

INTRO TO EBIKES



Electric bikes are a new and promising alternative form of urban transportation. They provide all the advantages of a regular bicycle: fun exercise, free parking, zero emissions, and freedom from gridlock, while eliminating one of the bicycle's more serious drawbacks, lack of power. Imagine pedalling up a hill as comfortably as riding down, that's what the e-bike experience is all about. In most situations in the city, riding an electric bike will be faster and cheaper than either car or public transit.

Fundamentally, an e-bike is just a regular bicycle with an electric motor to provide additional assistance. You can pedal normally and just use the motor to help out on hills and headwinds, or use the motor all the time just to make riding easier. The experience is entirely different from riding say a gas scooter or motorbike. Here the electric assistance is perfectly smooth and silent, and it complements rather than supplants human power.

For an introductory guide to electric bikes for absolute beginners take a look at the [Grin Basics Ebike Guide](#).

Are they road legal in Canada?

Yes, the Motor Vehicle Act was recently modified to include a class of Power Assisted Bicycles. In BC the rules state that with continuous motor power under 500 watts, and at speeds less than 32 km/h, there is no need for either a license or insurance to use an electric bike on public roads.

In the past several years, many countries have adopted some kind of legislation to legitimize electric bicycles on the roadways or are in the process of doing so. In many of these jurisdictions, the limitations are quite a bit more restrictive, with 20 or 25 km/h maximum speeds and power limits of just 200 or 250 watts. For fit cyclists or people who are seriously considering ebikes to be their primary vehicle, these conservative regulations can have the effect of hindering the adoption of what is indisputably among the greenest and most convenient transportation modes to come around.

Won't the extra weight make it difficult to pedal without the motor?

The short answer is yes but not much. The effect of weight is largely exaggerated in how a bicycle performs. People spend thousands to shave off a few pounds for a really high-end bike. But since the rider is already at least 5-6 times heavier than the bike, the vehicle weight itself makes minimal difference. A heavier bicycle is slightly harder to ride uphill, somewhat faster to ride downhill, and pretty much the same on the flat as a lightweight one.

The addition of a motor and batteries can add anywhere from 20 to 40 lb to a bike and has surprisingly little effect on its rideability. My university textbooks weigh a comparable amount and aren't nearly so helpful on the road. You definitely do notice the weight if you have to pick the bike up and carry it for any reason though, and it can be a bit unwieldy.

Now those 20-40 lbs of additional weight are more than made up for in their hauling capacity on even the steepest of hills, and trip times with an ebike are usually between 20-30% faster than a regular bicycle.

How much power does it use?

The average power that a typical cyclist will deliver is on the order of 150 watts, or 1/5th of a horsepower. If you're curious, most modern exercise bikes will display the exact wattage and you can get a feel for how much power you're producing with the legs. A fit individual can sustain 350 watts for about 10 minutes and up to 600 watts for a few seconds, but for continuous riding between 100-200 watts is typical. You might think then that 150 watts would be all you need for an ebike, but if you ever ride a 150 watt bike it will feel unimpressive. When a cyclist hits a hill, they switch to an easy gear and the speed drops to 10-15 km/h as they work hard and move at a slow pace. However when an electric bike does the same thing and slows to walking speed on the hills it seems way under powered. To maintain nice speeds over 30 kph while going uphill requires on the order of 400-500 watts or more. On the flat, 400 watts (about 1/2 horsepower) will move a typical bicycle about 40 km/h.

For comparison, car engines are usually several hundred horsepower, and travel at a comparable average speed in the city, and only twice as fast outside.

Does it recharge the batteries while you pedal?

For some reason this is one of the most commonly asked technical questions we get and it shows that the advantages and capabilities of electric drives are widely known. The answer is that yes, on most hub motor ebikes it is possible to recharge the batteries from pedaling. BUT, only when you are moving at a speed faster than the motor can attain itself.

Recharging from pedaling is not really the intent of the electric drive as it is with, say, a hybrid car. In general, with an ebike you draw a net amount of power out of the battery pack to assist you riding. You then replenish this energy from the wall outlet, rather than by working extra hard later on in the trip. BionX is the only ebike kit I am aware of that has a specific regen mode that allows you to work against the motor and recharge the batteries continuously while riding at lower speeds. Its like hauling a heavy trailer with two flat tires, so unless you're in it for the exercise alone there is little point.

