

## The “Lithium Lounger” Project, by Bob Dahse

**The Concept:** The Lithium Lounger (as in lounge chair) is a **Human-Electric Hybrid Vehicle**, built from off-the-shelf components as a **self-fueling** automobile alternative for 3-season commuting and touring over poor roads in very steep terrain, often pulling a well-loaded trailer at speeds up to 25 mph.

**The Bike:** I began with stock trike built by Catrike in Winter Garden, FL, purchased from the Hostel Shoppe in Steven’s Point, WI. Three fat-tired wheels were chosen instead of two for a number of reasons:

- 1) The rider can concentrate on pedaling and steering without having to balance
- 2) ANY hill can be climbed, regardless of slope or road surface
- 3) Stopping and restarting requires no change of body position
- 4) Riders can easily steer a very straight “track” which makes them more predictable in traffic

The low, recumbent riding position offers:

- 1) Maximum comfort, with no stress on the hands, arms, shoulders, neck, back or butt
- 2) Maximum efficiency at high speeds or in headwinds
- 3) No struggling with sidewinds in traffic, and better visibility
- 4) Maximum stability at any speed, fast or slow

**Steering:** Each front wheel pivots in sealed headset bearings, angled as they are in automobiles, to give very responsive and precise steering that’s also very stable at higher speeds. The steering grips connect directly to the wheels and are linked by an adjustable bar that sets the steering “toe-in”. The rider’s hands need never leave the grips, as steering, shift, brakes, and motor throttle are all controlled from them.

**Gearing:** The stock trike utilizes 3 front chainrings and a 9-speed freehub cluster, yielding 27 gears. As seen, the freehub cluster has been replaced by a Shimano Mega-Range, 11-34T, 7-speed freewheel mounted on a 3-phase, DC hub motor, offering 21 gears but in a wider range.

**The Human-Electric Conversion:** Converting a 30-pound trike into a 60-pound hybrid may sound counterproductive. But the first time a rider starts up a steep hill and finds that they can maintain normal cruising speed by just flexing a thumb, it begins to make more sense. 30 pounds of weight adds the power output of three elite cyclists!

**How it works:** Sunshine hits the solar panels in the rear, charging a set of four DeWalt, 36-volt, lithium, cordless tool batteries. These power a 40-amp PWM (Pulse Width Modulating) motor controller, connected directly to the Crystalyte Phoenix Racer electric hub motor. For the rider, electric power is controlled by a variable-speed, thumb throttle and cruise control. The rider simply pedals (or doesn’t!) at whatever intensity is preferred, then adds whatever assist is desired, locking in the setting with cruise.

**Speed, Power, and Range:** Top speed on just electricity, on flat terrain, is 24 mph. If you want more speed, a 72-volt controller and battery set-up nearly doubles the speed but can severely limit range if you exceed 35 mph. The four batteries weigh a total of 10 pounds, and have a charge/discharge life of over 2000 full cycles, but supply over 300 watt-hours of power. An elite cyclist at full lung-bursting, leg-burning output, maintaining this torture for one hour, puts out the same amount of power. Riding range increases with more pedaling, less throttle, fewer hill climbs, and more time in the sun. The opposites reduce range.

**Recharge:** Self-charging if left out in the sunshine, it takes 15-18 hours from dead to full charge. Charging using three, 120-watt PV panels wired in series takes about an hour. AC charging with the onboard charger takes about 4 hours. Each of the 4 DeWalt batteries (with cells from A123Systems) can survive a charge or discharge up to 60 amps (240 amps with all 4) without damage (don’t try this with other of lithium batteries)!!

**Cost:** The stock trike was \$2250, with another \$1200 spent on electric conversion. But well worth it!

### Sources:

- 1) [www.Catrike.com](http://www.Catrike.com) or [www.HostelShoppe.com](http://www.HostelShoppe.com) - the Catrike “Road” trike and other trikes.
- 2) [www.electricrider.com/crystalyte/parts.htm](http://www.electricrider.com/crystalyte/parts.htm) - the Crystalyte Phoenix Racer motor with pre-built wheel, controller, throttle, cruise control, keyswitch, fuse, and torque bracket.
- 3) [www.Ebay.com](http://www.Ebay.com) - DeWalt DC9360 Lithium-Iron-Nanophosphate batteries
- 4) [www.GeoPathfinder.com/9659](http://www.GeoPathfinder.com/9659), [www.GeoPathfinder.com/Details%20of%20Trikes.pdf](http://www.GeoPathfinder.com/Details%20of%20Trikes.pdf), or [www.GeoPathfinder.com/LithiumLoungerConversionDetails.pdf](http://www.GeoPathfinder.com/LithiumLoungerConversionDetails.pdf) for more details and photos
- 5) [www.a123systems.com/#/home/phev](http://www.a123systems.com/#/home/phev) - the lithium nano-particle cells used by DeWalt