Sirius Supercapacitor I-V-SOC Profile

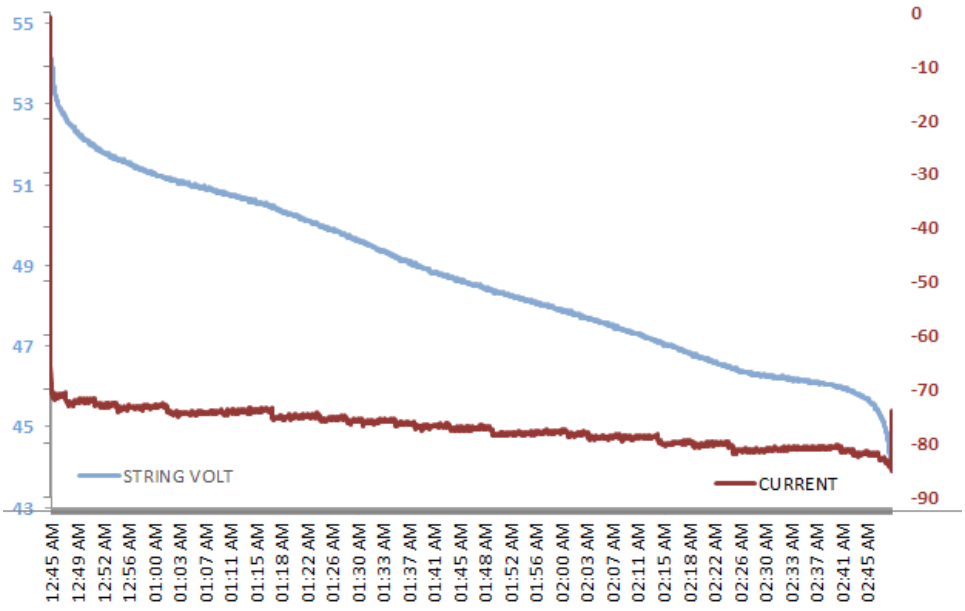
Introduction

Using 100% of the Sirius' capacity is easier said than done, especially when the block will activate safeties and disconnects when it ventures outside the specified voltage range. If you understand the I-V-SOC curve of the block it is easy to set up the block for safe usage and still get full capacity out of the unit. This document will help you set up inverters/LVD (Low voltage disconnect) devices in order to get the maximum energy out of the Sirius Supercapacitor. This test is performed at C2 (3600W constant load). Solar applications will always run at slower rates than C10 due to the length of the daily non-solar span. The only difference C-rates make to the Sirius unit is that the voltage drop is slightly higher over the power electronics, and therefore moves the voltage curve up and down.

Test conditions

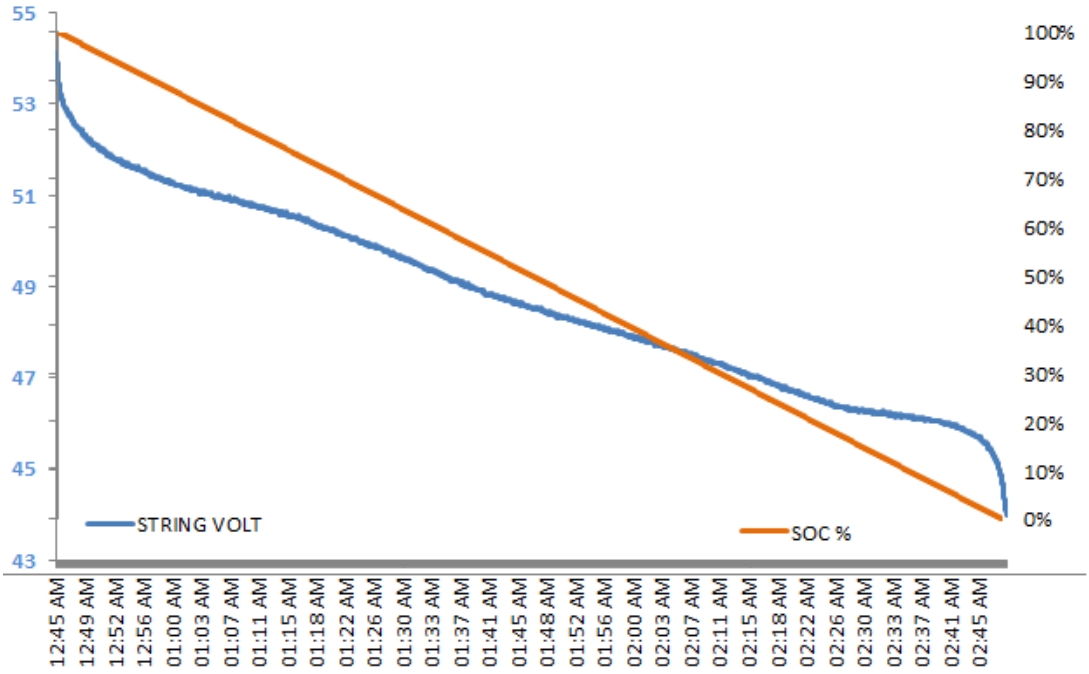
The 7.1kW.h Sirius module is set up to discharge at 3600W (0.5C). The load bank will adjust the current a few times during the discharge, as the resistance needs to be adjusted to maintain a constant load as the voltage drops. The purpose of this test is to determine the SOC at various voltages, to see where the safe LVD setting is to get all the energy out of the unit but not to push the unit into safety disconnect.

