

RailPower Rolling Now

By Bill Moore

Originally published in EVWorld.Com Aug 15, 2004

Interview with RailPower president, James Maier on his company's 'Green Goat' hybrid-electric switch yard locomotives

What happens to a diesel railroad locomotive when it's seen its better days on the mainline?

According to [RailPower](#) president, James Maier, it 'retires' to the switch yard where it is used to assemble trains; and in the process spends most of its time idling, spewing massive amounts of pollutants, carcinogens and climate-altering CO2 into the urban environment.

Maier knows something about 'retirement' since he's tried to retire three times now, the most recent one to his organic farm on beautiful Vancouver Island where he's surrounded by seven wineries, one next to his farm. But the railroader in him couldn't pass up the opportunity to take on the challenge of solving the problem of polluting locomotives by taking the helm of the Vancouver, B.C.-based company that builds the "Green Goat" and it's smaller companion, the "Green Kid" hybrid-electric switch yard locomotives.

With federal and state air quality rules growing increasingly stringent, large railroads like Union Pacific, which has its headquarters in Omaha, Nebraska, where EV World is also located, approached RailPower's chief technology officer, Frank Donnelly to come up with a solution. That solution is a 2000 hp, series hybrid locomotive that spends most of its time running on electric power, generating a fraction of the pollution and CO2 of aging, 'retired' mainline units.

Maier stressed to EV World that the railroads needed the locomotive to not only be cleaner environmentally, more importantly, it had to demonstrate real financial payback or ROI, return on investment.

"The real economics for the railway have to be in operational costs, in safety operation, in maintenance, in reliability, in performance. And they have, over the years, developed very exacting formulae for how to calculate that return on their money," Maier said.

"What we said is, look, let's deliver a product that can deliver those economics; and then... the environmental comes as a product with locomotive. You're not selling hard to the railways on the environmental. You're selling hard on the economics and performance, but then you have this wonderful caveat of look at what this does in terms of its very low emissions, its low maintenance, its low operating costs, its ease of maintenance."

In addition to reducing pollution and saving the railroads between 35 and 80 percent on fuel, RailPower also helps them recycle their old, mainline locomotives. Borrowing a million dollars from friends and investors, Donnelly engineered his hybrid-electric drive system to breathe new life into equipment the railroads would have eventually written off a scrap. In effect, the railroad gets a completely refurbished switch yard engine for half a price of a new one. Maier said a RailPower conversion runs between \$750-800,000 compared to a new GE or GM locomotive that can cost between \$1.2-1.5 million.

UP Breaks the Ice

Although RailPower had three class-one railroads initially express interest in its locomotive, it was the Union Pacific that made the original commitment to test the "Green Goat", first for six months in the heat of its Southern California yards and then through a cold Chicago winter. Canadian Pacific Railway has also tested the locomotive proving that the series hybrid design which relies heavily on lead-acid batteries can perform in cold

locomotive, proving that the series hybrid design, which relies heavily on lead-acid batteries, can perform in cold climates.

"This is an ideal product, actually, for cold weather operations," Maier asserted. "And that also helps in the environmental, because in a very cold weather situation, a big old diesel locomotive idling, it's tricky for it. But the hybrid does it very, very well."

Where battery weight poses a challenge for electric passenger cars, which are sometimes derisively referred to as "lead sleds", in locomotives it is an advantage, particularly in switch yard applications where the extra weight provides much needed traction. In the Green Goat's case, it relies on the electric energy stored in 300 batteries, which are kept recharged by a standard, off-the-shelf diesel generator set. Patented control systems only switch on the generator when the batteries require it, and according to Maier, the locomotive can operate for four to five hours in zero emission mode before having to kick in the generator. He added that one operator told him that the Green Goat uses only as much fuel as a standard locomotive that is sitting idling all day. In addition, the locomotive can be configured to operate by remote control from up to half a mile away, eliminating the need for an engineer.

RailPower's hybrid diesel-electric system differs markedly from the standard diesel-electric locomotive where the big, 6000 hp diesel engine runs continually, powering a generator, which, in turn, drives the electric motors that power the wheels. The diesel engine is never turned off during operations, where on the Green Goat it only runs when needed.

Competing with the 'Generals' RailPower is a relatively small company, especially when compared to the twin giants in the locomotive business, General Motors and General Electric, usually referred to as the "Generals." EV World asked Maier how his company can compete against these multi-national powerhouses, which are two of the world's largest corporations. He responded that both companies are far more interested in building mainline products, the big locomotives that pull hundred-plus car trains across the continent, than they are yard switchers. Maier, who at one time worked for GE and also Bombardier, isn't concerned that either company will decide to enter his market segment; in fact, he says RailPower has a good working relationship with both. The company occasionally seeks their technical expertise, since it converts chassis built by each; and also orders parts from them.

"There's a large demand on the railways today for mainline locomotives," he noted, adding that the last time either company built a dedicated switcher was in the 1970s. RailPower finds itself, for the moment at least, Maier admits, with having the only product of its type anywhere in the world. He recognizes that this is likely to change someday, but for now RailPower has a corner on the market.

Selling "Green" Locomotives

While Maier prefers to focus on the economic benefits of his "green" locomotives, one question that does continually come up is battery life cycle costs. When you've got 300 lead-acid batteries, that typically have a service life to three to five years in industrial applications, the economics of replacing them, say, every five years has to figure into the equation; and it does.

Maier addresses the issue this way. First he points out that the weight of the batteries provides needed track "adhesion", which is a positive thing for a switch yard locomotive. He next points out that lead-acid batteries have one of the highest recycle rates of any product made, more so than glass bottles or aluminum cans. Chances are, he speculated, the lead in the Green Goat's batteries has been recycled several times.

