$4 Solar Battery Charger

by JoshuaZimmerman on February 3, 2011

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I'm an elementary school teacher in Milwaukee, Wisconsin. I like making random things and then teaching my students how to do the same.

If you're ever feeling the urge to donate money to a needy 4th grade science club... send me a message. All money sent will be used for SCIENCE!!!

Intro: $4 Solar Battery Charger

When I got into electrical circuits and solar power the first thing I wanted to do was build a little solar powered battery charger. Only I had a heck of a time trying to find a simple and strait forward guide to doing this.

So in this guide I'll give you a bit of info on solar power and battery charging, as well as show you how to make a solar battery charger for all of $4.

If you'd like some solar panels or solar kits I have quite a few on my gadget site, browndoggadgets.com or you can also buy them off ebay or various other websites.

Step 1: What You Need

To build a solar battery charger you need several things, as well as have several tools on hand.

Parts
A clear, water-proof container. (Dollar Store tupperware with built in O-Ring)
AA Battery Holder (Radio Shack, also fits AAAs if you're careful)
One or Two Solar Panels rated 4 Volts or above
Blocking Diode (Radio Shack, or buy 100 for $1 off eBay.)

Tools you need
Soldering Iron
Solder
Tape
Safety Goggles
Some wire

Time: 20-30 minutes

Difficulty: Easy

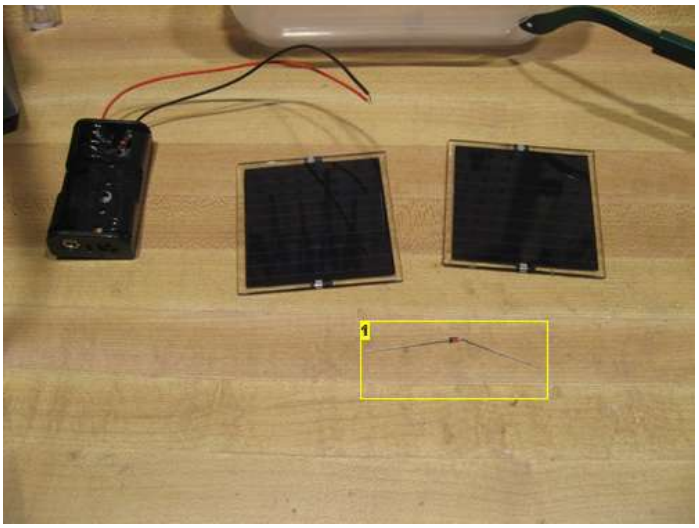


Image Notes
1. Blocking Diode

Step 2: Things You Should Know

Solar Power is fun, and adding solar to your projects is even more fun. Plus these days it's darned cheap to do.

When making a battery charger there are things you should keep in mind.

First, know your batteries. NiMh batteries are the most common these days, and you can find them at any store. Your typical AA NiMh battery probably is 1.2 Volts and has anywhere between 2000- 3000 mah worth of charge in it. (Check you batteries, they probably have the capacity written on them. That or check the maker's webpage.)

Secondly you need to know your solar panels. For instance the ones I'm using in this project put out a max of 4.5 volts and 80 ma of charge.

With only 4.5 volts coming in I really shouldn't try charging up any more than two batteries (hooked up in a series giving me 2.4 volts). Also, because one of my solar panels only puts out 80 ma at a max it's going to take a long time to charge up all 3000 mah hours my batteries hold. In this guide I hooked up two panels in parallel to give me around 160 mahs worth of power coming in. If I had a bigger case I could hook up another one or two to give me even more power.

Your'e probably asking yourself, "hey, why doesn't he hook up a whole lot of panels to thrown down a massive amount of amps and fast charge those batteries!" Good point, but if I did that I'd kill the batteries. Your standard wall charger has brains that let it fast charge a battery without blowing it up. We're going about our charging using the "trickle" method. As a general rule of thumb you don't want to throw more than 10% of the capacity of the battery (C/10) at the battery when charging. As our batteries are 3000 mah capacity, and we're throwing 160 mah of charge at it, we're ok. (AAA batteries hold between 800 -1800 mah, so we're probabl ok for them as well as we're never going to actually get the full 160 ma from the cells.)

