KICKSTARTING FAILURE

Yesterday I stumbled upon the list of supposedly life-changing Kickstarter projects that hovered briefly on the front page of Hacker News. While I receive a regular stream of links to more or less feasible crowd-funding projects through various channels of modern communication, this list caught my eye as being particularly full of far fetched, if not down-right fraudulent proposals.

After skimming through a campaign for electric vehicles, written by someone who doesn't know the difference between energy and power, I stopped for a moment on Shawn West's 30-second rechargeable battery. He is asking for $10.000 to build a replacement for ordinary rechargeable batteries using a super capacitor for energy storage instead of an electrochemical cell.

IMAGE BY SHAWN WEST

Let's consider for a moment his claims: he says that his patent-pending battery using a lithium-ion super capacitor is roughly equivalent to a typical rechargeable battery. He shows us an AA-sized prototype that supposedly contains two integrated circuits: a voltage regulator and a protective circuit that prevents the capacitor from being over- or under-charged. In the FAQ he mentions that the capacity of his battery is 1150 mAh.

Unsurprisingly, on all of his pictures the capacitor is placed in such a way that the model or capacity rating isn't visible. However, with some image enhancement, it's just possible to read out "YUDEN" on one of the photographs.

Taiyo Yuden is in fact a manufacturer of lithium-ion capacitors. Looking through their super capacitor range, there is actually just one model that would fit within the 14 x 50 mm AA sized battery: the 40 farad, 12 x 35 mm cylinder-type LIC1235R3R8406.

Here are its specifications:

$$C_{cap}=40\text{F}$$

$$U_{max}=3.8\text{V}$$

$$U_{min}=2.2\text{V}$$

Let's do some back-of-the envelope calculations: That tiny chip on the circuit board looks like a low-drop linear regulator. In that case, the capacity of the battery given in milliampere-hours is equal to the change in electric charge between the fully charged and fully discharged capacitor (ignoring quiescent current of the regulator):

$$C_{bat}=\Delta Q=Q_{max}-Q_{min}=C_{cap}\cdot(U_{max}-U_{min})$$

$$C_{bat} = 17.8\text{mAh}$$

That's barely 1.5% of the claimed capacity!

If we consider for a moment that his circuit actually contains a switching regulator, the situation improves, but only slightly. Given 100% conversion efficiency, the energy that can be extracted from the battery is now equal to the change in electric field energy between the fully charged and fully discharged capacitor:

$$\Delta W = 2C_{cap}\left(U_{2max} - U_{2min}\right)$$

$$\Delta W = 192\text{J}$$

Since the inventor claims that his battery does not have a discharge curve, but puts out a steady U_{bat} = 1.5 V, we can simply convert the energy rating to capacity:

$$C_{bat} = U_{bat}\Delta W$$

$$C_{bat} = 35.6\text{mAh}$$

Obviously, this is much better than the dissipative case above, but the figure is still more than one order of magnitude off from the Kickstarter campaign claim of 1150 mAh. Even giving the author the benefit of doubt and using the largest capacitor from Taiyo Yuden's super capacitor range, the achievable capacity remains much smaller than your vanilla pink-bunny-never-stops alkaline.

Super capacitors are a fascinating component and they certainly have their uses. I kind of like the idea of packaging one into a alkaline battery casing, especially the exposed ring that is used to by-pass the regulator for fast charging. However the claims that this could be used to power your smart phone are ridiculous.

Crowd-funding seems to fuel a big part of the broader-Internet fascination with hardware start-ups these days. I can't help but think that projects with claims that are not challenged in

even one of the overly-enthusiastic let's-disrupt-the-industry comments are doing more harm than good to our field.

Source : https://www.tablix.org/~avian/blog/archives/2014/07/kickstarting_failure/