

e-Bike Econ

OUR FIRST TEST of an electric motorcycle created some unusual changes to our testing protocols. For instance, our measured performance numbers no longer needed correction factors to adjust for the 2600' air density of our test site. With no air intake to consider, the electric motor couldn't change performance with altitude, so what we measured was what we'd print. And when weighing the bike, we didn't have to care about whether the fuel tank was topped up to learn its "full wet" weight either.

But when it came to giving its cost of ownership, we couldn't just take the manufacturer's word for hard-to-measure numbers. We had to calculate our own.

Zero claims an average cost to recharge the battery of \$0.48 and gives its maximum range as 58 miles. But our evaluation found that its actual range was a great deal less. And when a second bike was delivered, with a working speedometer so we could check its speedo accuracy (59.4 mph at an indicated 65 mph), it also seemed stronger with better range, so before giving it back we made sure to ride it from a totally full battery until it died. It went exactly 27.6 miles, suggesting variations in individual battery capacity.

Of course, the whole perception of "clean" electric power tends to ignore the fact that just because you can't see, hear or smell electricity when it's added to a battery, it's somehow free. And just because you've moved the fumes from the vehicle's tailpipe to the power plant's smokestack doesn't change the fact that oil and coal still generate the vast majority of electrical power in America.

To learn just how much power was needed to charge the Zero's battery, we bought a simple \$30 device called the Kill A Watt™ from the local (Radio) Shack. Inserted between the bike's onboard extension cord and our own, it revealed a draw of 962 Watts, or almost exactly one kilowatt, and as charging requires four hours, the battery needed a total of four kilowatt/hours (kWh) to replenish.

But how many people have any concept of an individual gadget's comparative current use when the electric bill combines the draw of every item that has used power in the home over the past month? According to the US Department of Energy, a flat screen TV uses about 120W, a toaster 800–1400W, a clock radio 10W, a coffeemaker 900–1200W, a vacuum cleaner 1000–1440W, a washing machine 350–500W, a personal computer with monitor 270W and a laptop 50W.



While some of these items will run 24/7 (like the clock radio) and others for many hours a day (like the TV), some run for just minutes (like the toaster), so a 4kWh draw is significant.

To make nationwide calculations more difficult, electric utilities across the US charge greatly varying rates per kWh as well as different rates during certain times of day, so we'll base our data on California. It should come as no surprise to residents that California is among the highest for both gas and electricity—the average price of a gallon of regular was \$4.39 as we went to press—and one kWh of electricity averages \$0.153, so the Zero costs about \$0.60 to recharge. Figuring an average range of probably 20 miles between charging (just because your bike's theoretical range is 200 miles, you wouldn't risk riding it 195 miles every time before refilling), the Zero's power is \$0.03/mile. But beware, Californians, power use beyond the average home's "baseline" can also raise rates, to as much as \$0.40/kWh.

The Suzuki DR200S makes a great comparison, with a slightly higher top speed, 71.5 mpg vs. 68.1, a slightly quicker 1/4-mile, 18.37 sec. vs. 19.31 and a slightly slower 0-60 time, 13.62 sec. to the Zero's 11.73. The DR makes 13.29 hp to the Zero's 22.58, but has a 5-speed transmission and weighs slightly less, 276.5 lbs. to the Zero DS' 296. The Suzuki got as high as 86.7 mpg in testing and averaged 63.8 mph in both on- and off-road use (tested Dec. 2010).

The Suzuki therefore costs \$0.069/mile for gas to the Zero's \$0.03/mile for electricity. But that's not the whole story.

Maintenance is another factor. Using our standard maintenance chart for numbers, eliminating the replacement cost of the DR's washable air filter and the rear wheel R&R times, its 3000-mile service intervals for oil changes, valve adjustments, etc. might average \$187.29 or an additional \$0.062/mile.

Zero recommends maintenance too, 4000-mile inspections to check brake linings, lube cables, etc. which we'll figure as one hour or \$80 by our standard labor rate. Every 8000 miles, the DC motor's brushes will need inspection and probably be replaced, which we'll figure will add another \$100, for \$260/8000 miles or another \$0.033/mile. (We'll leave the cost of tires and brake pad replacements out of the equation as they should be a draw.)

But the most overlooked factor in the cost of electric vehicles is the price of the rechargeable battery, which has a limited life expectancy. Although Zero gives a life of 70,000 miles based on its optimistic estimate of range, the critical factor is number of charge cycles the battery can accept, which Zero gives as 1800. If your range is actually 20 miles per charge cycle, you get 36,000 miles per battery, and the Zero's custom-made Li-Ion battery isn't cheap, with an MSRP of \$3999 (compare it to the Toyota Prius' nickel metal hydride drive battery, current price \$3691 [2005-model] plus \$1050 for installation labor). Using the more realistic 20-mile range for our calculation, the Zero's battery has a cost of \$0.111/mile.

Grand totals: Zero DS = \$0.174/mile, and the Suzuki DR200S = \$0.131/mile.

There's no contest when it comes to purchase price: The DR200S retails for \$4199 and the Zero DS for \$10,495. Nonetheless, incentives abound for electric vehicles. The feds provide a 10% federal tax credit and the CA Clean Vehicle Rebate Program pays \$1500, making the Zero \$7945. Colorado's incentives are the most generous, and including the federal tax credit, drop the price to just \$5395. Zero's website has a map so you can check your own state's rebate programs.

While battery and electric motor capabilities will surely improve and gasoline prices may rise even higher to change these equations over time, currently the economic advantage is still with the gasoline-powered motorcycle. Interesting...

DAVE SEARLE

—Dave Searle
Editor