



Electric Bicycle Buyers Guide



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ELECTRIC BIKES

Introduction

Worldwide, electric bikes are becoming an increasingly popular and mainstream form of local transport offering a convenient, cost effective and environmentally friendly option for doing the daily commute, running local errands or simply enjoying recreational cycling with less effort.

Of course, with the increased popularity, greater options have become available in terms of bike types and styles so the job of choosing the right bike for your needs can be a little confusing.

This guide is designed to provide you with the key information you will require, in an independent and objective manner, to assist you in making the right choice for your needs.

What is an electric Bike?

Electric Bikes are effectively a standard bicycle that has had an electric motor and a rechargeable battery pack added to provide assistance in pedalling. They generally have a number of different levels of power assistance that the rider can choose depending on the terrain and the desired level of effort they wish to exert.

The objective is to allow riders to go further or negotiate hilly terrain with less effort.

While initially being quite rudimentary, dramatic improvements in electric bicycle technologies and capabilities have made the e-bike a more suitable option for many. Used by people looking for a low impact way to get back into shape, older cyclists seeking a more accessible way to enjoy leisurely bike rides, workers attempting to simplify their daily commutes, environmentally conscious travellers hoping to decrease their emissions footprints, or anyone in between, the electric bicycle has now come of age.

Types of E-Bikes

Electric Bicycles can be grouped into 2 broad categories:

1. E-bikes that have been specifically designed and built as Electric Bikes and have fully integrated motors and electrics.
2. Conventional non-powered bicycles that have been converted into an electric bike by way of electric motor kit or similar.

Within each of these categories we then have two sub-groups based on the drive system:

- a. Hub Drive
- b. Mid Drive.

Each drive system has its advantages and disadvantages and therefore should be considered in terms of your specific needs.

Hub Drive Electric Bike System

These can be either Front Hub Drive or Rear Hub drive but they effectively work the same way.

Hub drives are defined by the fact that they utilise an electric motor that has been installed directly into one of the bikes wheel hubs – either front or back. In this way they supply power directly to the relevant wheel giving you assisted forward drive.

To date, hub drives have perhaps been the most common form of e-bike drive however in recent times the Mid Drive bike has begun to gain more traction due to some of their inherent features.

Front hub drive systems obviously have the motor located in the front wheel. Compared with a rear Hub drive their advantages include being quite easy to install and remove because they don't have to work around chains, derailleurs, or gear sprockets which also make it relatively easy to perform repairs. They also can help balance out the weight of your bicycle as the batteries are quite often mounted on the rear rack.

On the other hand, front hub drives can have a tendency to "slip" or "spin out" since the bulk of the rider's weight is located behind the front wheel. They also tend to create the sensation that the bike is being "pulled" forward, which for regular riders of conventional bikes can feel a bit unnatural. Additionally, the extra torque introduced by front hub motors typically requires the use of more sturdy forks, rims, and spokes than may be usual. Finally, they are unable to leverage the use of the installed gear system as they bypass the crank drive providing power direct to the wheel. This can result in a lack of some of the drive efficiencies typically gained on geared bicycles in particular hill climbing ability.

Rear hub drives obviously supply power direct to the rear wheel which is effectively the same as your conventional bike and therefore actually "push" the bike forward, which can feel more natural to many riders. Also, because the overall weight distribution is toward the back, rear hub drive systems tend to have better traction and do not experience the same slippage issues that front wheel hubs can in certain conditions providing for a smoother and more efficient riding experience. They are also not prone to the same frame issues as front drives as the rear frame dropouts are normally stronger than the front fork dropouts and a rear wheel can generally handle more torque and power than many standard front wheels. Lastly, depending on the bike, it may be possible to attain faster flat terrain speed than Mid Drive bicycles.