The topic of regenerative braking comes up quite frequently, and the point here is not to recharge the batteries from your pedaling energy, but to recharge them from stored kinetic energy when you come to a stop. With any direct drive hub motor or geared ebike without a freewheeling motor, you will get regen currents when you are moving faster than the unloaded speed of the motor. So even though it won't bring you to a stop, it does act as a speed governor of sorts for long downhill, dumping the extra energy back into the pack, whether you want it to or not. In most cases it's quite rare that you would actually achieve speed greater than the unloaded speed of the motor for any length of time.

In order to use regenerative braking to come to a stop, then you need a 2-quadrant motor controller and a drive train without a freewheel. This saves wear on the brake pads, and extends the range of the battery pack by 5-10% with no penalty. The controllers that come with TidalForce and BionX ebikes can do this. With Wilderness Energy, Golden Motors, Crystalyte, and similar chinese hub motor kits, it generally requires a 3rd party motor controller. Most chain or gear driven ebikes, like the Lashout, Heinzmann, and Currie, have freewheeling clutches that make regenerative braking impossible.

How fast? How far? How much?

These are numbers that are unique to each bicycle design. Commercial bikes generally obey the 32 km/h speed limit, and many cut out closer to 24 km/h to comply with regulations in other countries. It is easy to make a homemade bike that goes over 45 km/h while still in the 500 watt power limit. The range depends almost entirely on the size of the battery pack. Most commercial bikes skimp out in this regard and (advertized claims aside) can only go 20 to 30 km under typical use. A high capacity pack will store over 500 watt-hours and gets closer to 40-50 km. The cheapest complete electric bikes cost about \$600 CDN, while most of the more reputable ones are in the \$900-\$1500 dollar range and the highest end bikes top out at \$3000. Conversion kits to make an existing bike electric vary from as little as \$360 for WE DC hub motor, to \$1999 for a Heinzmann. Additionally, we offer various products including full conversion kits from eZee here.

Should I do a conversion or get a prebuilt ebike?

There are two approaches to acquiring an electric bicycle. Either you can start with a regular bike of your choice and install conversion kit for the electric drive, or you can purchase one of the many commercial ebikes that are on the market.

When you buy a prebuilt ebike, you get the convenience of having a turn-key product, hopefully with warranty and shop support, and a system (battery, charger, bike, and motor) that is generally well integrated and slick. At the moment though, there is shortage of well-made ebikes in production. There are some good names like the Lashout, TidalForce, Giant Lafree, Panasonic Folder, Mercedeze and many more that are either discontinued or hard to come by. The bikes that are seen more and more frequently today are Chinese imports designed for the Chinese market.

These are usually clunky low end bicycles with hub motor drives, lead acid batteries and plastic paneling. Stylistically they often try to resemble scooters rather than conventional bikes, they are cheap for companies to import since they're produced by the millions overseas, and are now available at a Canadian Tire store near you.

The slick integration of commercial ebikes is also a vulnerability, since more often than not you become locked into a proprietary set of components and the options available for upgrading or repair are limited if any, especially with regards to the battery pack. You are also dependent on the manufacturing company staying in business in order for these parts to stay available. As many TidalForce owners can testify this isn't something you can count on, even with the most expensive machine.

With a conversion kit approach, you have unlimited choice in the bicycle type and style, and for individuals who are already cyclists and have refined bicycle tastes this is almost always the best route. Furthermore, you can generally pick and choose a battery pack customized to your range, weight, and speed requirements, and have the assurance that you can always upgrade and replace it down the road if you choose an 'open' kit system.

However, along with the kit comes the installation which can deter a lot of people. In general, most hub motor kits are pretty straightforward to mount if you have any familiarity with bicycle mechanics or are a competent hands-on type of person. There are also mid-drive conversion kits such as the StokeMonkey and Cyclone-USA which require a bit more modification to the bike, but have the advantage of using the motor through the pedal gears for a much wider speed and torque range at the wheel.