As to the issue of battery life, itself, he danced around the topic a bit, perhaps understandably because his company depends on the quality of the battery his supplier provides him; and here he noted that RailPower is working with their supplier to improve their batteries, along with other experts in the field. He explained that railroads have to overhaul their diesel engines every five to eight years anyway, so replacing the batteries on a similar time scale, doesn't add an undo expense for the railroad. Apparently, a combination of the right charging routine and operational duty cycles is expected to help the batteries last at least five years, but that's reading between the lines of Maier's comments. Only five years of real operation will answer the question one way or the other.

Near the end of our interview, I asked Maier what the hardest selling point was and without hesitation he replied, "the battery".

He pointed out that when there's a power failure on the grid, only about 30% of standby generators come on-line because the starter battery wasn't properly maintained.

"That is the biggest program we had to convince the railways of. The monitoring systems we have on board, the way we put the batteries in, the choices of batteries, the energy levels of the batteries, we've made the railways feel very comfortable about it... The fact that big railways are buying it, is their confidence in us and our program for the batteries".

Open Business Model

Up until now, RailPower has been demonstrating its prototype Goat and Kid -- a smaller, 1000 hp unit for working in manufacturing plants and oil refineries where tight track curves preclude the larger unit -- to class one railroads. Now the company is starting to get orders, so I asked him about who owns the equipment. Does RailPower buy the used chassis from the manufacturer and then sell it back or does the company simply do the conversion with the railroad retaining ownership?

In fact, RailPower is prepared to do either, Maier told me, adding that it also is willing to work with the railroad's own maintenance shop and show it how to perform the conversions, itself.

When the company begins a conversion, the chassis is stripped down to the undercarriage, which is sent out to a separate company that rebuilds this unit to the latest railroad standards, including an entirely new braking system. The newly-rebuilt undercarriage is then returned to RailPower and the process of installing the diesel genset, air compressor for the brakes, the battery modules, controls and the cab begins.

At the moment, the company has built four demonstrators, but with an influx of orders starting to come in, it has launched a production line that Maier estimates will turn out 18-22 refurbished locomotives before the end of the year. Full production begins next year.

"The small quantity of locomotives out had a huge impact on the railways. Everyone has tried it. The Goat, right now, is traveling across the country headed for Amtrak."

And as it travels around the continent, there is a cadre of amateur rail watchers who track its movement, along with other locomotives, as a hobby. Maier estimates that before it reaches Washington, D.C., where it'll be the centerpiece of another demonstration program, the rail watchers will have taken about 8,000 photos of it.

"We don't have to ask the railway where it is", Maier said, "these railway people that love railroads and locomotives, they let us know where it is."

Real Orders Rolling In

Thanks to the air pollution reduction programs in California and Texas, RailPower is beginning to receive its first commercial orders. Funds made available through the Carl Moyer program in California and the Texas Emission Reduction Program (TERP) in the Lone Star State are helping railroads with operations in both states to purchase Green Goats. In Texas' case, there have been two TERP awards, the first that led to an order for 13 locomotives and the second worth another \$24 million, which should translate into another 25 locomotives.

"Someone said to me the other day that the State of Texas is hybridizing, which is great."

California and Texas aren't the only regions from which railroads are ordering product. The company just signed a MOU with an engineering firm in Australia to help develop the market there and in Southeast Asia. There is also activity in Europe, as well.

"The whole company is focused now on getting the hybrid locomotive going," he said, explaining that while RailPower also has developed a prototype CNG (compressed natural gas) mainline locomotive that could compete with the "Generals" that project is definitely on the back burner for now

compete with the "Generals", that project is definitely on the back burner for now.

Happy and Scared at the Same Time

So, with orders starting to come in and worldwide business prospects definitely brightening, Maier said he's the happiest he's ever been, but also just a little scared. Now he has to deliver on his promises.



James Maier

"I am very happy where we are in terms of the product, where we are in terms of our relationship with the railways, and in terms of how we're getting it out. And when I say I am a little scared, it's just the speed we're going forward and doing this and the acceptance of this product worldwide... Some days, I look at myself and pinch myself and say, 'my God, this is wonderful...'"

What excites Maier is not just the fact that he now has a thriving business going, but that it's an environmental product.

Railways Best Days Ahead

Given the current high price of a barrel of oil on the futures market (currently at over \$46 a barrel), I asked Maier what impact that will have on the railroad and whether the industry's best days are behind it or still ahead.

He replied that looking over the last twenty years at the dramatic improvements in efficiency railways have implemented, he believes that its best days are yet ahead, at least on the freight side of the business.

"You're going to see rail continue to improve and be a very good way of moving freight," he stated, adding this caveat that since he's not been involved in the passenger rail side of the business, he's "not too sure."

With respect to the question of the impact of ever-higher diesel fuel prices, he said that railroads have people who watch this very closely, especially a company like Union Pacific which will burn over a billion gallons of fuel annually. About 8-10 percent of that is for switch yard operations, so saving them 30-80 percent on this part of their operational costs is significant, but it is only one aspect they look at.

"They have all these "ability" words," he explained. Words like durability, reliability, serviceability, maintainability; and they have financial formulas for each.

One additional selling point, particularly in Australia and Europe, is reduction of noise pollution. Here again, the Green Goat/Kid excel because the company can easily reduce the noise level of the gen set. Maier also added that there are plans of the drawing boards for completely silent locomotives, which presumably means the company is also investigating fuel cells.

If so, such a development will certainly bring locomotives into the 21 century.

