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XPLOR
BY sunflare

UNDERSTANDING SOLAR

How does solar work?

Harnessing the power of an incandescent star that over a million earths can fit inside can seem quite overwhelming. Choosing your solar setup requires a little more research than what SPF is most effective for not getting a sunburn. We're here to help alleviate the confusion and ensure you choose the perfect setup for your needs.

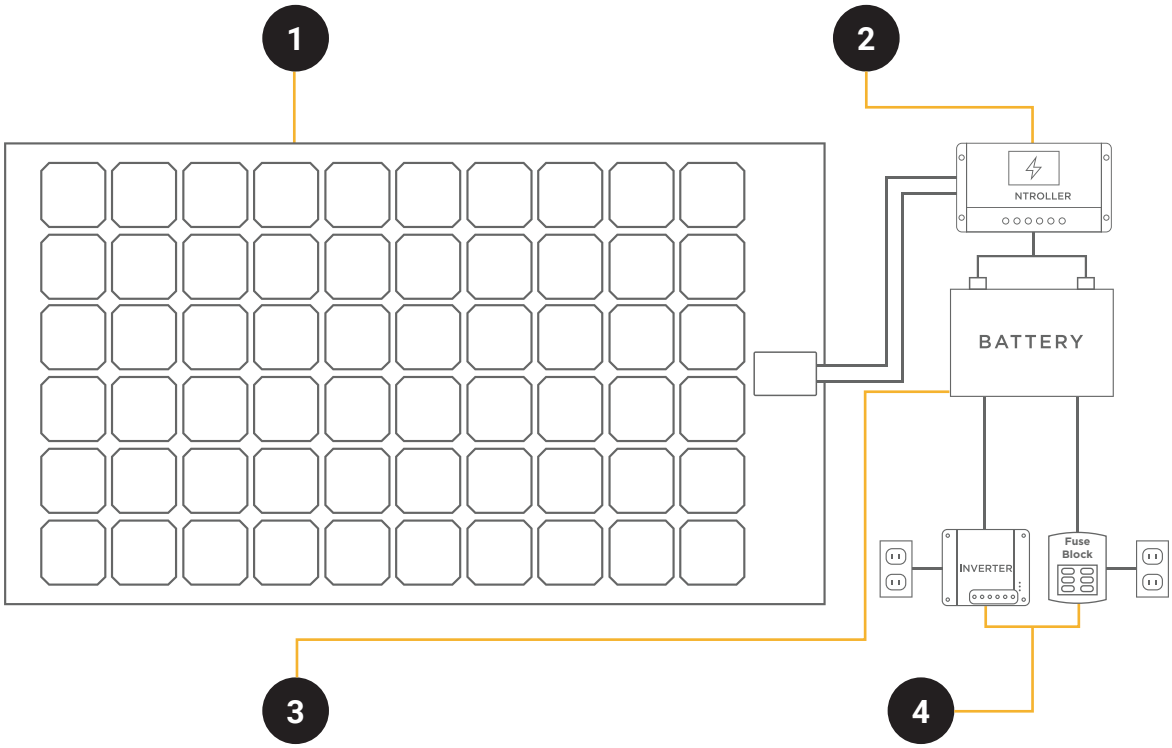
Solar power is simply the process of absorbing power from the sun, converting it into electrical energy, and then routing that energy into a battery bank to store for later use. Simple, right?

SOLAR PANEL

Solar panels captures the sun light and converts it to usable energy.

CONTROLLER

Controller makes sure that the energy output to thebattery isn't too high and doesn't damage it.



BATTERY

The battery stores the energy as DC power for later use.

FUSE BLOCK AND/OR INVERTER

The fuse block allows you to distribute the DC power via different styles of outlets to power most accessories; lights, fridges, and for charging devices. The inverter converts the energy from DC (Direct Current) to AC (Alternating Current) for use with some household devices.

Why is it important to understand how your solar panels work?

Does it really matter how solar panels are made? That depends on what you're using them for. If you're just needing a portable solar charger for your phone when you go backpacking, photovoltaics probably doesn't really matter to you. If you're planning on being in the backcountry in some form of a recreational vehicle for days on end off-grid and want to have power, then you should probably read on to determine what the best setup is for you.

Photo-wha? What is photovoltaics?

We know we can get energy from the sun. Absorbing energy seems simple enough. But how do we capture that energy into a battery bank so we can plug in and use that power whenever, and wherever we want? That's where photovoltaics comes in.

Those little grid sections that make up your solar panel are actually individual cells working hard to produce energy. Each cell has multiple layers, with the most important layers being the positive and negative semiconductors (material that conducts current). Each layer plays a part in creating and directing the energy absorbed.

When sunlight comes in contact with the top negative semiconductor layer, loose electrons (the negative charge of electricity) start warming up and move around inside the cell. As they move around, they become drawn to the bottom positive semiconductor layer. The longer sunlight is in contact with the cell, the faster the electrons move around. The electrons quickly hit a speed that forces them out of the cell as an electrical current into your battery bank, creating an electrical load for you to store.

This process repeats as long as the sun is hitting your solar panels, or until your batteries are fully charged.

Each cell produces and sends an amount of electricity to your battery. More cells equal more energy sent at a time. This is why you see different sized solar panels to meet everyone's specific needs.

How do I choose the right solar setup for my needs?

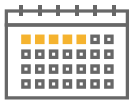
There's a lot to consider when choosing your solar power setup. A quick Google search is overwhelming with the growing popularity of solar power. Everyone has an opinion about what's right for them, but how do you know what's right for you?

