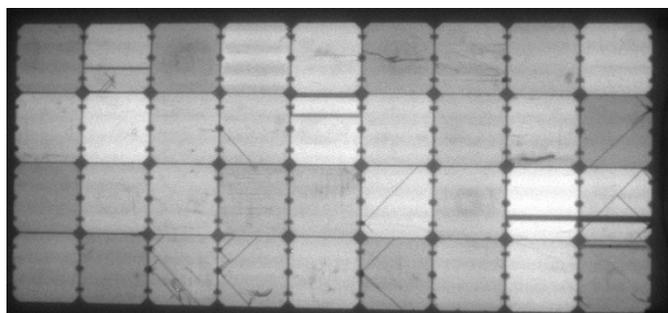


## TEST - Solbian with genuine SunPower® Cells vs Others

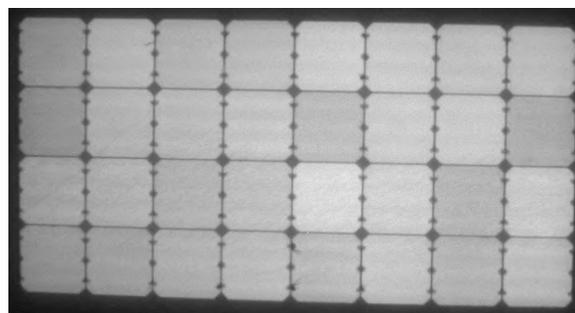
There are several semi-flexible solar products now on the market that feature all-black back-contact cells similar in outward appearance to the SunPower® cells used in Solbian SP panels. These panels all appear to originate from one manufacturer in China, and most are distinguished by a distinctive cable box. We will refer to these other products as “Brand X”. Solbian recently tested some of these panels at their facility in Italy.

### All Cells are Not Created Equal - The Truth Revealed

Once manufactured, all silicon solar cells are tested and then sorted according to quality and performance. The highest quality cells are the most sought-after by panel manufacturers and the most expensive, while the lower quality cells are more readily available at a lower price. A number of cells will inevitably have flaws and defects from manufacturing, and these are typically sold off without any brand identity for use in lesser quality products. If a solar panel manufacturer’s specifications refer simply to “back-contact” cells, they may well be defective or low grade rejects. Outward appearances will be identical for all grades of back-contact cells, and so it is impossible to distinguish high quality cells from defective ones by sight. However, inducing a current into a panel reveals hidden secrets when viewed with an Electroluminescence Detector, where cracks, defects and areas of low output will show up darker than others. The examples below tell the story:

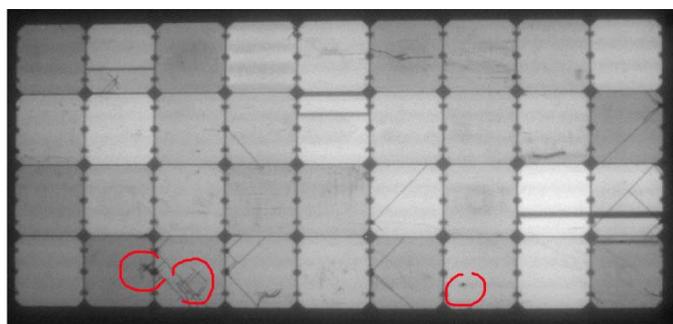


**Brand X 115w.** Cells have cracks, dings, or dark areas, indicating the existence of flawed or damaged cells.

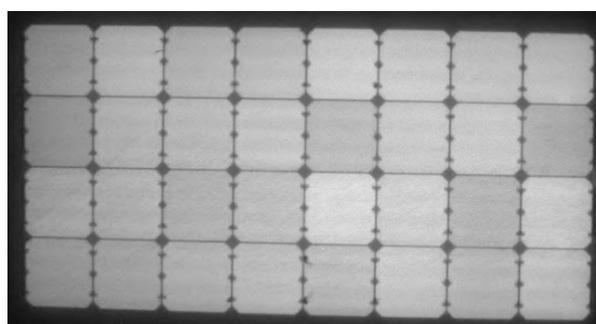


**Solbian SP 100L** with high-grade SunPower® cells. Two small cracks in the cell at bottom, center.

### The same panels were each then subjected to a series of 10 bending tests:



**Brand X 115w.** Note additional cracks after bending.



**Solbian SP 100L.** No new anomalies after bending.

Although lower grade cells will meet basic requirements when tested under Standard Test Conditions (STC), the inherent defects and flaws will seriously affect performance under other conditions, especially in low/poor light, when partially shaded, and when operating in high heat conditions. It is also possible that the physical defects will contribute to premature panel failure in use, and while Solbian SP panels carry a 5 year manufacturing defect warranty, it is not known what warranty is given by Brand X panel manufacturers.

