The Use of Supercapacitors as an Emergency Power Source

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Since 2013 energy storage research has been focused on supercapacitors (SCs) due to their many advantages over batteries: 1) charge times are exponentially smaller 1-30 second instead of 10-60 minutes for a similar sized lithium Ion (Li-Ion) battery; 2) they have a much longer cycle life (100,000 to 1 million cycles) compared to Li-Ion (500 to 10,000 cycles); 3) they have an extremely fast discharge rate; 4) they are much safer than Li-Ion batteries; and 5) they can operate in a wider range of temperatures (-40F to 150F). Even so, SCs do have disadvantages: 1) they have much lower energy density than Li-Ion batteries; 2) they have a relatively high self discharge rate, and 3) they are much more expensive than batteries ($20/W compared to $1/W). Current research, however, is beginning to overcome many of these issues so SCs may hold the key to our future energy storage needs. Since SCs seem like the future of battery technology, I designed and fabricated a 2222 mAh SC power bank made up of six 2.7V, 500F SCs in series (a total of 16.2 volts) to test its functionality during emergency situations. Teamed with a solar panel or hand crank (both 20W, 12V) I was able to fully charge the power bank in 15 min (a comparable Li-ion power bank took over an hour). The power bank was able to power a USB bulb for over 17 hours, or could charge a standard mobile device. When connected to the solar panel I was able to both charge a device and power an internet modem. Due to its quick charge times, its ability to power devices from 1.5-16V (with the use of a DC buck module) my prototype proved to be a perfect device for emergency situations. In fact, my family used it extensively during a recent PSPS power shutdown to keep our devices charged, our modem up, and to provide light at night.