If you really want to charge up your batteries fast you could try and hit the C/10 power supply. Though this being solar it would still take awhile.

So there you have it. Now you've got a basic idea of how to add solar power to your projects. Now go out and buy some Solar Panels and NiMh batteries.

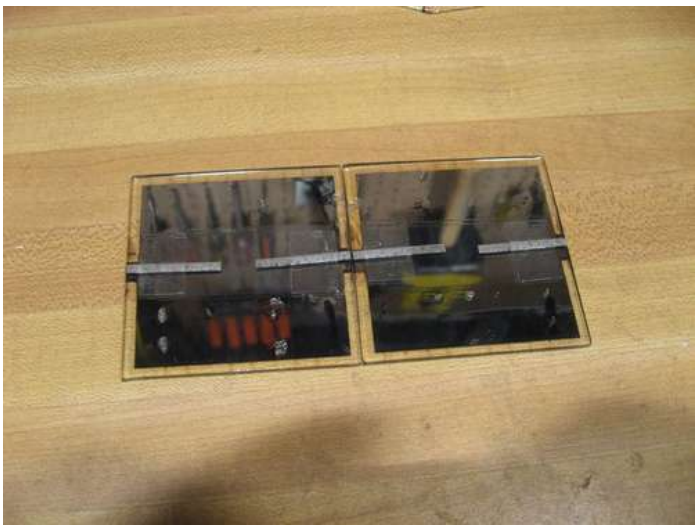
Step 3: Panel Power

I love these 4.5 volt panels. I use them for most all of my solar projects. They're small, light weight, strong, and throw out a lot of power.

Because my solar panels have little tabs on them I'm going to need to do some extra soldering and taping that you might not need to do with your solar panels.

That being said, no matter what kind of solar panel setup you're using, you'll want to be wiring them up the same way.

(For instance you could use a smaller panel to charge up a single AA battery, or a bunch of panels in a series to charge up a whole bunch of batteries at once.)



Step 4: Blocking Diode

The first thing I'm going to do is hook up my blocking diode. I just soldered it onto the positive wire coming off my battery holder, and then the other end of the diode onto one of the positive tabs on a solar panel. Also, at this time solder the negative wire from the battery pack onto one of the negative tabs of the solar panels.

(If you're only using one solar panel, you've actually done with soldering.)

Why do we need this? Well solar panels are great at creating power when it's sunny out. When it get's dark they try and suck power back into themselves, which then destroys them. To stop this we use a blocking diode so that power only flows in one direction.

Also, see that black bar on the diode. Always make sure you know which way it's going. You want the black bar pointing in the direction you want power to flow.

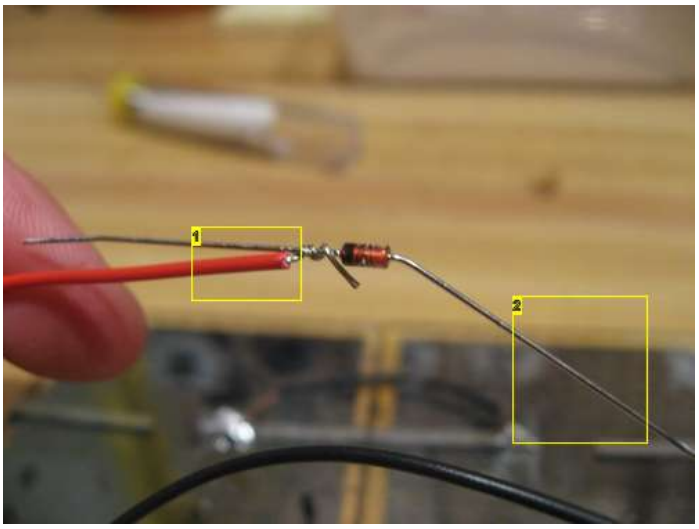


Image Notes
1. Wire to battery pack.
2. Solder this onto a positive tab on your solder panel.