I-V Curve at 3600W



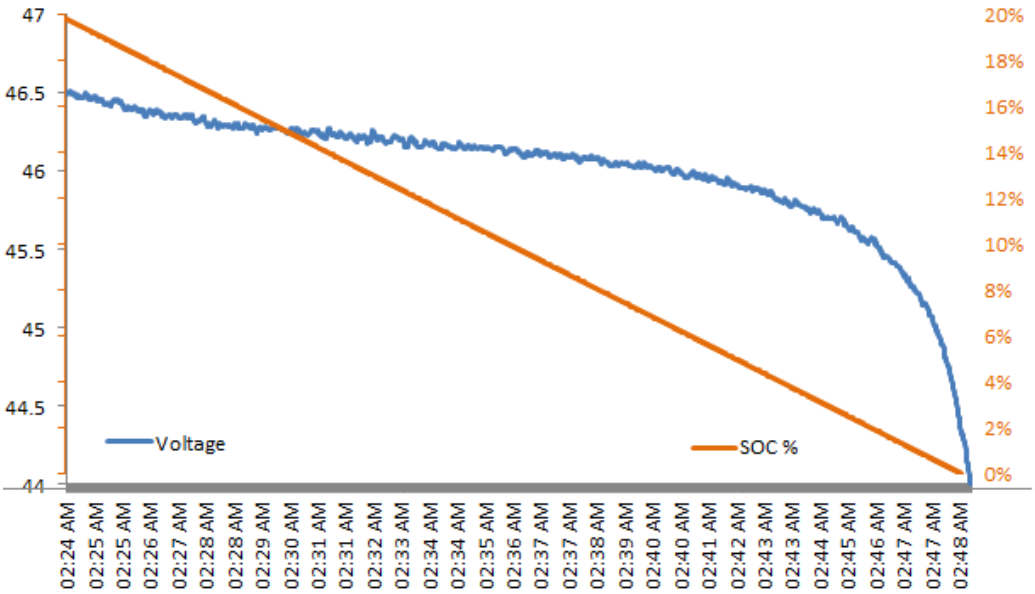
Graph 1: Sirius 7.1kW.h IV curve at 3600W constant discharge

V-SOC Curve @ 3600W discharge



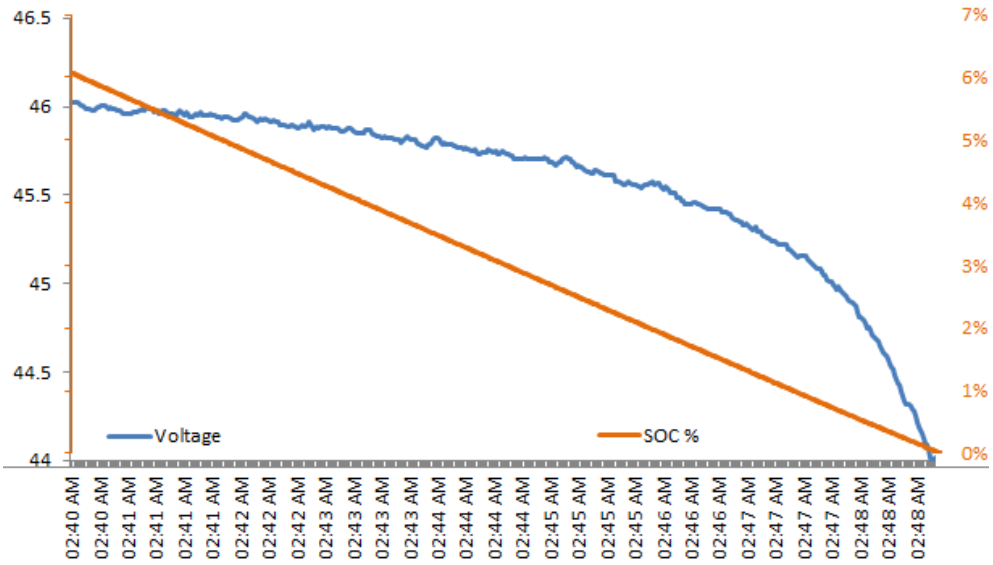
Graph 2: Sirius 7.1kW.h V-SOC curve at 0.5C