What do I plan to power?

We take power and its availability for granted when living in a brick-and-mortar home. You probably won't notice a difference in your power bill if you're charging one or three laptops a day. You'll definitely notice the additional power consumption if you're parked on BLM land for 5 days and only using solar as your power source.

Will you have a refrigerator? What kind? Do you like to cook? Will you be using propane or an induction stove? Maybe you want to bring that air-fryer or Instant Pot? Do you want air conditioning in your rig?

Based on the questions above, you'll also want to consider and research the differences between a 12 volt and a 24 volt system, and in series vs. in parallel circuits.



How long do I plan to stay off-grid?

Are you a weekend warrior? Full-time traveler? Do you stay mostly off-grid, or at campgrounds/ RV parks with shore power? What's the weather like where you travel most? Sunny or cloudy?

How much space do I have available?

Consider the space available for both your solar panels, as well as space for your battery bank. If you cover your roof with panels but you only have room inside your for one battery, you'll charge that up quickly for sure, but it won't be much good if you have a few days of cloudy weather. Power input and power capacity should align.

Where and how do I mount the solar panels?

Once you decide if you want rigid or flexible solar panels, that will determine how you should mount them. Rigid solar panels are typically mounted with brackets drilled into a solid surface, such as a roof. Not only do you need to know how much space you have to mount them on, you also need to know where your mounting points are to ensure a safe, secure installation.

Flexible solar panels attach to your roof via some form of adhesive and can flex to the shape of what you're mounting it to. They are lighter weight and typically can be installed by one person.

If you want an option to tilt your panels, then obviously you'll have to have a movable mount to stick them to. But unless you're a hard-core traveler and going to areas with a consistently low sun (like Alaska), this really isn't necessary.

Do I need a 12v or 24v system?

Voltage is simply the amount of electrical pressure it takes to push an electrical current. When determining what voltage you should use, you'll need to know how much power you are going to consume, and how quickly you will need it on demand. Are you charging laptops or using power tools? You also have to take all of your other components into account, like your batteries, inverter, and charge controller. Can your components handle the draw?

There are benefits to both 12 volt and 24 volt systems.

Most brick-and-mortar homes, commercial buildings and very large RV's are set up with 24 volt systems due to the large draw they have on batteries and additional wiring needed to get from point A to point B of the building or vehicle.

12 volt systems are typically more than sufficient for camper vans, small trailers, and overland vehicles. If you're going to have a mobile construction business out of your van and will need to power large tools, that's when you might want to invest in a 24 volt system.

In Series vs. In Parallel Circuit

Remember the scene in National Lampoon's Christmas Vacation when Clark Griswold went to turn on the Christmas lights adorning his house and nothing happened? (if not, just YouTube it) Well, that actually has nothing to do with this because it turns out his extension cord just wasn't plugged in properly. He initially thought that his in series Christmas lights had one bulb blown, which meant if one was out, they all were out. Now-a-days Christmas lights are designed in parallel, which means power still continues through the string, even if one bulb blows.

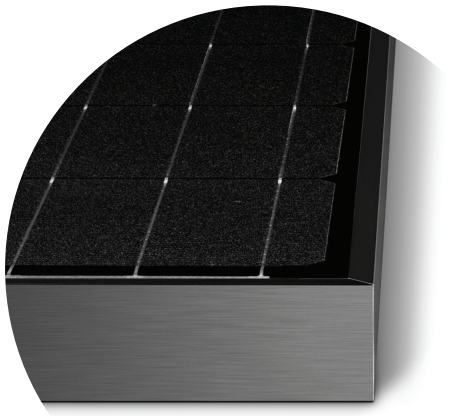
That's a fun example and explanation. The more technical explanation is that in series circuits form one continuous line of electricity, with only one path for electricity to flow. In parallel circuits are just that; two parallel circuits that together share a flow through a common component. If a component "breaks", power will still flow to the next device. Make sure when you're designing your build that you understand the difference so you don't end up testing bulbs for nothing like Clark Griswold.

Purpose of each solar component

You get it. You need a battery. And of course, you need the solar panel to charge up the battery. But what the heck is a charge controller or an inverter? Why do I need those? What does each piece of a power system do, and what are my options?

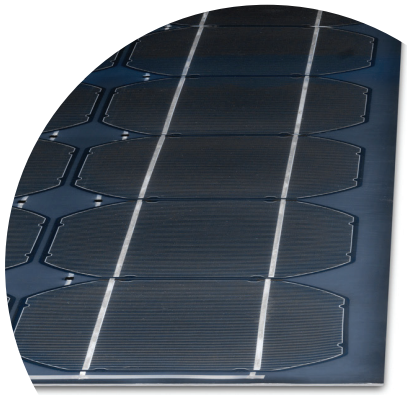
Solar Panels

We already talked about rigid vs. flexible solar panels and how they are mounted, but what's the difference other than the obvious: rigid vs. flexible? We'll get to size and watt generation later, but for now, let's focus on the technology.



Rigid solar panels

Rigid solar panels are heavier due to being housed in an aluminum casing and having tempered glass covering the cells. These are durable, heavy, and not very portable unless they are anchored to the roof of your overland vehicle or RV.



Flexible solar panels

Flexible solar panels are… well… flexible. They don't need a flat base or brackets to be mounted on and can be installed on a wide variety of surfaces. Some come with adhesive (literally peel and stick) and others you can use silicone or even Velcro to mount. They are lightweight, easy to install, and can be portable if needed. They are also twice the cost of rigid solar panels.