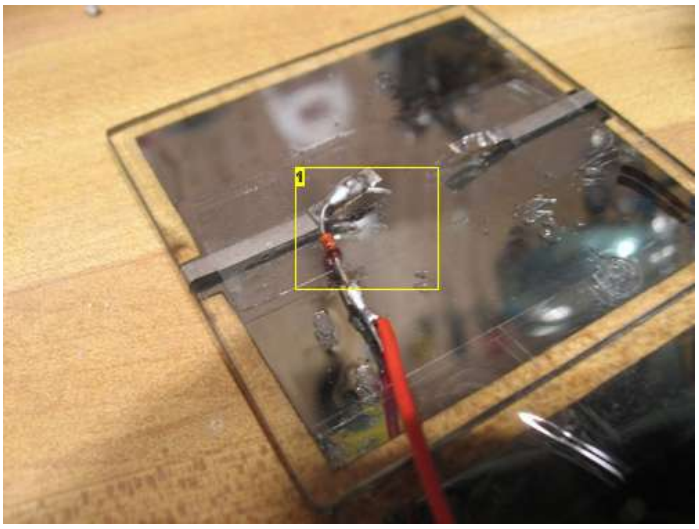


Image Notes
1. Hooked to panel.

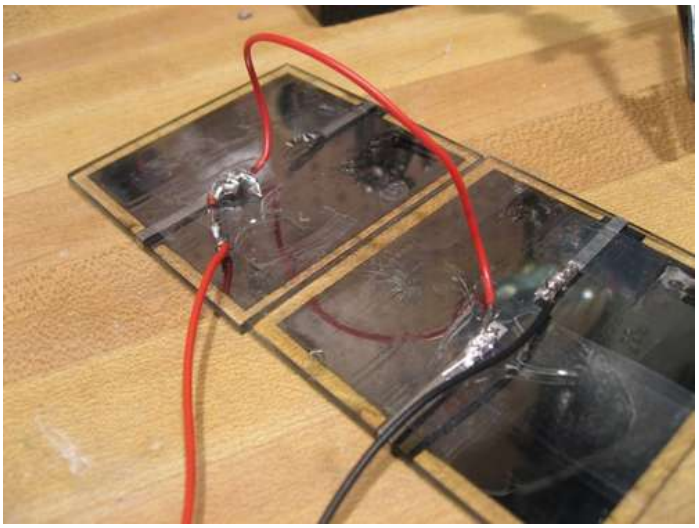
Step 5: Strength in Numbers

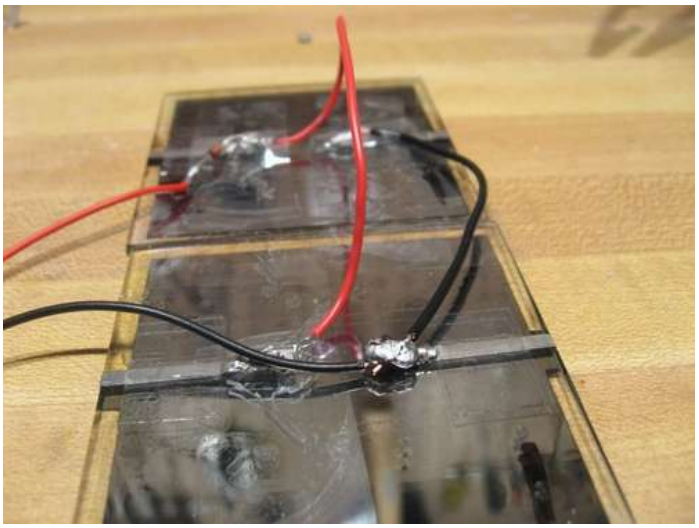
Ok, so if we only had one panel we'd be done now. Since we're using two panels hooked up in parallel we have a bit more soldering to do.

To hook them up in parallel we're going to use two more wires to connect both positive tabs and both negative tabs.

Cut two wires at about the right length for a bridge and solder.

Remember, we're hooking positive to positive, and negative to negative.



