

This is a review of a 100w CIGS solar panel provided to me by BougeRV. I do not receive any compensation from BougeRV. The review is conducted at the request of BougeRV. I agreed to conduct the testing I felt necessary in order to post a legitimate review, because I wanted to install additional solar panels on the roof of my RV, and believed that CIGS panels might be a superior solution for my needs versus traditional flexible panels or hard monocrystalline panels.

Before beginning the meat of the review, it is important to gain an understanding of the technology behind a CIGS panel, and what it's inherent advantages are versus traditional flexible panels and versus hard monocrystalline panels.

What is a CIGS panel?

Copper Indium Gallium Selenide (CIGS) is a thin film technology which does not have the cell structure of traditional solar panels. For an in-depth discussion of how CIGS panels are made see this article: <https://www.magic-film.com/materials-and-manufacturing-process-of-cigs-solar-cells/>

My testing is simple. It consists of observing total daily production of first one, then two 100w CIGS panels wired in series connected through a roof gland to a Victron 100/30 MPPT Solar Charge Controller. The Victron records total total daily yield of the controller in watt hours. The mounting during the test is flat on roof, non-permanent. For contrast, on certain days, I record the daily yield of a 110w monocrystalline ETFE soft portable panel connected to a Victron 75/15 MPPT controller through a sidewall SAE port.

I purchased the second CIGS panel used in this test because I believe that a single 100w panel of any type cannot provide sufficient power to meet the needs of most campers. In my case, we have a compressor refrigerator, which nominally consumes 50 amp hours per day. Our total power needs are approximately 70-80 amp hours per day. Therefore, our solar array needs to be capable of producing 80 amp hours (960Wh) daily to allow us to boondock virtually limitlessly (power-wise) without using a generator, or shore power.

Inherent Advantages of CIGS Panels:

Light Weight: A 100w CIGS panel weighs in at about 4.3lbs versus a total of about 20lbs for a hard monocrystalline 100w panel with its associated mounting hardware.

Durability: The manufacturer claims CIGS panels are resistant to scratches, tree debris, and hail, none of which affect panel performance. You can walk on a CIGS panel. My experience of several months with a non-permanent roof deployed CIGS panel seemed to bear this out. It was exposed to hail, snow, and tree debris with no effect on its efficiency.

Longevity: CIGS has about the same resistance to degradation as hard monocrystalline panels (about 0.5% per year) vs. traditional soft panels (about 5% per year)

Efficiency: CIGS operates at a much higher voltage 25v (Vmp) than monocrystalline panels of the same wattage 18v. Therefore one would expect the CIGS panels to maximize MPPT, which is biased toward voltage.

Low Light: Generally, I have observed CIGS to perform about 25% better than monocrystalline in low light, and partial light conditions. Shading has less effect, so panels can be wired in series with better output in morning and evening

hours, and better output in partial shading. CIGS panels begin producing output earlier in the day and later into evening compared to mono panels.

Easy Mount: CIGS panels are flat, thin (1mm), and flexible. They can be mounted flat on an RV roof with no tools and no mounting hardware. The ability to mount panels without making holes in the roof is, in my opinion, a game changer for those who own campers with rubber/epdm roofs. The panels I'm testing have two-sided tape that you just pull off the backing, prep the roof with alcohol and stick them down to the roof for permanent mounting.

Inherent Disadvantages of CIGS Panels

Initial Cost: CIGS Panels are very expensive compared to hard monocrystalline panels. The cost is about 2.5 times as much as comparable wattage monocrystalline. BougeRV also markets a 200w CIGS Panel with a slightly lower cost per watt.

Portable Use: Although the CIGS panel rolls up tightly to fit into a small box, it is unwieldy as a portable panel. It's long and narrow, and when deployed it lays flat. At 13.7" wide by 85.6" long, the panel does take up some real estate, and it will blow over in strong winds. BougeRV does make a model with grommets for tie downs which are more suitable for portable use.

Compatibility: Because CIGS panels operate at a much higher Vmp (maximum power voltage) (25v) than all other portable panels, CIGS may not be compatible with many small portable power stations. For example, my 300wh power station has a maximum input voltage of 18.5v. So, it's BMS (battery management system) senses an over-voltage condition and shuts down the charging circuit. Check your powerstation's specs to determine if you can charge it with a CIGS panel's high voltage.