So why would you go with flexible vs. rigid panels? If you're concerned about weight, don't want to drill bracket holes, or if the shape of what you're trying to mount them on is not flat, flexible panels will be perfect. If you have a solid flat space to mount them and weight isn't a concern, rigid panels will be just fine. Both panel types have about the same power output capability, and both are very durable (depending on the brand).

Solar panels

Charge controller

Battery

Fuse Block
& Inverter

CIGS vs. Silicon solar panels

Did you think you just had to consider flex vs. rigidness? Dig a little deeper and you'll see even more options out there.

CIGS

CIGS = (Copper-Indium-Gallium-Selenide). Don't worry, that doesn't mean much to most other people either. Think of CIGS solar panels as the blue-eyed cousin to silicon panels.

CIGS panels are more light-sensitive, and will produce up to 15% more power over the course of a year. This isn't because they actually produce more power over the same amount of time. It means due to them being more sensitive to light, they will produce power more often than a silicon panel. They work better if it's cloudy or smoky and will still produce some power during twilight hours. CIGS panels also require more protection to withstand use (think sunglasses on cloudy days) and are more difficult to create due to having to combine the four elements in a lab prior to manufacturing. The manufacturing process itself is more efficient since less overall material is needed and glass isn't used in the final product.

Produce up to
15% more power

Works well under cloudy
or smoky conditions

Glass isn't used in
the final product

Silicon

Silicon is the second-most abundant material on Earth next to oxygen. So, silicon is pretty darn popular and widely used across the globe. Tried and true, silicon panels last 25 years or more. Although they are not as efficient as CIGS panels in low-light conditions, they are more efficient under direct sunlight due to how the silicon atom cells are connected like a grid. This helps the current exit each cell and enter your battery bank faster. They are less expensive since they are easier to mass-produce, although they require more energy to make since you must purify the silicon (heat). This means they are not as environmentally friendly to produce as CIGS panels.

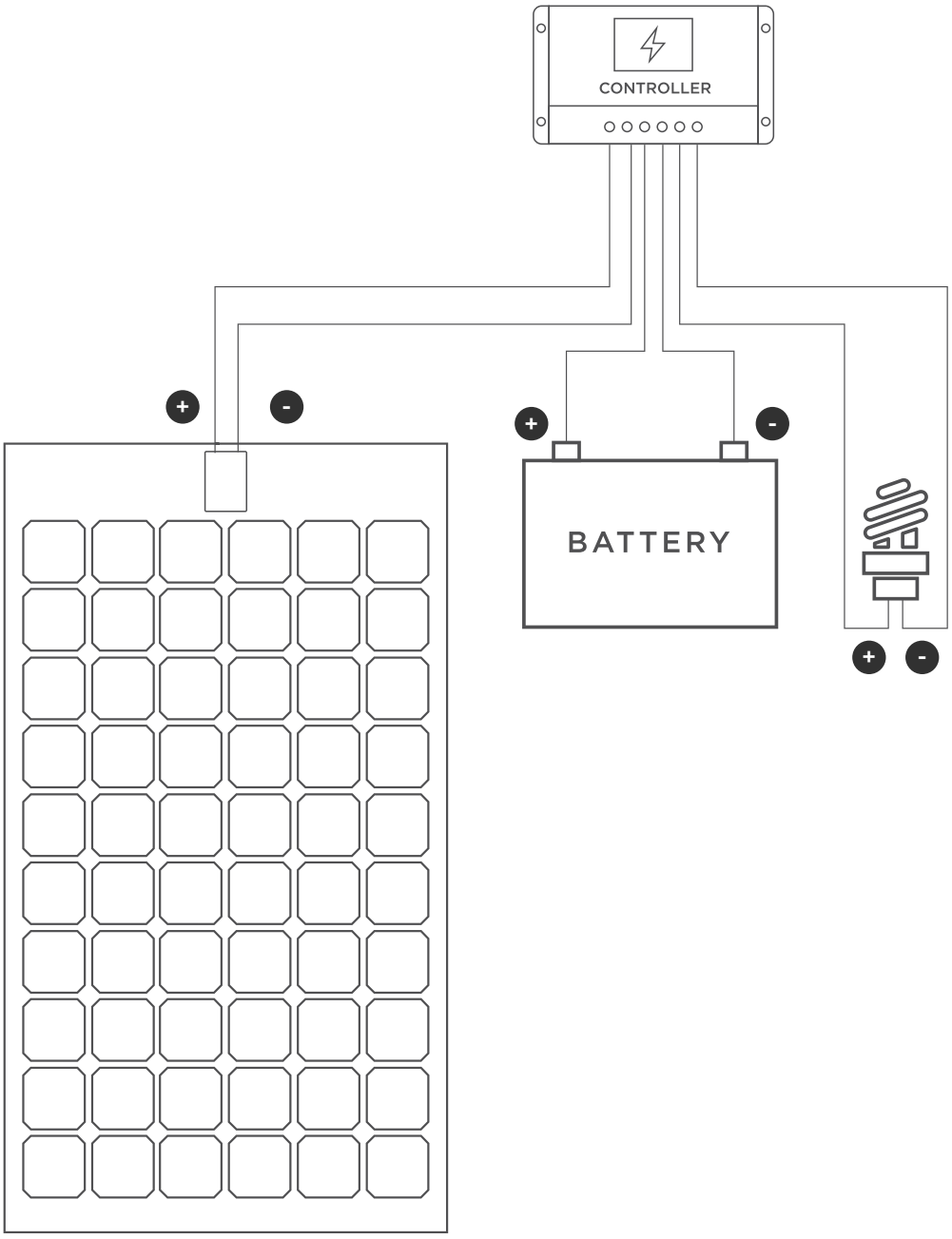
Last 25 years
or more

More efficient under
direct sunlight

Not ECO friendly

Charge controller

We can't control the sunlight and have it supply the right amount of power to charge our batteries safely. Most solar panels actually generate more power than they are rated for when conditions are perfect. A charge controller ensures that the volt output to your battery isn't too high so your batteries don't get damaged by overcharging. Unless you have a small setup with a trickle charger or are using a panel that only generates a few watts per 50 amp hours, you will need a charge controller so your batteries will work. There are a wide variety of charge controllers available that will meet your specific needs.