There are some downsides however. Rear hub motors can be tricky to install or remove since they have to work around derailleurs, chains, and cassettes, which can also make it difficult to perform certain types of repairs. Despite the familiar feel of power being generated at the rear wheel, the added bulk of the rear hub motor can negatively affect the overall handling of the bike, making it feel a bit back-heavy with some riders experiencing tendencies for the bike to 'wheel stand' particular if taking off on hills. Finally, like their front hub cousins, rear hub motors are unable to leverage directly any of the normal gear systems that may be on the bike as they are bypassing the crank and gears and providing power direct to the wheels.

Mid Drive Electric Bike Systems

As noted earlier, mid drive systems are becoming more commonly used on a variety of electric bike styles, and for many riders, these motors provide an especially versatile, balanced, and powerful riding experience. Many consider them to be generally more powerful, more reliable, more sophisticated, smoother and can often supply greater torque than a traditional rear or front hub motor.

In Mid Drive Systems, the motor and in some cases an additional gear drive, are positioned at the centre of the bike providing power directly to the main front chain gear sprocket. This of course replicates the way your conventional bike works with power normally supplied by the rider to the front chain gear sprocket via the pedal cranks. The key advantage of this is that the power offered by the motor can be fully leveraged by the bikes gear system providing increased hill climbing ability. In addition, the good use of the existing gear system can help maintain a more optimum motor speed thus increasing power efficiency. Some systems also feature 'gear reduction systems' that further enhance this efficiency and minimise torque loss in the motor providing even greater hill climbing ability.

Other features that are making the mid drive systems more popular include ease of maintenance and general ride experience. Typically attached to the bike somewhere around the main crank, mid-drive motors leave the large majority of standard bike components untouched, which makes it easier to repair or replace standard bike parts as needed. Similarly, the placement of mid-drive motors means that the additional weight introduced by the motor is located closer to the bike's natural centre of gravity, creating a more natural riding sensation than hub motors and negating some of issues around slippage and wheel stands.

With all that said, however, mid-drive motors can put additional wear on cranks, bottom brackets, chains, and cassettes due to the extra torque generated by the motor. Additionally, most mid-drive motors come only on specifically designed electric bikes. Some kits are available but in many cases these are harder to install when attempting to convert a conventional bicycle to an electric bike.

Batteries

The technical evolution of batteries led by the computer and mobile telecommunications industries over the past couple of decades has made a significant contribution to the development of other battery dependent applications including of course the electric bike.

Reliable, efficient, lightweight and rechargeable batteries have opened the opportunities for e-bike designers to create bicycles that can truly offer a practical transport alternative while also creating improved experiences for those who simply need or desire some help to go the full distance.

The most common battery in use today is the lithium ion battery with good quality batteries having integrated battery management systems (BMS) designed to improve safety and battery life by managing the charging and discharging process. They are also lighter than earlier technologies allowing batteries with larger capacities and therefore greater range to be used.

Range of course is one of the key considerations when choosing your electric bike. Generally referred to in terms of kilometres per single charge there are a number factors that affect the range performance of the battery. Firstly a good quality battery from a known manufacturer is important. The other factors affecting range are then more about how you use the bike and environmental factors. Obviously the level of pedal assistance you provide will be a major determinant of total range achieved. The more you pedal and the less you use the motor, the greater distance you can get from the battery. On the other side however, the more motor assistance you rely on and the less you pedal, the fewer kilometres you will get out of your battery.

Other key factors are environmental relating to the number of hills and their steepness. The steeper the hills you need to climb and the more of them or longer they are the more power the battery will use. The presence of headwinds and weight of user and or cargo you will be carrying will also affect power usage in similar ways. If understood and well managed, then battery range can be maximised.

Today's high quality electric bike batteries are typically 10aH which should give you a range of up to 50km dependent on the factors noted above. Larger battery capacities, 13aH or 15aH are often available as alternatives and can extend your range to up to 80km depending on usage. You should also look for battery configurations that are integrated well into the bike so as not to affect the overall riding experience.

How do electric bikes operate?