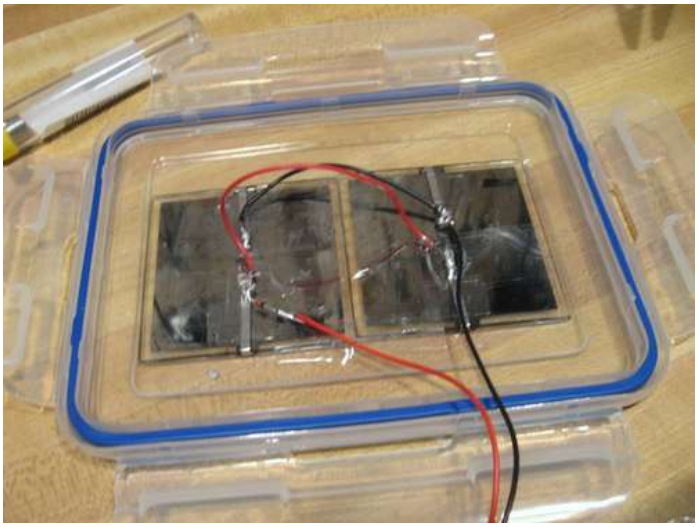


Step 6: Lots of Tape

While all my soldering is done it's painfully obvious that my little solar panel tabs look like they're ready to break off. For good measure I always put some tape over the solder points on my solar panel, especially panels with little tabs on them.

Then just tape the panels into the lid of your enclosure. That was easy.

For my enclosure I used a little tupperware thing I got from a local Dollar Store. It has a freshness o-ring in it that keeps moisture in, which also means it'll keep moisture out. Handy for projects you want to leave outside for long periods of time.



Step 7: Enjoy

That was easy. I've done this a couple of times before and at this point building one takes me under 20 minutes.

So the breakdown is this.

Cost: $4

$1 Tupperware
$2 Solar Panels
$1 Battery holder
$0.02 Blocking Diode

Time: 20 minutes.

You can use this EXACT same setup to power little light up projects. Throw in a few transistors and resistors and you can make a dark detecting circuit for all of $0.20 more.

If you're looking for solar panels or little solar kits I have several available on my website browndoggadgets.com.

Related Instructables

How to make a Solar USB charger! (simple!) by dabomb1022

DIY Solar USB Charger - Altoids by JoshuaZimmermar

9V Solar Battery Charger by JoshuaZimmermar

Solar Powered AA Battery Charger by sgeddy

How to Make a Solar Powered Powerwheels by knife_eye

Solar Power System by Mr. Chicken

Comments

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ken4an says: Apr 11, 2011. 3:44 PM **REPLY**

can we hook 4 solar panels and we get 9V @ and 160mA and batteries connect in series so they will be 4.8V and half the capacity right? how can we be sure @ 99% we will not overcharge them ?

JoshuaZimmerman says: Apr 11, 2011. 9:31 PM **REPLY**

You could, and it would be fine. We're just trickle charging them which means we don't have to worry about over charging them.

So just connect four cells into two sets in series, then connect two two sets in parallel you would in fact get 9V @ 160 ma. Then connect two sets of batteries in a series and you would get 4.8V.

It's a good idea that would work just fine. Just remember to put 4 batteries in at one time.

ken4an says: Apr 12, 2011. 4:45 PM **REPLY**

if i use solar panels with 3*2V will be enough to charge 4.8 batteries? or the 6V are just too low ?

nutsandbolts_64 says: Mar 26, 2011. 9:29 PM **REPLY**

We've been considering gathering some solar cells from calculators and just putting them together then using that for small applications like charging your phone (which gets annoying). Would that work?

JoshuaZimmerman says: Mar 27, 2011. 7:50 PM **REPLY**

You would need a whole lot. Heaps.

You'd be better off just spending the $5-10 and getting yourself some good quality solar cells. The little calculator ones don't put out much current, and some phones won't charge unless there is a certain amount of current coming in.

If you'd like some info on how to make a cell phone charger, send me a PM. I've got a couple of designs that have worked well for me.

nutsandbolts_64 says: Apr 6, 2011. 1:49 AM **REPLY**

I think we'll just wait for a few more years and let the development of cheaper solar cells come and go then swoop in with a lot of cash and power this house here with the sun, since "make solar phone charger" isn't really in our to-do-during-single-life list.