Form Factor: CIGS panels are long and narrow. Although they are flexible and can conform to curved roof structures, they're long enough that it's difficult to find a good mounting location on a small RV without getting some shading from air conditioner cowlings, or vent covers. In our case, we decided that we will have to sacrifice the forward vent cover which always shades one panel depending on time of day. see photo:

On Day 0, we arrived in the late afternoon at Sigsbee Campground, NAS Key West. After setup, we got the monocrystalline panel and one CIGS panel plugged into their respective charge controllers at 4:30pm. In the late January sun, the CIGS panel immediately began outputting 20-22 watts, while the monocrystalline was outputting 9-10 watts. This re-verified for me that the CIGS panel delivers superior performance in low light conditions like sunrise or sunset. Recording of production for the one CIGS and one monocrystalline begin on Day 1,

Tuesday January 17, 2023. Day 1.

A negative parenthetical comment I have about CIGS panels is that they have very short MC4 cable leads. This limits placement options unless you buy waterproof MC4 extensions. BougeRV should consider lengthening the cables by 12". Since our travel trailer is small and has very limited unobstructed roof space, I will be forced to permanently remove our forward vent cover, as it casts shade on the panels. On this first day of testing, note that SOC is virtually unchanged from morning to evening. That is because we consumed a lot of power

that day after boondocking for two days prior. ; needing to charge powerstation, tools, and devices, and using microwave. Generator was run to raise SOC this day.

Wednesday January 18, 2023. Day 2

Sunny in the mid-day. SOC finished about the same as where it started the day. No generator use.

Thursday January 19, 2023. Day 3

Installed 2nd CIGS Panel in series with the first CIGS panel early in the day. Note placement to avoid shading.



Friday, Jan 20th - Tues, Jan 24. Days 4-8

Results were similar each day. The two (2x100w) CIGS panels together in serial consistently yielded more than three and times more watt hours than the single 110w ETFE soft monocrystalline panel. Or, per panel, about 150% of mono.

Conclusions

In order to compare apples to apples, we placed all panels flat on the roof for testing. In the winter with low angle sun declination, one would normally expect any kind of panel to perform 20-30% lower than in summer. We would normally place our portable mono panel on its stand to get a better sun angle, and we've found that doing so produces up to 15% more power. So, for our purposes, we have determined that using one monocrystalline panel and two CIGS panels in serial produce enough power in winter to equal our daily consumption. However, it's not an elegant solution. It's likely we will purchase a third 100w CIGS panel to drive average daily CIGS production to 1,000 watt hours per day (87.5 amp hrs) or more. Then we can use our portable panel primarily to charge our power station.

Although we were producing enough amp hrs to boondock without generator, we simply could not live in South Florida without using our air conditioner, mostly for protection from no-see-ums in the evenings. That requires generator use. No-see-ums can come right through standard window screens. The drill is to cool down the camper between 8-9pm, then, close all the windows for the night, and turn on 12v fans. We rarely used AC inverter power during this test. When we did, it was for watching a DVD movie on TV, or re-charging our powerstation. We did also use our air fryer a couple of times. Coffee was made using a French press thermos. We tend to watch other programming, like news, streaming on our iPad using a hotspot. Cpap power and device charging was drawn from our powerstation.

Based on this test, I believe that two 100w CIGS panels wired in series and permanently mounted on the roof are the ideal solar solution for campers who have an absorption fridge and don't want to make any holes in their roofs. For campers with compressor fridges, two CIGS panels are not sufficient to meet daily power production needs. A third panel will be necessary for those with compressor fridges.

Data Table:

	WH Yield	WH Yield	WH Yield	Sunup	Sundown	Weather	Watt Hrs
DATE	1 CIGS	2 CIGS	MONO	SOC AM	SOC PM	This Day	Used
Day 0						Clear/sunny 70F	
1/17/2023	340		200	57%	58%	Cloudy then clear 68F	1032
1/18/2023	350		200	83%	81%	Mostly sunny 72F	576
1/19/2023		630	210	44%	57%	Mostly sunny 78F	684
1/20/2023		560	170	15%	98%	Partly cloudy 77F	630
1/21/2023		490	160	80%	86%	Partly cloudy 78F	645
1/22/2023		700	200	53%	60%	Partly cloudy 79F	1,042
1/23/2023		640	180	64%	59%	Sunny then overcast 76F	922
1/24/2023		310	100	40%	39%	Overcast, rain 72F	980