

How to Maximize Runtime

As the author of Battery University, I get many interesting inquiries from battery users. One battery user writes, “Hi, I am looking for an answer to a perplexing question. A co-worker and I have identical mobile phones from the same provider. Moving into a new house, she complained that her battery life has shortened. I told her she was out of her mind, but then I noticed my battery behaving differently when I travel. Is there some mysterious force that’s draining the battery?”

Yes, there is a hidden force that drains the battery, but it’s not mystical. In standby mode, a mobile phone is in constant communication with the tower, transmitting small bursts of power every second or so to check for incoming calls. To save energy, the transmit power adjusts according to signal strength. Being close to a repeater tower lowers the power; moving away or entering an area with high electrical noise, such as a shopping mall, hospital or factory, boosts the power. An analogy is having to raise your voice in a noisy restaurant.

Living in sight of a tower has advantages and your battery will run longer between charges. Where you park your mobile phone in the house also affects runtime. A manager of a large cellular provider in the UK said that his son experienced shorter standby times after moving from the upstairs bedroom to the basement. If possible, leave your mobile phone in an upstairs room facing a tower. When traveling by car, place the phone near a window rather than on the floor, but avoid direct exposure to the sun.

Similar rules apply to TETRA and P25 radio systems, cordless telephones, Wi-Fi and Bluetooth devices. A wireless headset communicating with the cell phone from belt to ear provides longer runtimes than when placing the handset on the dining-room table while cooking in the kitchen. Although the quality of communication does not change, the Bluetooth headset needs to work harder when placed farther away from the user.

When the mobile phone is “off,” the load on the battery is very low and only provides power for housekeeping to maintain the clock and monitor low-level commands. These consumptions, including self-discharge, amount to 5–10 percent of the available battery energy per month.

Laptop batteries fare badly in terms of life span. Laptops are demanding bosses that request a steady stream of power under poor working conditions, toiling in a warm climate. In addition, the battery is exposed to a high charge voltage when connected to the AC main. Warm temperature and full state-of-charge are the cause of short battery life in laptops, not cycling.

Modern laptops run cooler, so do tablets and smartphones. Circuits have become more efficient and the battery capacity is increasing but these improvements are being offset by added features. The two major gas-guzzlers are the display and the transmitter. Data transfer consumes about twice the energy to simply talking on the phone.

Simple Guidelines to Prolong Lithium-ion Batteries

- / Do not discharge Li-ion too low; charge more often. A random or partial charge is fine. Li-ion does not need to be fully full charged as with lead acid.
- / Heat the battery to room temperature before charging. Do not charge below freezing.
- / Limit the time the battery resides at 4.2V/cell (full charge), especially when warm.
- / Moderate the charge current to between 0.5C and 0.8C for cobalt-blended lithium-ion. Avoid ultra-fast charging and harsh loading.
- / When possible, lower the charge voltage limit to prolong battery life.
- / Keep the battery cool. Move it away from heat-generating environments. Avoid hot cars and windowsills that are exposed to the sun.
- / It is not necessary to unplug the laptop from the power grid when not in use. The charger stops charging when the battery is fully charged.
- / When the SoC fuel gauge becomes inaccurate, calibrate smart batteries by applying a deliberate full discharge and charge.
- / Add some charge before a long storage. The charge level is not as critical as cool storage.

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