Battery

This is how you store your power for later use, so selecting the right battery(ies) for your specific need is very important. There's nothing worse than wanting to make pancakes and coffee in the morning with your induction cooktop after three days in gloomy, cloudy weather and realizing your batteries are nearly dead from lack of charge.

Ok, there are plenty of worse things, but who doesn't want pancakes on a brisk autumn morning in the backwoods? So, are you a pancake and pour-over coffee person, or an instant oatmeal and Starbucks Via person? Are you just running low-watt lights in the evening, or charging electronics, using power tools, and cooking with an air fryer?

In addition to battery capacity, it's important to look at other things like battery lifespan (warranty, longevity, charge/discharge cycles), what temperatures you will be in (some batteries don't perform well in heat and/or cold temperatures), and battery type (lead-acid vs. lithium-ion).

Here's a look into two main types of batteries. AGM (Lead-Acid) and Lithium. There are even more variations among these two, but we're going to keep it simple here.

AGM

AGM batteries are much less expensive than Lithium because they use materials that are more common and are easier to produce. They require little to no maintenance and work well in cold weather conditions.

AGM batteries can't "cycle" (the time it takes to get from 100% charge to 0%) below 50% of charge without damaging the battery and shortening its lifespan. So, if you have a 100AH battery, you can only use 50AH before possibly damaging your battery.

Lithium

Lithium batteries are significantly more expensive than AGM due to the different materials and newer technology involved in producing them. Lithium batteries outlast AGM batteries by up to six times longer. Some companies have a 10-year warranty on their lithium batteries, so although they are more expensive, the initial investment can be worth it if you're planning long-term.

Lithium can cycle down to 0% (but preferably not completely dead often) and not cause significant damage. This means that you can use nearly all your 100AH battery if needed, nearly doubling your battery bank capacity usage for the same amount of amp hours stored.

Lithium batteries are significantly lighter than AGM. If you're concerned about overall weight in your build, you can cut weight by more than half and have twice the power available.

Solar panels

Charge controller

Battery

Fuse Block
& Inverter

Battery capacity and output

Depending on the brand you chose, lithium batteries charge significantly faster than AGM. This can come in handy when the days are shorter and you're still using the same amount of power. Of course, the speed of charge will depend on how many watts of solar you have and how many amp-hours of batteries you're charging.

Since Lithium charges faster and you can use more of the battery's capacity, we'll just talk about AGM charge times and what you can use with its capacity. Keep in mind this is only referencing a few items you might use, and usage will vary greatly depending on what other appliances or items consuming power you have. Even keeping an inverter on so you can charge your laptop will consume a tiny bit of power in addition to the laptop charging. It all adds up, and it's important to understand and keep track of what you use daily.

Here is an example of what you can power with typical Batter

*All estimated daily PV generation is assuming 3.5 hours of ideal solar irradiance. Battery capacity calculations are assuming the battery gets depleted no farther than 80% of its capacity. All values are estimates and will very depending on weather conditions, geographic locations, and orientation to the sun.

100AH AGM battery

You can run a Dometic CFX3 35 Portable Cooler for 3 days, charge a 100w laptop for 9 hours, and run 10 CFL lights for 10 hours. Perfect for the weekend warrior.

Run a Portable Cooler
for **3 days**

Charge a 100w laptop
for **9 hours**

Run 10 CFL lights
for **10 hours**

200AH AGM battery

Your Dometic CFX3 35 Portable Cooler will run for 6 days, you'll have 18 hours of laptop charge time, and your lights will still work for up to 20 hours. Pretty good stats for the longer weekend trips or for someone who just doesn't use a lot of power.

Run a Portable Cooler
for **6 days**

Charge a 100w laptop
for **18 hours**

Run 10 CFL lights
for **20 hours**

300AH AGM battery

Planning on spending weeks in the backcountry, or living in your vehicle full time? With 300 AH of AGM batteries, your Dometic CFX3 35 Portable Cooler will run for 9 days straight, and you'll have 27 hours of laptop charge time to edit all those amazing photos you'll be taking. Wintertime? Are days getting shorter? Your lights will run for 30 hours.

