(Approx. 1453)

President's Corner

To Charge or Not to Charge? (That's Only One of Many Questions)

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We have many batteries in our lives because we use a lot of battery-powered technology. Of all those devices, big and small, the one battery-powered device that almost every person has at this point in human civilization is the smartphone. Even in developing countries where water distribution and sanitation systems are woefully lacking, cell phone infrastructure is often very robust and advanced.

Over 8 billion people live on the planet today. Around 7 billion smartphones and approximately 16 billion mobile devices make these devices a shared human experience. From the migrant or homeless person to the CEO, from whatever ideology, religion, political tribe, gender, or gender identity we may be part of, we are all the same in one way: we are all out there looking for a place to charge our phones.

I've written a few columns recently about the wide range of battery-powered devices we use and how to care for them: small battery devices (like electric toothbrushes and earbuds) and medium-sized battery devices (like laptops, hand tools, and smartphones). Being a near-universal device, the smartphone needs a bit more elaboration on its charging. It is unique in that it is almost always on; I doubt anyone turns their phone off (entirely powered down) at night. Nothing else we use is depended on for so much.

I used to think that charging battery-powered devices was fairly straightforward. All you had to do was pick an inactive time, plug the device into a wall-powered charger until it was fully charged, and you were ready to go again. Most devices weren't run so much that you regularly ran out of power when using them. A spare battery could keep you going for those devices where that could be an issue. I bought two extra batteries for my Panasonic Lumix digital camera to make sure photo-taking could last all day on my vacation trips. I have two battery packs for my DeWALT cordless drill, so I don't run out of power in the middle of a day of home improvement.

Some devices are designed to be on continuous charge when not being used. Our Roomba floor vacuum stays parked on its charging base when not cleaning. My Braun electric toothbrush and hair trimmer are stored in their charging cradles. It may not be the best for its battery, but I always keep my HP laptop plugged in (I use it like a desktop computer and only occasionally run it on the battery).

Our phones are not like these devices; we need them to be on all the time. We use them a lot, and we take them everywhere. Tethered operation won't work; we generally can't swap batteries, and though we can power and charge from a USB battery pack if needed, this typically limits our mobility.

When my wife and I had ordinary cell phones, we usually charged them overnight every night. After I got my first smartphone, a Samsung Galaxy J3, in 2017, I did the same. I believe I always used the AC charger (with USB output) and cable that came with the phone. I used this phone for five years (and still have it); the battery seemed to work pretty well during that time. Ultimately, it may have been down about 20% in usable capacity, but that was not the primary reason I looked for a replacement. My old phone could no longer run all the apps I needed, so in mid-2022, I got a Samsung Galaxy S22. Its battery seemed to last longer, but it was probably larger and more advanced. I initially charged it overnight with the charger and cable that came with it.

The battery management system (BMS) of the S22 is undoubtedly more sophisticated than the one in the J3. The S22 displays time and battery capacity remaining (as a percentage of full charge) with a single screen tap (though it is dimmed in intensity, making it harder for old eyes to read). It can also operate in fast charge mode. When charged from a typical USB source (charger or battery pack), it displays "Charging," along with the charge level and an estimated time remaining to full charge. At 64% full, it might indicate it would take 1 hour and 15 minutes to full level. When charged from a charger or battery pack capable of fast charging, the phone displays "Fast charging," the equivalent fill time estimate might be shown as 37 minutes.

My ideas about charging overnight changed after reading the article "Recharging your Battery" by Kurt Jefferson, editor of the newsletter for the Central Kentucky Computer Society ([https://ckcs.org](https://ckcs.org/)), which was republished in our group's November 2022 newsletter. The thrust of this APCUG PUSH article is that the batteries in smarter products should only be charged to between 40% and 80% of capacity, not left to be charged to 100% overnight, as many folks do. The main reason stated was the problem of additional heat from being on the charger all night. I have read other articles and heard from others who are adamant about the need to charge 40-80% to prolong battery life.

One problem with the 40-80% method is that it is much less convenient. It is easy to plug your phone in at bedtime and unplug it in the morning, knowing you now have a full charge for the day. Charging to a specified charge level means watching the phone while charging; I'm unaware of how to set the phone to shut off charging at 80% full.

Charging to 80% also means giving up 20% of the phone's operating time compared to a full charge. I typically use only 30-40% of my phone's battery capacity daily, which varies with usage. A day of driving with Google Maps and handling my navigation can drain my battery by late afternoon.

The most challenging part for me in switching to the 40-80% plan was finding a consistent charge time. I settled on early in the morning as, at that time, I would spend around an hour at my desk at work, allowing the charging to be (sort of) monitored. This worked for a while, as the fast charging mode meant I only had to be around the phone for about 30 minutes. Unfortunately, the only power outlet in my cubicle was under the work surface, so I had to crawl under it to plug in and unplug it.

Last holiday, I learned about USB battery packs that can charge phones using fast charging modes. In the 2022 Black Friday sales, I bought myself a Baseus 65W, 20,000 mAh power bank. It can fast charge a Samsung S22, so I can take it to work and charge my phone there each morning without crawling under my desk. Its capacity allows me to charge my phone daily for about a week under normal usage. It is supposed to be the largest-capacity lithium-type battery that can be taken on a plane. It has a digital display that can show its capacity, charging voltage, and current when providing power to another device. I liked it so much that I got a second one and bought a third in this year's Black Friday sales.

Now, I charge my phone almost exclusively from these battery packs. I've partially bought into the 40-80% charging philosophy; I seldom let my phone go below 40%, but I'll usually charge to around 90% rather than 80%. To me, to have that extra 10% capacity is worth a little lower battery lifespan. Of course, I'll occasionally not pay attention to it as much as I should, and I find it has charged 100%. To me, it is kind of like being on a diet; you can follow it most of the time, but cheating on occasion is not fatal.

I've read many articles on battery charging, but the most useful source of information is Battery University, a free educational website ([https://batteryuniversity.com](https://batteryuniversity.com/)) sponsored by Cadex Electronics, a battery-oriented company in Canada. This site has a lot of information on all types of batteries. It has many articles about how Li-ion batteries work, how they should be charged, and how to get the most life out of them. There are several rules to maximize battery life, some easier to follow than others.

I follow many Battery University recommendations in taking care of my phone battery, but I sometimes feel it is impractical to follow them all fervently. The battery that lives the longest is the one that is seldom used, but where is the fun and usefulness in that?