There are 2 types of power application for e-bikes:

1. Throttle power only
2. Pedal Assist

In throttle only mode, power is managed by turning a throttle similar to that of a motorbike or motor scooter. There is no requirement to pedal so you simply hop on and turn the throttle and away you go. The advantage is that this makes it easy for rider to get going, particularly if you are on a hill. You are also not required to put in any effort of your own so it makes the ride totally effortless. The disadvantages are that for many not used to this, there is a short learning curve to get a good feel for it and as you are not required to put in any effort yourself, it will draw on battery power more and reduce the potential range available. You also need to keep holding and managing the throttle position to keep the motor engaged. It is also important to note that as the legal on road maximum speed under throttle only power is 6km p/hr, throttle only assistance should only be available up to this speed at which point it should cut out automatically.

In Pedal assist mode, riders are required to at least turn the pedal cranks to engage the motor. It does not necessarily require a lot of force to be applied but while the cranks are at least turning, a sensor activates the motor to provide power to assist your pedalling. If you stop pedalling, the pedal assist sensor will then stop the motor until such time as pedalling starts again.

The advantage of pedal assist is that if you are used to riding a traditional bike, it has a more natural bicycle feel compared to a bike controlled by throttle only. It also means that you do not have to worry about managing a throttle while you ride, you can just ride as you would normally and simply select the level of power assistance you want and just pedal. Of course you will generally get better riding range using pedal assist mode compared to throttle only because you will likely be putting in a certain amount of your own effort reducing the reliance on just the motor and therefore the power draw from the battery.

One further benefit of the pedal assist mode is that as you are likely to be putting in at least some level of effort, you will get some exercise. Contrary to popular belief, it is often found that riders of electric bikes actually ride more often and are able to go further with more confidence so in fact get more exercise benefit than they would if they used a standard bicycle.

Once again, there is a legal limitation for on-road use with motor assistance limited to a maximum speed of 25km p/h. You can of course continue to use your own pedal power to travel faster than this if desired but not with any motor assistance.

Due the legal requirements for riding on road, a large percentage of e-bikes in Australia are pedal assist only however there are a number of dual system bikes that offer a combination of throttle only and pedal assist modes that take advantage of both systems and yet meet the legal requirements for on-road use.

So what are the legal limitations?

In May 2012, Australia changed the law to match European laws. There are 3 key elements of the laws are now as follows:

1. **Motor Output** – The allowable motor output rose from 200 to 250 Watts.
2. **Power Only assist** – This is where no pedalling is required and only motor power drives the bike applied by a throttle. This mode of assistance is limited to a maximum of 6km per hour.
3. **Pedal Assist** – This is where motor assistance is given as long as the bike is being pedalled. The maximum speed under this mode is 25 km per hour.

You do not need a licence or registration etc. to ride a electric bike that meet these limits on public roads or pathways.

So what type of bike fits my needs best?

Whether you buy your electric bike online or from a bricks and mortar store, there are a number of important points to consider that will help determine the right e-bike model for you. The familiarity with electric bikes you've gained by reading this guide should assist you in having meaningful conversations with e-bike retailers as you'll go into these conversations with a strong foundation of knowledge already in place. This foundation will ultimately become the base from which you make your purchasing decision.

When you start talking to e-bike retailers, here are the most important questions you should consider:

1. Do you prefer a hub-drive motor or a mid-drive motor? As discussed earlier, mid-drive motors have a number of advantages over hub-drives due to their ability to take full advantage of the bike's gear system, thereby maximizing power and efficiency. Thinking about the terrain you will be riding on how much effort you want to put in yourself will help you decide which will suit you better.
2. What size motor do you require? Again, as noted earlier, the size of an e-bike motor is generally described in terms of its power output measured in watts. For on-road use in Australia the maximum size power output is 250W however if you are looking to use your e-bike off-road then you may wish to consider a higher power bike which will help handle the steeper and rougher hills you may encounter. In this instance you could consider a dual mode electric bicycle which has an on-road mode and an off-road mode available.
3. What modes of power assistance does the bike provide? i.e. Does the bike offer Pedal Assist mode only or does it have Throttle Mode also. The benefit of having both is that the throttle mode allows you to get started easily without having to pedal and once moving you can begin to pedal at which point the pedal assist mode kicks in. This makes it easier for many to ride particularly if you are likely to want to get started on a hill at some time.
4. What sort of gear system does the bike have? Effectively combining the mechanical efficiency of the bike's gear system with the power and torque of its motor is one of the best ways to fully maximize the overall performance of an electric bike. You'll want to know whether the bike has a single speed gear system, which will limit your ability to optimise the riding performance and may force you to rely more on the motor, or if it has a multiple gear system which will give you a broader range of riding options and makes it easier to climb hills and even perhaps improve battery performance.

