locomotive engineers for their success. More than 6,800



engineers participated in 2008 and helped Union Pacific reduce fuel consumption by four percent – or 58 million gallons – compared to 2007. The amount of fuel saved would allow a passenger automobile averaging 25 miles per gallon to travel a staggering 1.3 billion miles, or across the continental U.S. more than 400,000 times.

EMERGING TECHNOLOGY


There is a trend among engine manufacturers to work to identify alternative fuel sources. However, diesel has the highest energy density of all known ground-transport fuels, and the higher the energy density the greater the distance between refueling events. Ethanol, for example, has approximately 56 percent of the energy density of diesel fuel; liquid hydrogen just 25 percent.

In our view there is no silver bullet for increasing fuel efficiency. Instead, we have learned that a steady stream of small technological advancements represents the most practical approach. Union Pacific is evaluating several emerging technologies, including:

- Wheel/Rail Lubrication and Friction Modifiers. Tests are evaluating friction modifiers such as sticks, sprays and liquids to reduce rolling resistance where wheels and rails meet. Trackside applicators push liquid material onto the rail in

high-curvature areas, where the potential to reduce rail wear is the greatest. Located every 1.5 miles, they decrease forces on the track by 30-50 percent, while minimizing friction to save fuel.

- A fuel cell locomotive project with the University of California at Irvine. We will host tests on UP locomotives as the project progresses.
- Locomotive and Car Aerodynamic Enhancements. Modifications that could reduce aerodynamic drag are in development.
- Other innovative efforts underway include assigning power by improved matching of freight train tonnage to the number of powered locomotive axles to reduce fuel consumption and locomotive wear; and increasing the use of distributed power to reduce in-train forces and drag while saving fuel and train starts.

It took innovation and ingenuity to build the railroad, and 147 years later Union Pacific continues to be the engine of change in the ground freight transportation industry. 

Mike Iden is general director – Car and Locomotive Engineering for Union Pacific. He serves on several technical committees of the Association of American Railroads and has been chairman of three committees: the Locomotive Committee, the Technology Scanning Committee and the Coupling Systems and Truck Castings committee. Visit: www.up.com