

What makes a ‘High Quality’ Solar Array Installation?

Solar can be complicated and confusing. If you compare solar arrays or bids for solar installations, how do you know which one is better? Should you choose the lowest price to save some money? Or the highest price because you think it must be better because it is more costly? **You want high quality but how do you know what ‘high quality’ is when it comes to solar?**

This guide is intended to help you answer these questions and more and hopefully help you make a good, well informed decision when you choose a solar contractor.

It is very hard to make the ‘right’ choice unless you really know what to look for. We have created this guide to help you identify good quality and bad. We have broken the guide into the following parts:

- **Materials: Panels, inverters and racking**
- **Labor and workmanship: mounting and methods**
- **System Design: Wire sizes, material types, orientation**
- **Warrantees: Panels, inverters and workmanship**
- **Experience and references**



Materials: Panels, inverters and racking

- **What makes a good solar panel?** This is the primary component of your array and your biggest investment. You should give this serious thought before choosing. There are hundreds of new panel manufacturers on the market today that were not here five years ago. Though they may have inexpensive panels and grand boasts of efficiency and quality, they are untested and most of the companies are located overseas. You may be able to save a few dollars today, but who will replace panels if they fail ten years from now?

- What type of panel is it? There are three types of panels:



- **Thin Film or Amorphous silicon** is the cheapest type of panels on the market and also the least efficient. Thin film panels are popular in utility grade settings since they are cheap and large ground mounted arrays do not need to worry about how much space they use. In residential settings or any time space is a concern; other panels are a better choice. You also have to consider the cost of racking. If a panel is less efficient, then you need more of them and hence, more racking and labor so in the end, it is not more competitively priced. Thin Film panels have a dull solid look. They have no wiring or grid on them and the entire panel is the same color.



- **Monocrystalline** silicon means the entire silicon wafer is center cut from a single silicon ingot. This is the most efficient method of making solar panels and generally the most expensive type of panels you can buy. Since it is more efficient, you can use fewer panels and get the same result. These panels are also often cut from the best silicon and are generally more reliable and perform better in real world settings. Monocrystalline panels are easy to identify. They generally have a white pattern between each cell and small white diamonds at the corner of each cell. Energy Independent Solutions uses Monocrystalline Panels for all of our installations.



- **Polycrystalline** silicon is when they take all the parts and pieces from the monocrystalline cell production lines and use them to make a panel. These panels are very good, nearly as high quality as Monocrystalline. It is easy to tell them by sight; they will have a solid iridescent blue color and be striped with solder connections in a grid pattern.

- **Do you know who manufactured it?** About five years ago panel production machine prices dropped significantly with their introduction of small self-contained micro plants. These machines can be purchased anywhere from \$30,000 to \$50,000 and part of the package is a guarantee that the panels will be accepted by the state of CA solar program. If a panel is accepted in CA, it is accepted throughout the US, including PA. Essentially this means a company can start producing panels in a garage somewhere today and stamp them with a 25 year warranty tomorrow. They have no track record and no way to back up their warranty but they still have the ability to sell on the US market. Considering the cost of the investment, 'Buyer Beware' is a huge understatement.
- **Choose a reputable Panel manufacturer.** Have you heard of them? Is there more data than a fancy website? Can you call other folks like you who are actually using their product or do they just have bold product claims and a fancy website?

- **Make sure they have been around for more years than the warranty implies.** If they started up 5 years ago, how can they predict the performance of the panels 25 or 30 years down the road?
 - **Look at the method of manufacturing.** Are they using compression to produce the panels without screws and attachments that can loosen over time? Are the contacts welded or screwed? Are the wires enclosed in solid plastic or are they attached loosely in a box to vibrate loose over time?
- **Where was it made?** We are biased here. **Energy Independent Solutions only uses 100% American Made panels.** We believe our money should be spent in our country to build our economy and create American Jobs. Many Chinese and Indonesian panels are on the market with no track records and no way to collect warranty claims down the road. They are cheap both in price and quality and we will not install them.
- **How long has the manufacturer been in business?**
 - Ensure the company has been around for enough time to make you feel comfortable they will be there if you have problems with the panels.
- **How long is their warranty?**
 - Does it last longer than they have been in business?
 - Does it drop in tiers or is it Linear meaning it prorates over time?
- **What is 'tolerance'?** Does your panel have a good 'tolerance' level? Each panel has a rated number of Watts it will produce in perfect laboratory conditions. These range run from +10% to -10% meaning a 100 Watt panels could produce 90Watts or 110Watts. Since you are paying for panels by the Watt it is important to know you are getting at or better than the rated Watts.
 - Look for panels that have a +-3% or a -0%+3% or 5% rating. Some manufactures like SolarWorld use methods like Plus Sorting that ensure all panels outperform rated Watts. This ensures you get what you pay for and most times a little more.
- **What are the 'field performance' ratings of the panels?**
 - Independent companies like Photon Magazine produce studies of installed Wattage versus actual installed field performance of panels each year. Some panels perform better than rated in actual real work conditions. Look for a panel that has scored high on this type of test. In the end this is the only test that matters since you will never have your panel in a laboratory.
- **What makes a good racking system?**
 - **Is it a 'solar engineered' racking system** or did your contractor pick up a bunch of parts from Home Depot and slap them together?
 - Make sure you are getting a quality racking system that is either coming from a reputable racking company or has engineering documentation available.
 - **Is it engineered for 90-120mph wind loading and 25-35 lb snow loading?**