Both the conversions and prebuilt setups suffer from being a relatively new technology with lots of minor bugs and glitches that the manufacturers are still ironing out. A common sentiment by ebike owners is that it's quite nice, but still a little rough around the edges. This is true not just with the cheap imported conversion setups but even a lot of the more expensive and higher end ebikes which I've been caught having to repair.

Environmentally speaking, isn't this a step backwards from the regular bicycle?

Surprisingly, electric bikes can have a smaller environmental footprint than pedal-only bicycles. Not convinced? Look at it this way, a human powered vehicle is using the human metabolism to convert food energy into work, with a conversion efficiency of about 25%. That's the first part of the picture, then we have to step back and look where the food energy comes from. In North America and Europe, the food is grown with the aid of chemical fertilizers and machinery, it is then transported, processed, packaged, transported, sold, transported again, and finally cooked before consumption. In the end about 10 times more primary energy went in to producing the food than is actually stored in the food itself. The net effect is that for every unit of human energy used on a bike, about 40 times that much was consumed.

By comparison, with an electric vehicle you are taking primary energy from the grid and storing it in a battery at between 60-80% efficiency, and then converting it to work through an electric motor with roughly 75% efficiency. That's a lot more direct than the human route. Once you take into account the energy to manufacture and recycle the batteries, e-bikes end up consuming from 2 to 10 times less fossil fuel energy than their human-powered equivalents. To see more details and references, have a look at the Ebike Energy article.

Also, electric bikes open up cycling to a whole slew of people who would otherwise be driving a car. It's wrong for cyclists to assume that anyone can ride a bike. Many people would like to, but find it impractical or impossible because of hills, distance, health reasons, knee problems, aging, or even the inconvenience of having to shower and change at work. Ebikes suddenly make biking a whole lot more accessible to the 98% of our population who aren't cyclists.

Where can I try or buy one?

Most cities now have at least one dedicated ebike shop that's sprung open. Vancouver probably has the highest density anywhere in North America, with new stores opening and others closing every year.

- JV Bikes is located downtown and was the first store in Canada to carry the powerful TidalForce bike from Wavecrest. They sell and rent a wide variety of complete bikes and ebikes, including small electric folders for urban commuters and electrified cruiser bikes for the fashion-conscious. JV Bike does custom installations of both Crystalyte and BionX conversion kits.
- The World Cycles on Commercial St. offers electric bike conversions and specialises in vintage Schwinn bikes too
- If scooters and skateboards are your thing, check out E-Ride, near 4th and Burrard. They have recently expanded their offerings to include a large assortment of Jetdek powerboards, from the 150W Junior up to an 800W Off-Road version. Their latest generation Motorino looks like a small gas scooter, but it still has pedals to legally count as an ebike. They also have a variety of attractively priced chinese ebikes with NiMH battery packs.
- Cambie Cycles is a specialized recumbent bike store that also deals with electrics. They used to carry the German built Heinzmann hub motor conversion kits which

were to die for if you had \$2000 to spend, although it looks now like they are down to just Wilderness Energy hubs and a few ebikes like the Panasonic and Merida.

- Every year brings something new to the scene. The latest store to open in Vancouver is Ecodrive E-cycle, located on 2nd avenue near Granville Island. They carry a line of chinese ebikes and scooters similar to the offerings of GWEV and E-Ride. They also have an outlet in Richmond.
- Another somewhat recent addition to the scene is City Biker, with one store located downtown and another branch on Hastings St.
- Raylight is another electric bicycle store that is still running, selling folding ebikes, electric scooter bikes, and other miscellaneous items. They are located on Kingsway near Boundary Rd.
- Unfortunately, Voltage EV is no longer in the ebike business. For many years Christian and Erika pioneered the electric bicycle scene here in the west coast, setting a very high standard for quality offerings and customer service. Their shop on Main St. has steadily phased out of electric bicycles and now carries an assortment of interesting art toys and designer T-shirts.
- Finally, we at ebikes.ca have started Grin Technologies, selling parts and accessories to the DIY crowd and to established and reputed bicycle stores. Our shop is located in a non-descript brick building at 20 East 4th Ave