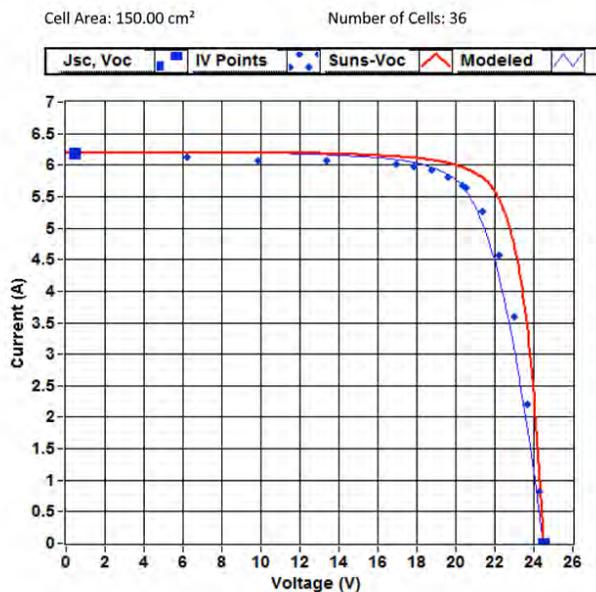
Over:

## How defects in lower grade cells can effect performance.

The cracks and other areas of poor contact within lower grade cells result in a low Shunt Resistance ( $R_{sh}$ ) figure. This has the effect of some of the power generated by a cell being “lost” within the cell and not contributing to total panel power output. The higher the Shunt Resistance, the lower the losses, and the more efficient the panel will be. While low Shunt Resistance has a relatively small negative effect on the panel output at standard test conditions (theoretically perfect conditions), it becomes significantly more detrimental and more influential when the panel is in normal, everyday use. There is also a very real danger that cracked cells will form “Hot Spots”, with cells being burned when subjected to full sun, especially in lower latitudes. Exceptional low light performance and high heat tolerance are vital cell characteristics for a cruising vessel looking for the best possible 24 hour solar yield. Only Solbian SP panels with genuine high-grade SunPower® cells have what it takes to produce the maximum possible daily power output, from sunrise through to sunset.

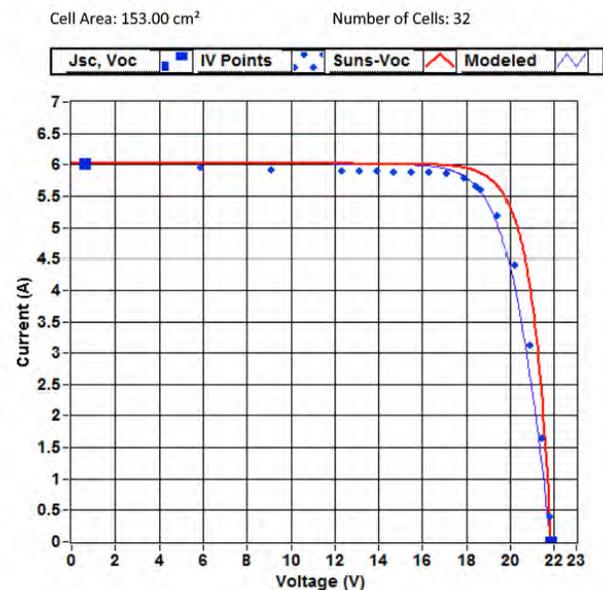
## Test Results reveal the effects of the lower grade cells.

All Solbian panels are tested on completion, and the test results sheets are available to purchasers. The test results below show a higher efficiency and Fill Factor (another measure of efficiency) for the Solbian SP panel than for the Brand X panel. This is almost certainly the result of the poor Shunt Resistance figure of the Brand X panel which is indicative of the employment of lower grade cells. This difference in efficiency will become greater at lower light levels, and in shaded and high heat operating conditions.



$V_{oc} = 24.4807$  V       $I_{mp} = 5.64$  A  
 $I_{sc} = 6.20$  A       $V_{mp} = 20.45$  V  
 $J_{sc} = 6.20$  A/cm<sup>2</sup>       $P_{mp} = 115.37$  W  
Fill Factor = 76.03 %      Efficiency = 17.10 %  
 $R_s = 0.26$  Ohms       $R_{sh} = 309.59$  Ohms

**Brand X 115w.** Note low Shunt Resistance ( $R_{sh}$ ) figure, suggesting the existence of damaged or flawed cells.



$V_{oc} = 21.8391$  V       $I_{mp} = 5.61$  A  
 $I_{sc} = 6.02$  A       $V_{mp} = 18.63$  V  
 $J_{sc} = 6.02$  A/cm<sup>2</sup>       $P_{mp} = 104.45$  W  
Fill Factor = 79.43 %      Efficiency = 17.25 %  
 $R_s = 0.18$  Ohms       $R_{sh} = 1553.43$  Ohms

**Solbian 100w.** Shunt Resistance ( $R_{sh}$ ) is five times higher than Brand X panel, due to the high grade cells.

**Solbian: High Quality + High efficiency = Maximum Performance!**