Run a Portable Cooler
for **9 days**

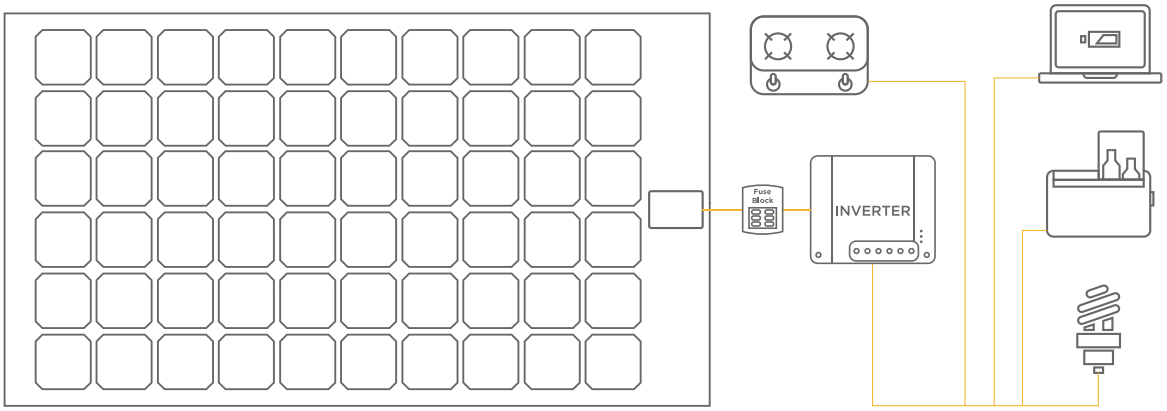
Charge a 100w laptop
for **27 hours**

Run 10 CFL lights
for **30 hours**

Fuse block

The fuse block is a central hub that directs DC power from the battery to individual low amperage items in your system, such as your refrigerator, lights, USB ports, etc. Fuses in your fuse block (sometimes called a distribution block) protect your wires and devices in case of a malfunction that results in an overcurrent. If you're running something that unknowingly is drawing too many amps through wires that can't handle the load, your fuse will "blow" before any damage occurs to your device, or before your wires heat up and cause a fire.

There are a variety of fuses that you can utilize depending on the gauge of your wire, how much current is running through it, and how you're going to use your power. Your fuses should match your items' needs, so be sure to research this in detail prior to installation.



Inverter - AC vs. DC

AC/DC isn't a rock band here. When it comes to your solar setup, DC (direct current) is what your solar panels generate which is stored in your battery and distributed to most accessories by the fuse block. Your home uses AC (alternating current), and if you absolutely must power something from home that normally plugs into the wall, you can pass the DC through an inverter and is converted to AC. To know what type of inverter you should choose, you'll need to understand how much direct current you're getting from your solar panels, and how much alternating current you're going to draw at a time.

Your battery, solar panels, and inverter should all have the same input voltage. The output would be determined by how much power you're going to use. If you have a low-watt inverter and try to run a high-watt appliance, you'll blow a fuse (or worse, fry your inverter). So, going back to what's right for you? You'll need to determine how much power you're going to use at a time.

Things to consider

Sure, all this technical stuff sounds super cool. But what do you really need? As much fun as it is to build a totally tricked-out system and be able to boast about all the power you have, you may not need it. Or maybe you do? Here are a few things to consider when planning your power setup:

How long are you keeping the vehicle?

Do you need a 25-year warranty or are you just using the system for a short period of time? How long do you want your system to last? If you're not keeping your vehicle long-term, what do you want the resale value to be? Are you savvy with electrical systems and able to fix things easily on your own, or do you want this to be a one-and-done scenario?

Where are you going?

Do you plan to be in the desert in full sun most of the time, or do you head to the mountains and ski all winter? Will you be in dusty environments often? Clouds, shorter days, dust, and smoke are all things that affect your power absorption, and capacity needs.

How much effort do you want to put in, post-installation?

Going back to that savviness, do you plan on bringing tools with you? (You should regardless, even if minimal) Are you building your system yourself or is someone else? Are you comfortable troubleshooting and fixing electrical systems?

Going all-electric

Reading all of this you might be getting super excited and start contemplating going all-electric. You know there are already all-electric cars on the market, but they do require shore power (a charging station) to recharge. What about Solar?