- **What makes a good roof penetration?**

- **What kind of roof sealant are they using?** There are many 'outdoor' rated sealants but not all are created equal. You are building an array that you intend to have on your roof for the next 30 years. You need to ensure all parts of the installation are built with this in mind including the caulking.
 - Make sure your contractor uses the highest quality caulking available, like Solar Seal.

Good



- **Are they flashing the penetration or just using 'L' brackets?** Flashing is critical on shingle roof installations. We have yet to find another contractor in Western PA that uses this method other than Energy Independent Solutions. Every installation we have seen other than ours has attached the array to the roof using an 'L' bracket and no flashing. Once again, **you are building something that will be on your roof for 30 years. You need the roof penetration to last that long and not leak.** Simply attaching racking systems directly to a roof without using any flashing is irresponsible and will cause you problems down the road. You will be the one paying to have the array removed so it can be corrected.



Bad

- Ensure Flashing is used on each penetration.
- Have the contractor provide pictures of other installations that show how they flash the penetrations.
- Get references who have similar installations and find out if they do what they say or if they are just giving you a sales pitch.

- **What makes a good ground mounting system?** The key to a good ground mount, beyond obvious racking quality issues, is making it maintenance free when it is done. The last thing you want to be doing is running lawnmowers and weed whackers under the array around the wiring or having to repeatedly paint the steel every year.

- Ensure rock underlayment and a weed barrier is used to eliminate the need to mow and trim around the wiring under the array.
- Ensure only galvanized steel, stainless steel and structural aluminum is used in the structure so you will not need to repaint year after year.
- Ensure the concrete piers or foundation points are finished and tapered so water does not pool around posts allowing ice and water to damage the connection to the ground.
- Ensure all wiring is tightly attached to the racking system so it will not rub and wear when the wind blows.



Labor and workmanship:

- **Is the installation crew a subcontractor for the solar contractor?** This is not always bad but you should be aware of whether the contractor you are signing a contract with is using their own people or if you are actually hiring another company.
 - Most solar installations are subject to Prevailing Wage legislation and you as the homeowner are responsible for this compliance as the law is written. Is the subcontractor ensuring they comply or will this come back to haunt you a few years down the road?
 - Can you communicate with the install crew or do they speak another language? Are they Legal?
 - Do you want to hide from the crew because they look like they just got released from prison? Do you trust them to be in your home? If you feel uncomfortable asking about the 'image' of the crew that will be working on your array, **ask for references** and ask them what they thought of the crew. In the end, it is the crew who will be in and out of your home and not the salesman.
 - **Are they insured?** Not just liability but do they also have Workman's Comp insurance? If they are on your roof a fall can be devastating and a claim could come back to your property. Ensure you have documentation of insurance coverage before they start working.
- **Do they have experience or is this one of the first arrays they are building?** PA has a very loose policy on approving solar contractors. Hundreds of solar contractors have sprung up in the past year. Many are from out of state and those who are local are just entering the business. This does not mean they are bad but you may want to be sure they at least know what they are doing before hiring them. It is difficult to get a reference from someone who has never completed a project outside of a training program. But how do you know if they are experienced? They can tell you anything and show you pictures of someone else's arrays to back up the story.
 - **Ask for references.** Make sure the references match the pictures they are showing you.
 - **Ask to visit a local system.** Most people who have solar arrays love to talk about them and many like to show them off. If they cannot produce people who want to show their systems they may not have actually built any or they are aware the client is not satisfied.

System Design: Wire sizes, material types, orientation.

