



THE GOMICYCLE



A Honda Rebel 250 motorcycle goes electric. By Marque Cornblatt

Photography by Marque Cornblatt and Jeff Kramer

While most civilians wait patiently for electric vehicles (EVs) to arrive at their local showroom, we makers take matters into our own hands. We've created a dizzying array of street-legal electric cars, scooters, and motorcycles, and there's even a National Electric Drag Racing Association.

I wanted to go electric for my own day-to-day transportation, but I didn't want to reinvent the wheel. So I researched the existing art, and purchased plans for the "El Chopper ET," a Honda Rebel 250 project that was developed by motorcycle EV conversion guru John Bidwell.

The plans turned out to be a little dated. They promised a quick and easy build, but the cost of the materials has risen, and some components are no longer available. I adapted and redesigned a few parts almost from scratch, but even though the

project went "off the reservation," the El Chopper ET plans were a useful starting point.

Since I didn't have all the tools and skills needed to do the full conversion, I assembled an informal team. Gary Xaoui and Kat Townsend helped with fabrication, while Todd Kollin at Electric Motorsport in Oakland, Calif., where I bought most of the electrical components, contributed valuable advice.

Battery Matters

Projects like this always have tradeoffs like speed vs. range, sturdiness vs. weight, or quick acceleration off the line vs. high top speed. The biggest factor with this one was cost vs. performance, particularly regarding the batteries. In theory, a lithium-ion battery bike would rock, but the batteries alone would cost something like \$10,000.

MATERIALS

Honda Rebel 250 rolling chassis **We found a bike with a blown engine (Figure A) for less than \$500 on Craigslist, [craigslist.org](https://www.craigslist.org).**

12V, 50Ah sealed lead-acid golf cart batteries (4)
Perm PMG-132 electric motor
36V–72V PWM (pulse-width modulation) controller
0K Ω –5K Ω twist-grip electric throttle (potentiometer)
48V AC charger
48V–12V DC-DC down converter, or additional small 12V battery for lights, signal, and horn
½" steel angle beam, 80" long
Thick, long zip ties
¼" plate steel
#4 welding cable and lugs
Front/drive sprocket and rear/driven sprocket

The optimal number of teeth for each of these will depend on the specs of your motor, the size of your rear wheel, and your target top speed. Consult a gear ratio calculator, such as makezine.com/go/gearratio. You may need to order custom sprockets.

EI Chopper ET Builder's Guide by John Bidwell available from [21 Wheels, 21wheels.com](https://21wheels.com)

Honda Rebel 250 original factory service manual
Without this, the project would have been lost.

TOOLS

Welder
4" angle grinder with cutting and grinding wheels
Drill press
Metal band saw
Sawzall or other reciprocating saw
Wrenches and other standard auto shop tools
Heavy duty wire cutters/crimping tool
Rags and solvent for cleaning
Friends who can help



Fig. A: A used Honda Rebel 250 with a blown engine, from Craigslist.

less. The smaller battery set was less powerful, but the changes saved so much weight that the Gomi-Cycle got roughly the same top speed and range as before, 40mph and 15–20 miles.

Mod the Frame

The first step in the GomiCycle conversion was to strip the frame (Figure C). This was surprisingly fun and fast to do with basic hand tools. Make sure you save all the nuts, bolts, and other bits and pieces for reassembly later. Clean the frame using rags and solvent. Then use the Sawzall and angle grinder to cut off the motor's mounting points and tabs.

The original plans called for chopping and lengthening the frame to fit 4 batteries in the engine compartment. Instead, we opted to retain the Rebel's original geometry. The relatively compact 50Ah batteries all fit in the compartment, arranged in 2 pairs. We made trays for them out of ½" steel angle and held them down with enormous zip ties.

We modified the frame's swing arm, the fork-like part that's mounted on shocks and holds the rear wheel. Following the original plans, we cut a rectangular hole in the arm for the electric motor to fit into, just in front of the rear wheel (Figure D). Then we shaped and welded a custom bracket out of steel plate to mount the motor (Figure E), making sure its sprocket would align with the rear wheel sprocket, which is critical for keeping the chain in line and at the correct tension during travel over rough roads.

Assemble the Power Train

The next step is to replace the motorcycle's entire original drivetrain — the engine, clutch, transmission, carburetor, and exhaust system — with 4 batteries,

The EI Chopper ET plans estimated the cost for the whole project at \$1,200.

The first version of my GomiCycle used a set of 4 big 80Ah lead-acid batteries, 2 of which were free; I already had them lying around from an old robot project. But they had suffered through the heat and corrosive dust of Burning Man and were in sad shape. We welded heavy, ultra-sturdy trays for the batteries using 2" angle steel (Figure B), and held them down with strap steel and a padlock. Two batteries fit in the engine compartment and 2 more straddled the back, mounted like saddlebags.

But the batteries were a mismatched set, and their performance proved disappointing. For the next version, we bought new, smaller 50Ah batteries and made trays to hold them that weighed 80%



Fig. B: The original, overbuilt battery tray for the engine compartment. Fig. C: The stripped motorcycle frame. Fig. D: The swing arm, with a clearance hole and mounting bracket for the motor. Fig. E: The electric

motor, bolted to the mounting bracket on the swing arm. Fig. F: The GomiCycle's wiring, on an earlier version of the bike, with 80Ah batteries. We stuffed the electrical components into a camping cooking pot.

an electric charger and controller, and a motor with just 1 moving part, the hub. No oil is needed, and virtually no noise or heat is produced during operation. Clearly, this is not your father's motorcycle.

An unmodified Rebel has a small 12-volt battery under the saddle that powers the lights, horn, and starter. Our new electric drivetrain needs to operate along with this original electrical system. One option is to keep the systems separate, by simply adding a small 12V battery dedicated to the lights and such. This option simplifies the wiring, but also requires a second battery charger and more daily maintenance — a solution that I found inelegant.

Instead, we spliced a 48V-to-12V DC converter into the main power system and pulled our 12 volts from there. This taxes the batteries slightly, especially when the headlight is on, but everything recharges from a single standard wall plug. Xaoui figured out the wiring, which was way outside my comfort zone, and it took a few rounds of trial and error to get it right (Figure F).

Conclusion

The GomiCycle project was a challenge. It required a lot of people, skills, and tools. The original plans said that the bike would cost around \$1,200, go

+ WHAT IS GOMI?

Gomi is originally a Japanese word for dust or garbage, but it's now slang used to describe anything that people discard or no longer value. The word was introduced to English speakers by best-selling author William Gibson, who uses it to describe a near-future dystopia of our material culture gone haywire.

In my working, *gomi* is DIY. *Gomi* is tech-positive. *Gomi* breaks the rules, but is responsible. *Gomi* is an aesthetic choice — the best defense against mindless materialism.

—Marque Cornblatt

60mph, and have a 40-mile range, but ours cost almost \$3,000, tops out at 40mph, and has a range of 15–20 miles. But the story is far from negative.

The GomiCycle is a great short-hop urban commuter bike with lots of torque and pep — it climbs San Francisco hills without difficulty, and people love it wherever it goes. It costs pennies per mile to ride, and its lack of emissions makes the wind smell that much sweeter.

Marque Cornblatt is a conceptual artist, roboticist, and maker. He is the creator and host of *Gomi Style*, a DIY lifestyle and design video series (gomistyle.com).