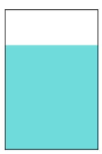
Lectric XP eBike's Mythical Mileage Indicator, Version 1.0

By R. G. Sparber

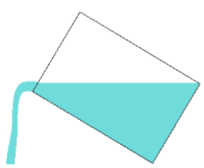
To avoid unassisted pedaling all the way home, we need to know how many miles are left before the battery dies. You won't see that number on your display.

There is an "Energy Bar" on the Lectric XP. It won't take you long to realize that this bar is not telling you the remaining miles. Well, what is it saying?

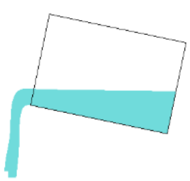
Let me attempt to answer by using an analogy.



I have a bucket with 1 gallon of water in it.

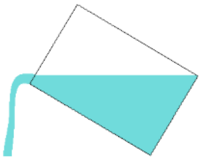


If I pour it slowly, it will take a long time to empty.



Pour it fast, and you will be done quicker.

Your battery is the bucket. Instead of containing water, it holds energy. Make the motor work hard, and it will consume more energy than when it is loafing along. The more energy you use, the shorter the time until you are out.

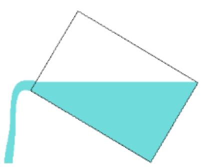


It is possible to indicate the remaining energy in the battery, but without knowing how much energy your motor will consume over time, there is no way to predict how many miles you will get.

Things get murkier when we look at the "Energy Bar." The best it can tell you is that when you have all bars, the battery has plenty of stored energy. When there are only a few bars, the battery doesn't have much left. It won't take you long to realize that half of the bars does not mean half full.

Is there a better indicator of energy? Yes, but it is not straightforward.

The Lectric eBike's battery is rated "10.4 AH." The "AH" stands for Ampere-Hours. For the useful range of battery voltages[2], we can draw current, in amperes, over a period of time, in hours.



Just like with the bucket of water, you can draw a high current, but the battery will be dead in a short period of time. A lower current will let you ride more miles.

For a wide range of currents, we can say that our run time, in hours, will equal

$$\text{Run time} = \frac{10.4\ Ampere{-}Hours}{drawn\ current\ in\ Amperes}$$

For example, I can draw 10.4 amperes

$$\text{Run time} = \frac{10.4\ Ampere - Hours}{10.4\ Amperes}$$

and the battery will last 1 hour. Draw 5.2 amperes, and it will last 2 hours.

[2] This is a "first order approximation". As the battery voltage drops, more current is needed to get the same power into the motor. However, the voltage only varies about 10% and the current goes from 0 to 20 amperes. So talking only about current is all that inaccurate.

Change your display to show "CUR" which stands for current. With Peddle Assist (PAS) at zero, you will see a current of zero. Raise the PAS and go up a steep hill and the current can rise to 20.0 and stay there, regardless of how fast you wish you could go. This limit protects the motor from burning up.

If you rode on flat ground and constant speed, the displayed current would be constant. Say you saw 2 amperes. The above equation predicts that you could ride for

$$\text{Run time} = \frac{10.4\ Ampere{-}Hours}{drawn\ current\ in\ Amperes}$$

$$\text{Run time} = \frac{10.4\ Ampere{-}Hours}{2\ Amperes}$$

Run time = 5.2 hours.

Life gets complicated when the current is not constant. Say you rode for 1 hour at 2 amperes. That is 2 Ampere-Hours. The battery holds 10.4 Ampere-Hours, so you would have 10.4 – 2 = 8.4 Ampere-Hours left.

Then, say you rode at 4 amperes for 1 hour. That uses 4 Ampere-Hours, so you now have 8.4 – 4 = 4.4 Ampere-Hours left.

Do you have enough to get home? I have no idea. It depends on how much current you draw and how long you draw it. However, this does say that if you have battery anxiety, slow down and/or peddle harder to lower the current being drawn. Maybe you are willing to run at PAS 0 on the flats and then climb that killer hill very slowly. It is all about current and time.

The better battery monitoring systems keep track of energy put into the battery and taken back out. They measure the current over time, which lets them display a running total of remaining energy. The XP's computer can measure current, but I suspect it doesn't have the computing power to continually run this calculation. An external circuit could perform this task, but it would be messy to measure the current.

I welcome your comments and questions.

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