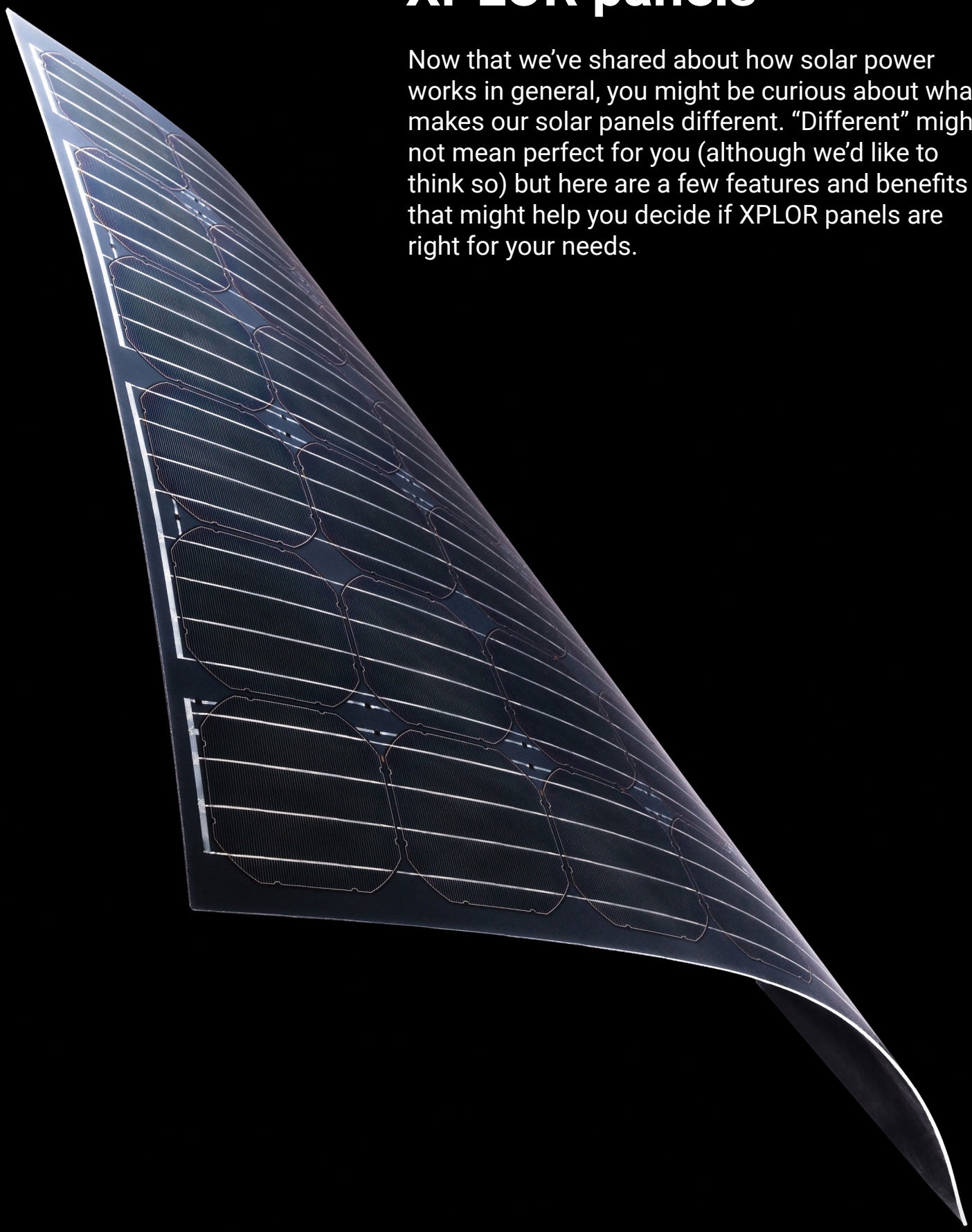
Solar charging for electric vehicles is still in its infancy, but it is possible. The pros are obvious: no pollutants are burned so it's environmentally friendly. It's 100% renewable and free once you have it. No more gas stations.

Cons are that it takes a lot of solar panels to generate enough electricity to operate an electric motor. That means space. Your power availability is also dependent on weather, so if you get too many cloudy days in a row and can't charge up another way, you're a sitting duck.

Technology is growing quickly and there are already some solar-assisted vehicles on the market. When can we go 100% solar? That will still be a while, but we're excited to see when that is a reality!

XPLOR panels

Now that we've shared about how solar power works in general, you might be curious about what makes our solar panels different. "Different" might not mean perfect for you (although we'd like to think so) but here are a few features and benefits that might help you decide if XPLOR panels are right for your needs.



Technology

Our XPLOR Series Solar panels are made to precision in a sustainable manner with CIGS technology. CIGS technology is more sensitive to light, so it has an exceptional absorption rate even in low light situations. Our panels are still working hard while you're watching that sunset.

Our panels are only 1.7mm thick, made with a cell-by-cell manufacturing technique with high-quality stainless steel and layers of semiconductor materials.

What does cell to cell manufacturing mean? Our unique, cell to cell manufacturing method has a bypass diode for every cell, which optimizes the power output for each cell. That means you will still have power if a cell is covered or shaded. If you end up parked in half shade at a trailhead after you arrive in full sun, any cells that remain in the sun will still produce power. Want to strap that kayak on top of your vehicle but it will cover some of your panels? The exposed cells will still work and charge up your batteries.

DURABILITY

Our XPLOR Solar Series panels are perfect for the overland lifestyle. We understand what rugged means to you, so you don't have to think twice about exploring that questionable road with low-hanging branches, and there's no need to worry when you're caught in that unexpected hailstorm.

FLEXIBILITY

From the top of a houseboat to the curve of your extended roof on a Westfalia, our XPLOR Solar Series panels can conform to nearly any shape you want to mount them to. We even make custom panels for those one-of-a-kind perfect fits.

NO MICRO-CRACKING

XPLOR Series Solar Panels are flexible and durable. They are even walkable so you can have them on a deck, utilizing every inch of space to generate power.

Silicon solar cells are brittle and can end up with micro-cracking even upon install. One drop of a rigid silicon panel and your panel could be damaged. Micro-cracking is often invisible to the naked eye and can cause a variety of issues with your panels or even complete failure.

WARRANTY

We offer a 25-year warranty for our solar panels. If ever you read about how flexible panels aren't as rugged or durable as rigid silicon panels, you don't have to worry about that with our XPLOR Solar Series.

EASY TO INSTALL

Our panels are flexible and adaptable to any surface. You can simply peel the adhesive covering and stick in place. Since our panels are lightweight, you can install these by yourself, and the adhesive is included so no running back to the hardware store for silicone or Velcro.