You may also wish to consider the differences between a derailleur gear system and an internal hub gear system. For many people the internal hub systems are easier to use, more reliable and require less maintenance however they are also significantly more expensive and local bike store support may be more limited depending on the system.

5. What type of battery does the e-bike come with? Currently, lithium batteries are the lightest and most efficient batteries to use on electric bikes, so be sure the e-bike you're looking at uses a high quality brand rechargeable lithium ion battery.
6. What's the battery's range? For electric bicycles this is generally described in terms of how many kilometres a rider can go before needing to recharge the battery. The range of the battery you need depends on the type of riding you plan on doing. If you are likely to use more motor power than pedal power, then you'll be using your battery's charge quicker and will therefore need a larger range. If you plan to pedal a lot and use the motor assistance only periodically, you can probably use a battery with a smaller range. The length of your rides similarly impacts the type of battery you need: if, for example, you have a long daily commute then you probably need a larger range than someone who only goes a few miles each day. In short, be sure the range of the e-bike you're looking at will conveniently cover the distances you plan to travel.
7. What is the warranty? How long is it and is it for parts only or labour and parts. There are many e-bike alternatives on the market currently and many of them offer what appears to be an extended warranty such as 2 years. It is important to check the details of this as in many cases this extended warranty is only on specific parts of the bike that are unlikely to ever have an issue while the key areas that may have issues have a shorter warranty and are often then for parts only – no labour. If the e-bike retailer is reputable and supports the bike well then you should look for a min 12 months parts & Labour warranty on all elements of the bike.
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9. Parts availability – Notwithstanding the warranty offered, you should check to see if all spare parts are stocked locally in Australia or do they have to be ordered in from overseas each time. This of course can affect the cost and the particularly the time required to get your e-bike repaired if necessary.
10. Service Process – If at some time you require the bike to be serviced or repaired, either under warranty or outside of warranty, how does this work? Is there a well organised way for this to happen in an easy and efficient manner? Is the motor and drive system relatively simple and therefore easy to find someone to assist in repairs or do it yourself or is it more complicated thus requiring a specially qualified service agent to work on. Obviously this again will affect both the cost of timeliness of repairs if necessary.

Final Word

As electric bikes continue to prove their usefulness as incredibly efficient, convenient, quick, and fun vehicles for everything from leisurely rides with friends and family to daily commutes and weekly errands, they will become more and more widely available and the choices will become larger.

When trying to figure out which type of electric bike is right for you, it's important to think about just what it is you're trying to get out of your cycling experience. Are you looking for a low-impact way to get back into shape? Are you trying to find a bike that will allow you keep up with your grandchildren or a faster-cycling partner? Will your bike be used primarily for leisure or for practical everyday needs such as running errands and making daily commutes to and from work? Do you want the option of a physically challenging bike ride, or are you specifically looking for an affordable, easy to use, fully motorized mode of transportation? Will you be spending a lot of time riding up and down steep hills? Will you regularly be facing headwinds or other obstacles? Are you located close to any service/support options? What is your budget?

The answers to these questions, along with your understanding of the basic types of electric bikes currently being built, will help point you in the right direction as you begin searching for the electric bike that best meets your unique needs, interests, and expectations.

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