# Lithium battery pack 330 kWh

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Lithium-ion batteries don"t like to be fully charged or discharged--it tends to shorten their life, and manufacturers have instituted margins that are in place to prevent this accelerated degradation. This buffer is detracted from a battery pack"s total capacity to obtain what is known as the usable capacity, or its usable kilowatt-hours (kWh).

The battery powering the 2023 Mini Cooper SE, currently the EV with the smallest battery pack available in the US, has a total or gross capacity of 32.6 kWh, but its usable capacity is 28.9 kWh. Most of the 3.7 kWh difference is the buffer, which is set aside for the vehicle to use so that it not only preserves the battery pack but also keeps you from giving too much thought to the complex task of keeping lithium-ion batteries happy.

The buffer is also used during charging to allow for more consistent charging curves. It also works as capacity fade compensation to give you back some of the capacity lost through the inevitable process of cell degradation.

How big the buffer is depends on many factors, but the main one is the specific chemistry of the lithium-ion cells. Some types of lithium-ion batteries are affected less by being charged to 100 percent, so in this case, the buffer can be smaller.

The usable capacity is what you see on your electric vehicle"s display. When it"s charged to 100 percent, that means you"ve only really charged the usable bit fully, but the cells themselves are never actually fully charged.

The same is true when the indicated state of charge reads zero. If you"ve ever been in this situation, you"ll know that while your power is greatly reduced and the car will flash all sorts of warnings at you to immediately find a safe place to pull over, you will still be able to drive for a few more miles.

There is still some confusion surrounding gross and usable battery capacity because some manufacturers list one while others list the other, and they often fail to mention which they"re referring to. Manufacturers were also initially hesitant to share both numbers, and one famous case of this is Porsche with the Taycan. It initially only provided usable capacity numbers, but after being prompted for questions on this topic, it eventually made both numbers public.

Due to the intricate and complex nature of EV battery packs, as well as the many factors that can influence their storage capacity, calculating the exact usable capacity isn"t as easy as you may think. You can connect an app like Car Scanner to your EV, which you do through a special dongle that plugs into the OBD-II slot.

You will charge the car fully and then drive it until it is as close to flat as you are comfortable to take it. The

app will note how many kWh you used on your battery-draining trip, and this will give you a great idea about the actual usable capacity of your EV. That"s how we discovered that the Lucid Air has a small buffer, and most of its battery pack"s capacity is usable.

The results you get may vary based on the age of the battery pack, and outside temperatures, and the battery monitoring system (BMS) may occasionally give errors that can may corrupt the result.

Once you have the usable kWh number, you can then use that to determine the range if you divide it by the electricity consumption. This simple mathematical formula(range is usable capacity divided by consumption rate) is also what the car uses to show the predicted range, and that"s why it changes in real-time, based on how you"re driving, which causes variations in how much electricity is used.

When it comes to safety and longer cycle life, LFP batteries are superior to NMC and NCA, although their energy density is lower. NMC and NCA both have a considerably higher energy density than LFP, but this article proves that this advantage can only be observed in lab testing. LFP’s performance at the pack level matches that of NMC in terms of specific energy and energy density.

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Web: https://www.hollanddutchtours.nl/contact-us/
Email: energystorage2000@gmail.com
WhatsApp: 8613816583346