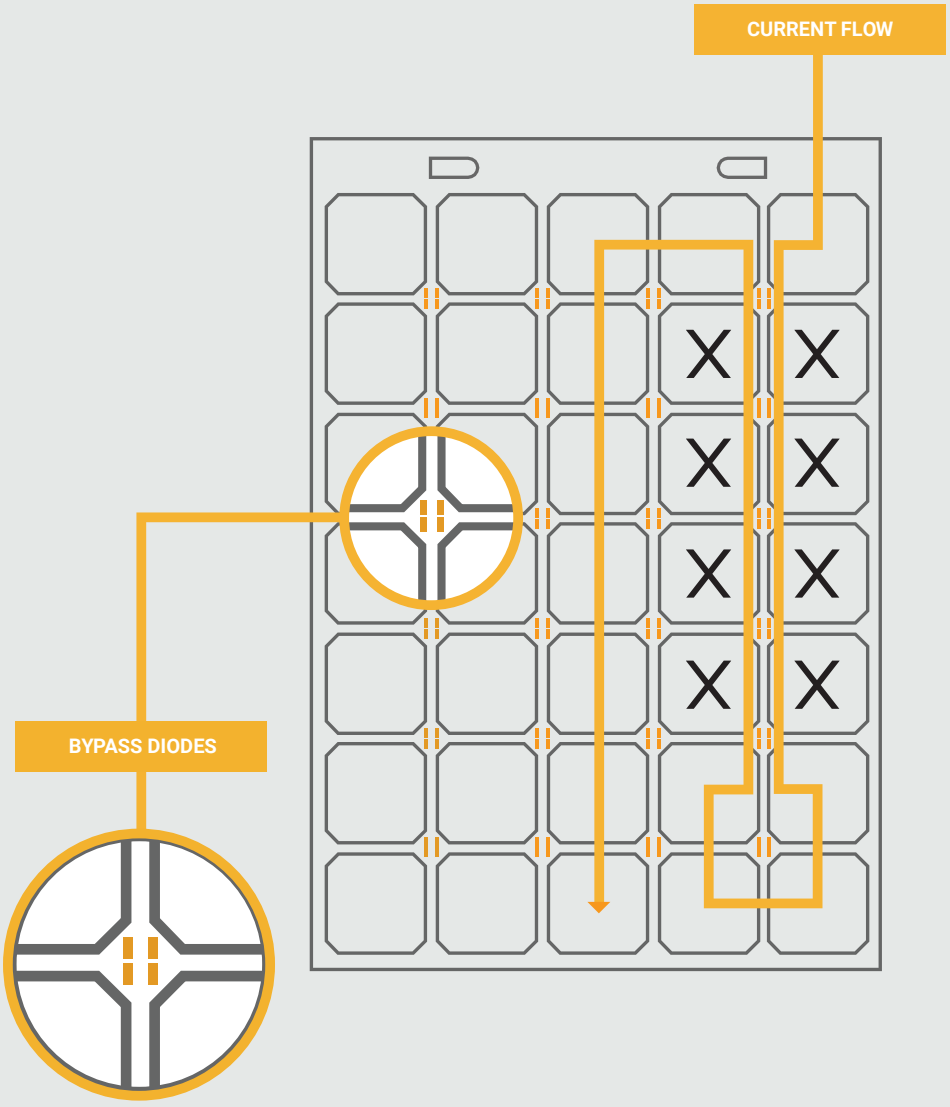
QUALITY

We believe in quality products, as well as processes. When you're in the backcountry you can't be concerned about your solar panels failing or breaking. We have a QR code on every single cell that tracks the exact conditions of each manufacturing step to ensure consistency and quality.

What are bypass diodes and how do they work?

When a solar cell s under shade--it won't produce as much or any current at all. Because all solar cells in a module are in series, and the same amount of current must flow through every cell.

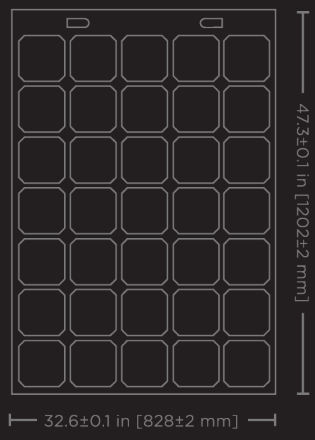
Affected cells will dissipate power as heat and cause "hot spots," and bring down the overall performance curve of the entire group of cells. Bypass diodes allow an alternate path for the current to go through. Allowing the electric current to pass around affected cells and thereby reduce the voltage losses of the solar module.

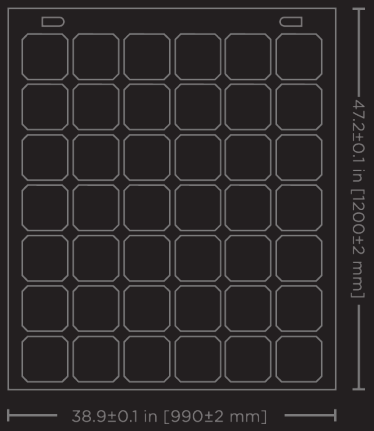


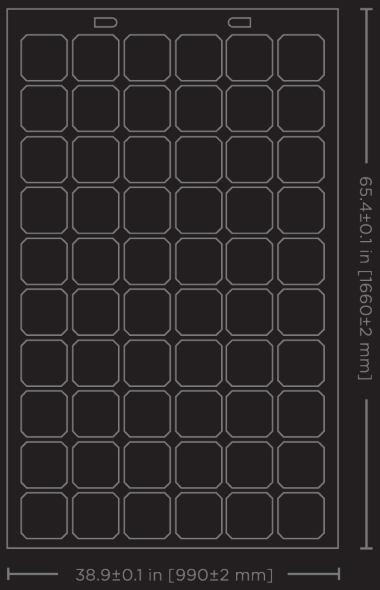
Consider getting solar panels that have bypass diodes. Some panels don't come with any, and most come with just a couple on a panel--but what would be best are bypass diodes on every cell.

Which solar panel is right for me?

There are a lot of options on the market, and the type and size of panel (and how many of each) you choose will be different depending on how much power you need. We'll share a little about what you can power with our XPLOR Series Solar Panels based on 3.5 hours of ideal conditions. This means full sun at the highest point in the sky.







