

A written guarantee is always a good sign. For example, premium e-bike maker Riese & Müller warranties batteries on its e-bikes for two years, saying “we guarantee that the battery will still have a capacity of 60% after two years or 500 full charge cycles (whichever happens first)”.

Your e-bike's battery capacity is rated in Watt-hours (Wh). If it starts to show a marked decline in range, it's worth doing a basic home test on the battery's capacity to make sure that it is holding charge. If not, and it's under guarantee, you may be due a new battery. I've written a guide for how to do this home test, which is on my website: bit.ly/battery-capacity-RP.

It's also worth noting that some e-bikes may show the number of charge cycles on the display; Specialized and Tenways models are among those I have seen that do. It's a helpful feature, especially if you suspect the range is dropping prematurely due to decreasing battery capacity.

E-bike batteries may be charged on or off the bike, and there are pros and cons to both approaches. Clearly, removing the battery allows you to take it elsewhere for charging. A non-removable battery can save weight, however, and it also means you have no key to lose.

Talking of losing keys: Abus locks are found on many better-quality e-bikes. If you keep a record of the key number, Abus can supply extras if you lose one. Its One Key system also means you can use the same key for removing batteries and for security locks that come with the bike. You can also order extra locks that will work with the same key.

One very useful feature of some e-bike batteries is the ability to charge devices from them on the go via a USB socket. Brompton batteries do this via a USB-A socket that will provide around 7.5 Watts of power, while the Tenways range extender allows fast USB charging of up to 40 Watts. USB charging is great for keeping GPS-enabled smartphones and navigation devices topped up while e-biking. It is difficult to waterproof such connections when they're in use, however, so this facility is best used in dry weather.

AVOIDING RANGE ANXIETY

Given that the power density of modern e-bike batteries is the best it has ever been, there should be no reason for range anxiety. Choosing the right capacity battery in the first place is the key to e-biking as far as you need to without



Above: E-bikes are especially useful for family cycling and cargo hauling, where the motor more than compensates for the extra weight of passengers or luggage

carrying around extra weight in the form of too much unused battery capacity.

Battery capacity is, as noted, measured in Watt-hours (Wh). Good-quality mid-drive systems from the likes of Bosch and Shimano typically use 500Wh or 625Wh batteries. This should be enough capacity for most daily journeys without having to stop for a recharge. However, if you ride very long daily distances, are a heavier rider, live in a particularly hilly area or haul heavy loads on a regular basis, then it might be worth going for something bigger. There are now plenty of batteries in the 750Wh-plus range.

If you buy an older, secondhand e-bike that has a premium drive system, such as Bosch or Shimano, you may be able to upgrade with a bigger battery. Not all newer batteries will fit older models so you need to check with the system manufacturer or a knowledgeable retailer.

A smaller-capacity battery doesn't necessarily mean a shorter range. When fitted to a lightweight, efficient design, you can get a range of many tens of miles from a battery with as little as 200Wh capacity. Mahle's rear hub-drive system and the Cytronex kit are good examples of super-efficient, lightweight systems.

Mid-range battery sizes of 300-400Wh

E-bikes show the battery level remaining in different ways. It could be an icon, an LED or a percentage

should mean a fairly lightweight e-bike with a pretty good range. The latest Bosch mid-drive system, the SX, is both light and powerful and comes with a 400Wh battery as standard. I was really impressed with the SX's hill-climbing ability and range when I tried it recently on Cube's Nuroad Hybrid C:62 SLX 400 (cyclinguk.org/cube-nuroad-hybrid).

If you need occasional extra capacity, bear in mind that a handful of motor systems offer plug-and-play 'range extender' batteries to use as and when required. Bosch, Mahle, Specialized and Tenways all produce these.

Touring with an e-bike should pose few problems in inhabited areas but out in the wilderness it's extra important to have plenty of battery reserves. If you have concerns, the obvious answer is to pack a spare battery if you can afford one. Riding with as light a load as possible and using as low a gear as practical to keep the pedals spinning will help get the most range from your battery, too. Note that it's been estimated that in very cold conditions an e-bike battery may give only 70% of its range compared to warmer temperatures.

Some new quicker and lighter charging technologies are here already, though not widely adopted. It's worth looking out for GaN (Gallium Nitride) chargers

that are quicker charging than traditional e-bike chargers.

Speedy USB-C charging

of your bike battery should now be possible with the new, faster USB-C charging protocols. We

