Grid tied solar wiring diagram

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This instructable describes the installation of a rooftop solar installation, from planning to full connected usage.

Since you need to connect a grid-tied system to the electric grid, you need permission from the electric utility. You may also need permission from a planning authority. A typical prerequisite is that you have a smart meter - one that is capable of running backwards. So the first place to start is the website of your electric utility, to discover what the procedure is.

My utility does not allow householders to generate significantly more power on an annual basis than they use, so I had to document my expected usage from all loads (heating, cooling, electric vehicle charging, lighting etc.). They also require details of the grid-tie equipment (manufacturer and model numbers, with appropriate certification). So the steps were:

To state the obvious, a solar panel installation needs sunlight. Direct sunlight. You need locations where panels will have an unobstructed view of the sun for at least some of the day.There are various online calculators that will tell you how much sunlight a system will receive in different places in the world, based on past weather averages and on spherical geometry - geographic latitude and calculated sun positions.The one I use is PVWatts Calculator

That assumes your view of the sky is completely unobstructed by trees, other buildings, chimneys, mountains etc. If you do have obstructions, you will need to de-rate the power calculated and install more panels to meet your annual power target. Panels are very susceptible to even partial shading - they are constructed of a large number (maybe 60) of cells in series, and if just one is shaded its electrical resistance will rise and the entire panel will be essentially non-functional. So it"s important not to have a panel partly shaded by something like a chimney or awning. A narrow shadow of something like a chimney bracket is not critical provided it only covers a small bit of any cells.

Typically, the panels are mounted on metal rails, the rails are mounted on brackets, the brackets are fastened to the roof. There are different bracket designs for different roof materials. Since the panels have an expected lifetime of some 30 years, and represent considerable investment in time to install, it is prudent to install them on a roof with a commensurate lifetime, rather than one which will only last another 5 or 10 years. It is possible to remove and re-install panels, but you should consider replacing the roof first, for instance replace tar-paper or wooden shingles with metal or ceramic tile.

Local regulations may require the use of fall-arrest equipment when working on a roof.

Regardless of regulations, metal roofs are very slippery, particularly when sitting or kneeling, and I have some

sections with a 1:1 slope. It"s impossible to work without a harness. I have rock-climbing equipment including Jumar ascenders that let me stop at any place on the roof and place my full weight on the harness, with hands free. On my first house I used a belay device with a knot, but the Jumar was much easier. On the first roof, I set an eyebolt in the joist in a pony wall, and passed the rope across the ridge to work on the other side. On my second house, I tied the rope to the snow rail. Since I installed panels on both sides, I had two ropes, one in each direction.

Tools and other items can slide off a roof very easily. They might hit someone underneath, but apart from that it"s just annoying having to retrieve them. Sometimes I secured tools with a lanyard, or stored them in a box that would not slide. Once you have some rails up, you can rest boxes against them.

Power cords and safety lines are a trip hazard. One time I stepped on a loose rope on the metal roof; it was like stepping on a bar of soap. I fell and hit my head; the harness stopped me sliding off the roof but my elbow hurt for months.

Solar panels generate voltage when in sunlight (somewhat obviously). However, the pre-attached connectors have shrouds so that there is little risk of touching the conductors. To stop a panel from being energized, you can cover it with a sheet of cardboard or rubber mat.

You need to decide how many panels are going go on what roof sections, which is going to affect how many microinverters are required, and what electrical connections are needed, as well as how many rails and brackets.