XPLOR 105W

Generating about 368 watts of power a day, you should be able to charge up your 100w laptop while running 10 CFL (compact fluorescent light) lights for 3.5 hours. You'll still have enough power to watch a movie on a 43" smart TV in the evening. This panel will recharge a 100AH AG battery in 3.25 days with optimal conditions.

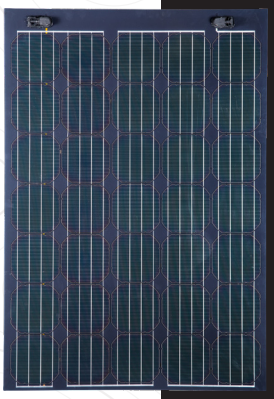
XPLOR 126W

Generating about 440 watts of power per day, this option might be better if you work a lot in your recreational vehicle. You'll have 4.5 hours of charge time for your 100w laptop and your 10 CFL lights. You can power a larger 50" smart TV for 1.5 hours. Recharging your 100AH AGM battery will take 2.7 days.

XPLOR 185W

If you're a solar power user (no pun intended) the 185w panel will be the smart choice. With the 630 watts this panel produces, you'll have 6.5 hours of charge time for your 100w laptop and 10 CFL lights, and power an even larger 65" smart TV for 1.5 hours. Our favorite panel (who doesn't like more power?) will recharge a 100AH AGM battery in 1.9 days.

105W / WEEKEND



105W MODULE SPECS

Dimension: **47.3±0.1 in X 32.6±0.1 in** | Weight: **2.9 kg (6.5 lbs)** | Module Thickness: **1.7 mm**

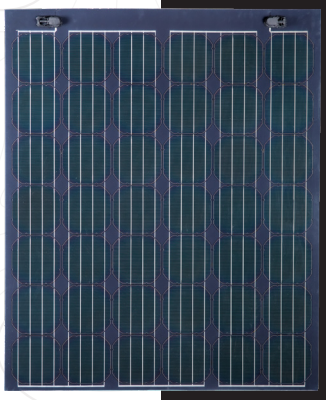
105W ELECTRICAL

Peak Power (+5/-0%) :	**Pmax 105W**
Avg. Module Efficiency :	**11.0%**
Peak Power Voltage :	**Vmpp 16.27V**
Peak Power Current :	**6.2A**
Open Circuit Voltage :	**Voc 21.0V**
Short Circuit Current :	**Isc 7.4A**

105W MECHANICAL

Solar Cells :	**CIGS**
Junction Box :	**IP-65, MC4 Compatible**
Hot Spot Protection :	**Bypass Diodes Per Cell**
Temperature F :	**-40° F to + 185° F**
Max Load :	**Wind / 50 psf, 2400 Pa**
Impact :	**1 in Hail at 52 mph (23 m/s)**

126W / ADVENTURE



126W MODULE SPECS

Dimension: **47.2±0.1 in X 38.6±0.1 in** | Weight: **3.6 kg (8 lbs)** | Module Thickness: **1.7 mm**

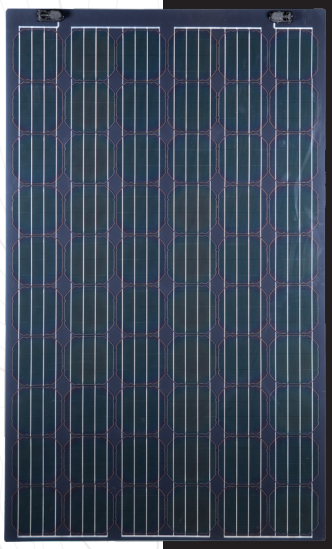
126W ELECTRICAL

Peak Power (+5/-0%) :	**Pmax 126W**
Avg. Module Efficiency :	**11.0%**
Peak Power Voltage :	**Vmpp 19.53V**
Peak Power Current :	**6.2A**
Open Circuit Voltage :	**Voc 25.2V**
Short Circuit Current :	**Isc 7.4A**

126W MECHANICAL

Solar Cells :	**CIGS**
Junction Box :	**IP-65, MC4 Compatible**
Hot Spot Protection :	**Bypass Diodes Per Cell**
Temperature F :	**-40° F to + 185° F**
Max Load :	**Wind / 50 psf, 2400 Pa**
Impact :	**1 in Hail at 52 mph (23 m/s)**

180W / EXPEDITION



180W MODULE SPECS

Dimension: **65.4±0.1 in X 38.9±0.1 in** | Weight: **5 kg (11 lbs)** | Module Thickness: **1.7 mm**

180W ELECTRICAL

Peak Power (+5/-0%) :	**Pmax 180W**
Avg. Module Efficiency :	**11.0%**
Peak Power Voltage :	**Vmpp 27.9V**
Peak Power Current :	**6.2A**
Open Circuit Voltage :	**Voc 36.0V**
Short Circuit Current :	**Isc 7.4A**

180W MECHANICAL

Solar Cells :	**CIGS**
Junction Box :	**IP-65, MC4 Compatible**
Hot Spot Protection :	**Bypass Diodes Per Cell**
Temperature F :	**-40° F to + 185° F**
Max Load :	**Wind / 50 psf, 2400 Pa**
Impact :	**1 in Hail at 52 mph (23 m/s)**

How else can we help?

We hope this download has been helpful for you. There are so many things to consider when planning your power setup for your rig, regardless of what type of rig you have, and we want to help make some sense of it all! Be sure to subscribe to our email list and check back in on our website for more helpful resources. You can also reach us directly with questions about our product by visiting our contact page.

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