- **What direction should my array be oriented?** Solar sites and books say south. Can it face east or west? Are there times when an orientation other than south is better? The answer is yes. Your solar contractor should be able to discuss with you how they want to orient the array a specific direction and why. Often times a few degrees East of south will be better if there is heavy shading on the West for example.
 - If East or West orientation is chosen, the array needs to have very little shading or it will not qualify for state rebates.
- **What size wire should be used?** You may take this for granted and not want to get involved in system design issues but you should ask the contractor to oversize each run. It is a very inexpensive option and can improve overall system performance. If you have several inverters, it is imperative. Multi inverters systems act differently than single inverters. They need significantly larger wire size to control voltage.

- **How do I know if my array is being optimized to give the most production?** This is difficult unless you do your homework. The first thing you must do is to choose a reputable contractor who knows what they are doing and has experience.
 - Ask for NREL calculations.
 - Ask to see the shading calculations.
 - Ask what shading factor was used to determine ROI.
 - Look closely at where the contractor proposes to place the array and ask questions about trees, buildings, telephone lines, ridgelines in the distance etc.

- **What about black panels or solar shingles?** Solar works best when it is cold. The colder the better. You buy solar based on STC or laboratory conditions which are 77F. If a panel is -35F it will produce 25% higher than rated. However, if the panel is 200F it will drop voltage by 25% and could be low enough to no longer be able to fire the inverter. Panels that are all black, mounted so they have no ventilation or attached directly to shingle roof like solar shingles have extremely high operating temperatures. They will NOT produce as well as rated. You WILL sacrifice performance for aesthetics.
 - Ensure panels have ample air flow under them. Systems should be mounted with a few inches of space between existing shingles and bottom of panel.
 - Ensure contractor is factoring in high operating temperatures when determining ROI of the system and not giving optimum numbers to talk you into signing.
 - Ensure shingle warranty will not be voided if the panels are placed directly on top of shingles. Some manufacturers will not warranty them due to high temperatures.

- **Warrantees: Panels, inverters and workmanship.**
 - Panel warranties vary from company to company. They are required to have a 20 year warranty but most have a 25 year warranty. Look at the warranty information. Many drop 10% in the first year and 20% in the tenth year. This is called a tiered warranty. Look for a linear warranty. It goes down a little each year instead of dropping all at once. The best warranty in the world will not mean a thing if there is no company to honor it. Some things to consider:
 - Will the company still be in business 15 years from now if I have a problem?
 - Are they located in the US or will I have to communicate with China to collect my Warranty?
 - Is the company financially mature enough to offer this warranty?

- **Experience and references:** This is perhaps the most important thing to consider. Does the contractor have the necessary experience to build a high quality solar array and do they have references to give you?
 - How many references can they provide? Have they built one or two arrays, perhaps none similar to what they propose for you?

- Can you freely contact anyone from a list of references or are they providing just one or two select individuals?
- How long ago did they build the system? Can you have a reference from one year ago? If not be wary.
- Are they related to the reference?
- Can you visit local installations? If not be wary.
- Is the company local? If not, how will they service the array?
- Are the pictures on their website their installations or did they just use someone else's pictures? Ask for the locations of odd looking photos that do not appear to be from this region.
- What should you ask a reference:
 - Was the crew professional and were you comfortable with them?
 - Did they build the array like they proposed, on budget and on time?
 - Did you have any issues with the installation?
 - Is the array performing like they projected?
 - Did they use flashing on the roof penetrations?
 - Is the ground mounted system maintenance free or do you need to mow under it and paint the steel each year?
 - Have you had any issues with the system since it was built? If so, how did the contractor handle it?
 - What kind of panels did they buy? Why?



The Energy Independent Solutions Difference



First we conserve, then we create...

At Energy Independent Solutions, we only build High Quality Arrays.

- We use only **100% American Made Panels**
 - Our Panels have the best warranty and **best field performance rating in the industry**
 - The company has been building solar panels since 1977
 - 100% of our systems outperform NREL projections
- We are a local company and **we do not use subcontractors**. Our crews are professional and we encourage you to contact our clients to see what they say about them.
- **Every penetration** we make to a roof **is flashed**. Our goal is to make every penetration last longer than the panels.
- **Our ground mounts** are built on galvanized steel and structural aluminum over weed barriers and rock underlayment creating a **nearly maintenance free array**.
- **Every wire run is upsized** at least one size for maximum efficiency.
- Every project has been **on time and on budget**.
- We have **many local references** and systems we can arrange visits to.
- Inspectors from Duquesne Light, Allegheny Power and Central Electric have told our clients **our installations are the highest quality they have seen**.
- Most projects can be completed 30 days from contract signing.
- **Don't take our word for it. Ask our clients.** We have active installations throughout Western PA and are happy to provide a list of references for you to call. We can arrange system tours so you can see our high quality workmanship first hand.