V-SOC < 46.5V at 3600W discharge



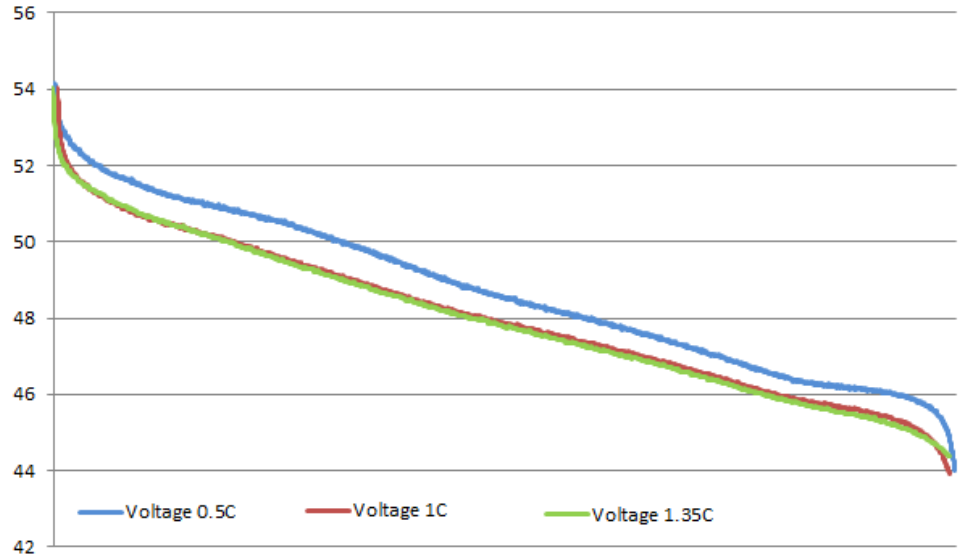
Graph 3: Sirius 7.1kW.h V-SOC @ < 46.5V at 0.5C

V-SOC @ < 46.0V at 3600W discharge



Graph 4: Sirius 7.1kW.h V-SOC < 46.0V at 0.5C

Voltage at multiple C-rates



Graph 5: Sirius 7.1kW.h Voltage at multiple discharge rates

Voltage at different C-rates

Below is a table indicating the end of charge time left "**T**ime **t**o **G**o" at constant current for a 7.1kW.h unit at different discharge rates. At constant current it is easy to select a voltage to activate a redundant source. In practical operation the current will not be constant. The 2V window from 46.0V to 44.0V is designed so that the voltage drop over the power electronics at various discharge rates will not activate the safeties before the unit has delivered all its energy.

Voltage	SoC @ 0.5C	TTG @ 0.5C	SoC @ 1C	TTG @ 1C	SoC @ 1.35C	TTG @ 1.35C
46.0V	6.7%	8Min	18.1%	10Min	20.2%	9Min
45.5V	2.0%	2Min	7.3%	4Min	10.0%	5Min
45.0V	0.8%	1Min	2.8%	1Min	3.5%	1Min
44.5V	0.3%	>1Min	0.9%	>1Min	1.2%	>1Min
44.0V	0%	LVD	0%	LVD	0%	LVD

Table 1: Sirius 7.1kW.h Voltage/SOC/TTG chart.

Summary

The IV profile is set up so that one could get all the energy out of the device. For slower C-rates you have a 2V window at the bottom. The faster C-rates this window should be used if you want to use all the available energy. Different inverters and LVD devices have different settings. The table above can be used to set the LVD or alternatively for redundancy source activation. **Voltage - time** is more consistent than **Voltage - SoC**. Solar applications would use less than 0.5C in most cases, for solar the 0.5C curve should be used.