JoshuaZimmerman says: Apr 6, 2011. 7:45 AM **REPLY**

Powering your home is rather cheap if you're willing to do a lot of soldering. You can be "chipped" cells that have been rejected by the factory for not a lot of money. They're still working perfectly fine, just have a few chips and dings on them. $500 will get you a full 1000 Watts of power, though you'll be spending a lot of time soldering. Then another $200-300 for a power control system and inverter.

Quite a bit cheaper than buying premade panels, thats for sure.

nutsandbolts_64 says: Apr 7, 2011. 12:38 AM **REPLY**

Over here, $800 is a lot of money, and we're probably the only household to actually have any plan whatsoever to switch to solar. I don't even think it's worth it since majority of power production here is provided by hydroelectric dams, and only less than 10% is provided by coal. The only problem here is too many vehicles in one place at the wrong time. What's the point of switching to solar when we're gonna immigrate anyway? But I'll take what you said with me when we move.

JoshuaZimmerman says: Apr 7, 2011. 9:28 AM **REPLY**

Thus the problem with solar, the inital cost. You'll eventually save money with a big solar system, but it's going to take awhile. Years.

If I was ever to have a home built (ha ha) I would have it built so that I could easily add panels to the roof. If I even end up living in the countryside I would set up a system over several years using a combination of solar and wind (as wind will give you far more power for your $, but is inconsistant).

For the average home owner spending a couple of hundred a year on this would be possible, but it would be quite a few years before you'd see the major payoff.

That or you could set up a bunch of well geared staionary bikes hooked up to batteries and open a gym/ powerplant.

nutsandbolts_64 says: Apr 9, 2011. 1:15 AM **REPLY**

Opening power plants is what I see in my future (at least chemical engineering). I remember we calculated the payoff time a few years back when solar was expensive. If I remember correctly, it would take 10 years. So it would have been halfway paid by now (if we had some solar installed here in the first place). I wonder what the folks would say if we turned the speed bumps into energy producers, instead of absorbers. Speed bumps reduce your car's speed by absorbing the energy from your car's wheels. If instead of absorption, it would be redirection, which redirects some of the energy to some kind of piezoelectric mechanism, while doing it's job in the first place (2 tons moving at 20 mph is still quite a lot of energy).

burdockwing says: Apr 4, 2011. 7:40 AM **REPLY**

when counting the price you didnt ad a soldering gun do you know how much those cost?

JoshuaZimmerman says: Apr 5, 2011. 8:46 AM **REPLY**

No, but I figure that most people have such things.

You can buy one for as little as $10, but if you're going to be doing a bunch of projects like these you'll want to buy one in the more $20-30 range that has adjustable heat.

Also be sure to get one with a fine tip, not a giant tip. This makes things much much easier in the long run.

lol XD says: Mar 21, 2011. 5:20 PM **REPLY**

Great Instructable, you've answered many excellent questions down below, It might help others to add a F.A.Q. or something in the Instructable itself

big_F says: Mar 14, 2011. 2:04 PM **REPLY**

My local hardware/ sell it all shop sells those solar garden lights the little ones that run off 1 AAA battery, these ones have glass Solar cells and not those crappy plastic coated ones that go yellow in sunlight. Pulling them apart gives you 1 1.5v - 2.0v solar cell and 1x 800mah nimh battery. Series these little guys up and then parallel them to get some good charging voltages and capacities. All that for 87 pence each :)

JoshuaZimmerman says: Mar 17, 2011. 9:40 AM **REPLY**

I found some solar garden lights from the $1 store here in town. The included a 3.5 volt solar cell and a 200 mah AAA battery. I bought quite a few...

You might also want to look at yard sales during the summer. Some of the nicer solar lights have rather powerful solar cells in them.

The one thing you'd need to watch out for is the power of your solar cell. A 1.5 - 2 volt cell isn't going to charge up more than one battery, and we still don't know how many amps it's putting out. To charge two AAA or AA batteries you'll need at least 4 volts of power. The more volts a cell is rated for the less sunlight you'll need to get the minimum voltage required to charge up your batteries.

Even when I'm just charging up a single AA battery I still use a 4.5 volt cell so that my battery will be able to charge for a much longer period during the day.

coindude says: Mar 13, 2011. 7:27 PM **REPLY**

where did you get the solar panels?

JoshuaZimmerman says: Mar 14, 2011. 9:30 PM **REPLY**

I get mine in bulk from several places. Either through eBay or though a Chinese factory. You can buy the from many online stores, from my site (browndoggadgets.com), or even salvage them from old garden lights. It depends on what you're trying to do.

coindude says: Mar 13, 2011. 7:32 PM **REPLY**

Awesome Instructable, I am going to make one

techno guy says: Feb 18, 2011. 8:06 AM **REPLY**

Why hook them up in parallel? Wouldnt it be better in sieries?

JoshuaZimmerman says: Feb 19, 2011. 2:46 PM **REPLY**

Hooking the up in a Series would double the voltage. 4.5 + 4.5 = 9 volt, but keeping the current the same at 80 am.

Hooking up in Parallel will double the current, 80 ma + 80 ma = 180 ma, but keep the voltage at 4.5 volts.

It works the same for any power source. Try and imagine the solar panels as big barrels of water. In a series the two barrels of water are hooked up one on top of the other. They have twice as much water pressure source, but can only squeeze 80 ma of water out at a time through the one pipe.

In parallel you have the who barrels side by side, each pumping out 80 ma of water, doubling the amount of water coming out, but only one barrels worth of pressure.

ferster says: Feb 9, 2011. 6:54 AM **REPLY**

This is a great Instructable. Thanks.

I may have missed this somewhere, but do you have to make sure to STOP charging the batteries after so long? So, if I forget that there out there on my deck, can I damage the batteries?

Also, would it be hard to add a charge controller that would handle this?

JoshuaZimmerman says: Feb 9, 2011. 10:29 AM **REPLY**

As we're only doing the "trickle" methoid we don't have to worry about over charging them. They'll max out after so long, and the trickle isn't enough to cause any extra problems.

That being said I wouldn't leave them outside for two months at a time, that would be sad.

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ferster says: Feb 9, 2011. 11:47 AM **REPLY**

Great to know. Thanks very much.

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naglfar909 says: Feb 8, 2011. 5:47 PM **REPLY**

Sorry, this is my first diy electronics. I have the following diode:
http://www.westfloridacomponents.com/mm5/merchant.mvc?Screen=PROD&Store_Code=wfc&Product_Code=DI033&Category_Code=

Along with a pretty nice solar panel I got from a VW Beetle battery charger.
It's got max power of 3.2 W, max power voltage of 18.8 V (!), and max power current of 170 milliamps.

Do these stats check out for this charger?

JoshuaZimmerman says: Feb 8, 2011. 6:25 PM **REPLY**

Well you could, but my goodness is your solar panel way overkill for this. What you have is a panel built to charge a big 12 volt battery, which is awesome! I just bought a big solar panel like that for an outdoor lighting project where I'm going to power a whole lot of LEDs.

So yes, that diode will work with your panel, but I wouldn't use that panel for charing AA batteries.

Buy a much smaller 4 or 5 volt solar cell for this project (all you need is one, two if you want to be fancy). Save your panel for bigger and better things.

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naglfar909 says: Feb 8, 2011. 6:46 PM **REPLY**

Many thanks!

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kz1o says: Feb 6, 2011. 12:29 PM **REPLY**

It's worth mentioning that the "mah" unit you are mentioning is for the battery, and not for the charger. It's like the difference between "kilowatt hours", and "kilowatt". The first one might be how much energy a light bulb uses in a month, and the second one is just how much the light bulb uses. Some people compare this to a hose filling up a bucket with water. The size of the hose is how fast the water can go into it, and the size of the bucket is how much water it holds. Think of how many hose-seconds it takes to fill up a bucket.

Your charger circuit here will have the desired effect, and for the batteries you mention, the issues with milliamps should not be a concern. The kind of series (blocking) diode is not a big deal either, since the forward drop will not matter. You may use any garden variety silicon diode, and worst case is that the diode will fail (without damaging anything else) and you are out a penny. Just be sure to pick a diode that will allow the max current from the solar cell, in your case, 80 mA, which is 0.08 Amps.

Good luck, and always, safety first. It's a great habit to have.

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ac-dc says: Feb 7, 2011. 4:07 PM **REPLY**

Actually the diode type used does matter. For example if you are charging 2 x NiMH cells in series you will reach a peak charge voltage of approximately 2.9V as 1.45V/cell, BUT we have to consider the sum nominal cell voltage over most of its recharge cycle, 2.4V as 1.2V/cell.

Now, if you have a silicone diode with about 0.6V forward drop, you have to produce 3V. If you have a schottky diode with 0.3V drop you only need to produce 2.7V.

3/2.7 = 1.11, an 11% efficiency increase. More importantly, during periods of less sunlight your cells may not even be able to get the voltage up to 3V at a meaningful charge current so that extra 0.3V margin could allow for charging for more hours per day too.

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kz1o says: Feb 8, 2011. 6:07 AM **REPLY**

You are right. My comment was made based on the statement made in the original post:

"One or Two Solar Panels rated 4 Volts or above"

If the 4-volt requirement is no longer true, then yes, it does matter.

JoshuaZimmerman says: Feb 6, 2011. 1:53 PM **REPLY**

Oh goodness. I can't believe I made that mistake. D'oh!

I really shouldn't be writing instructables at 1 a.m. anymore.

Thanks!

kz1o says: Feb 6, 2011. 3:02 PM **REPLY**

I disagree! Write them whenever you feel the motivation.... those creative juices flow at the most insane times of day or night, that is for sure.

The biggest tragedy would be for someone to have a great idea and not share it.

Vinsu says: Mar 27, 2011. 12:20 PM **REPLY**

Good instructable, JoshuaZimmerman! Nothing to do with this one but I guess that I'm one of those people that doesn't have guts to comment if something is annoying me. Don't know if it's a bad thing not to comment everything that comes into my mind because most of those disrespectful things are not constructive at all. I find it that myself should not say anything if it isn't "nice" or constructive. "How many usb-resistor-led-things do we need?"-comments are the ones that are the most hard to not to write when I feel the motivation... Flew! Glad got that out of my system. :)

Hummingbird says: Feb 6, 2011. 7:14 AM **REPLY**

Hi, where do you get 2 4.5v solar panels for $2? The title seems misleading since you yourself sell these solar panels for $4 each. This is more of a $10 kit, no?

zav says: Feb 6, 2011. 8:13 AM **REPLY**

These are discontinued Shell Solar CIGS solar cells. They should be able to be found on eBay.

Hummingbird says: Feb 6, 2011. 9:15 AM **REPLY**

Are these the 1/4 Watt ones? After looking up the solar cells as "Shell Solar CIGS solar cells" I found them. Thanks for the follow up!

JoshuaZimmerman says: Feb 6, 2011. 9:25 AM **REPLY**

Yup, you can find them on ebay cheap in bulk, or something like $4 each. Like most things, this project is very cheap to build as long as you're willing to buy items in bulk. They get super cheap when you buy them in quantities greater than 100.

That or you can pull them from defunct garden lights, which also has worked well for me.

I have a bunch of rechargeable AAA batteries that I bought in bulk so they end up being 50 cents each. To buy them individually would cost quite a bit.

ac-dc says: Feb 7, 2011. 4:19 PM **REPLY**

It is worth noting that the amorphous ones in "most" cheap garden lights have a much worse lifespan than the Shell CIS type. It may not matter for occasional battery charging but if it were to sit outside all day every day, definitely go with the CIS for longevity.

rumplesnitz says: Feb 6, 2011. 7:23 AM **REPLY**

My application would be for charging a deep cycle marine battery to run a trolling motor on a 12/14 ft john boat while I crappie fish in smaller creeks and ponds. Lotsa sunshine, not much demand, lotsa time to enable a trickle charge to get the job done. But I don't have the G-2 to adjust the components for the bigger battery.

I picture the battery being inside the tub to minimize weathering over time, with the battery cables to the motor running out the side of the tub... whatcha thank about that?

JoshuaZimmerman says: Feb 6, 2011. 9:34 AM **REPLY**

You'd need a much much bigger setup. To power your marine battery you'd need a solar setup that could charge at 12 volts. A system like that can be easily found and setup for under $100.

But directly powering your motor would be tough as I doubt the solar panel could put out the amps you need to drive the motor.

Also, because you're dealing with a much much bigger system you would need a power controller. It's a little box that makes sure the solar panel isn't providing too much, or too little, power. Those are rather cheap off eBay.

Again, you're looking at between $50-100 worth of setup for such a system. Not bad really.

rumplesnitz says: Feb 6, 2011. 1:31 PM **REPLY**

This is great info. Of course I'm not trying to power the motor with the charger - just to trickle-charge the battery as I sit out on the pond so I know I have power to get back to camp at the end of the day or at least a little more battery than I would have without the trickle. I putter out onto the pond initially relying on the battery to be charged and run the motor. Then I sit in the sun without the motor running, maybe use the battery to pump a little leakage water out of the boat once in a while, maybe putter back over to a different spot or back against the wind after drifting away from a good spot. But mostly just sitting and fishing. Of course space is at a premium on a small boat like mine, so the battery sitting in the tub the charging equipment is mounted to seems like a great concept. Would I have to worry about 'the ripple effect' shortening the battery life?

ac-dc says: Feb 7, 2011. 4:13 PM **REPLY**

You do realize the panel area you need will be several square feet to make any significant difference in a few hours out in the boat? You can find something like that for $100, but in a small boat you will need a mast + roof type arrangement to hold it overhead, adding to the cost. It could help keep you from getting a sunburn though... ;)

nerys says: Feb 6, 2011. 12:38 PM **REPLY**

but not with much capacity. to get enough solar capacity to apply a reasoanble "charge" to your trolling battery your looking at $240 to $300

sometimes you can get close to $200 on sale for example

http://www.harborfreight.com/45-watt-solar-panel-kit-90599.html

thats 45 watts. not much power but would put a measurable charge back into your battery. assuming a 50 amp hour deep cycle you need 650watts for a full charge so this panel "could" in ideal conditions recharge it fully in about 14 hours of GOOD FULL broad day light sunlight.

so if you were fishing for say 5 hours you could replace 1/3 of your battery capacity.

use TWO of those panels and you have something more usable. you go go till your battery dies in the morning fish for 8 hours and have a fully charged battery to get home with IF you had good broad daylight sunlight AND you tilted the panel TO the sun in the morning and toward evening to catch the most light.

Sounds4cc says: Feb 8, 2011. 5:56 AM **REPLY**

I've seen the solar panels at HF. They are of the older technology (usually black in color) and take a lot of space for the given power. The newer technology ones are more compact for the same wattage. You might have to dish out more $ though. But for your boat, you could mount them above your motor using PVC or aluminum brackets. I would recommend 2 x 10-20 watt panels AND a voltage regulator. I've been near a battery that overcharged, the explosion was not much fun. Also you could mount one directly to the lid of your battery box. Look for some salvage solar panels at auctions or industrial sales to keep the price down and get bigger power. Have fun!

ac-dc says: Feb 7, 2011. 4:17 PM **REPLY**

You can get 60W panels for a bit under $150, you just have to shop around instead of at the major consumer products type websites. For example,
http://www.ecrater.com/search.php?cid=0&keywords=60W+solar+panel&x=0&y=0

nerys says: Feb 7, 2011. 7:37 PM **REPLY**

wow definately keeping that bookmark !! but note those are short term sales and do not include controllers etc..

but still wow $108 for 60watts. Very very tempted. if I had $108 in the bank I would already have ordered it!

rumplesnitz says: Feb 6, 2011. 1:43 PM **REPLY**

I'll go check that out. Is that a pre-assembled kit or part of something I'd put together?

zav says: Feb 6, 2011. 8:11 AM **REPLY**

These are not solar "panels", they are solar "cells".

ac-dc says: Feb 7, 2011. 3:52 PM **REPLY**

They can be considered panels because they take a solar cell and encase it in plastic or epoxy. The number of individual cells doesn't make it a panel or not, some (single) cells are huge and some are tiny.

nerys says: Feb 6, 2011. 12:40 PM **REPLY**

but you end up with a 2 cell solar PANEL :-)

zav says: Feb 6, 2011. 4:14 PM **REPLY**

Uhhh, I really don't think that two cells really count as a panel.

view all 104 comments