

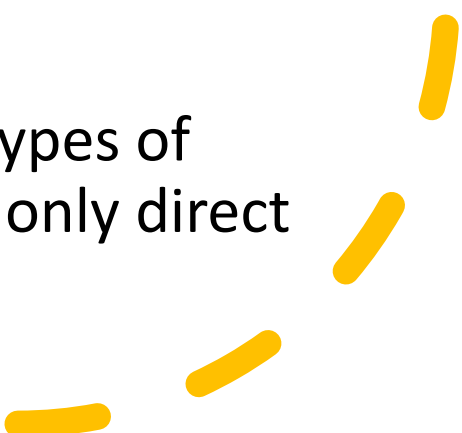


How to Determine the Feasibility of Solar For Your Home and Business

A Step By Step Guide To Help Educate Anyone Considering
Investing in A Solar System



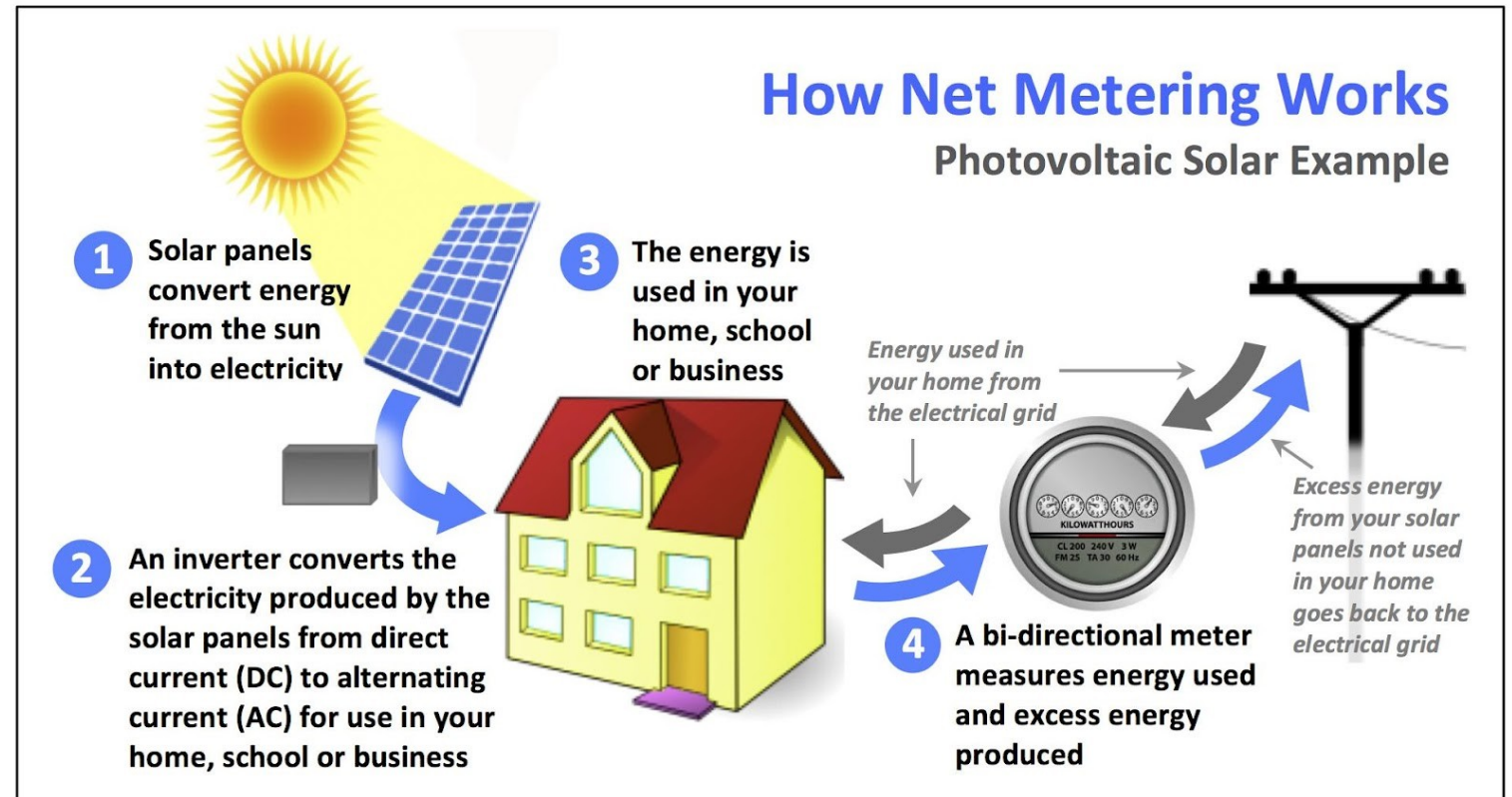
Is Solar A Feasible
Option for Your
Home And/Or
Business?

- Going “solar” is a major investment; the purpose of this tutorial is for people to determine, not how solar works, but if it is feasible option for their home and/or business. And how long it might take to recoup their investment.
 - Since everyone has different tax liabilities, for the purpose of this tutorial, only the Federal tax credit, will be considered. Other incentives, and kWh price increases, will only shorten the number of years for system to be paid off.
 - This tutorial will not cover different types of panels and inverters, warranties, etc; only direct costs and payback at current pricing.
- 

Solar Terminology

- Kwhs – Kilowatt hours – this is how you are charged for electricity
- Solar Panels (or modules) – Devices usually placed on south facing roof or, in some situations, pole mounted. They are measured by wattage. The sum of the wattage of all the panels is the wattage size of a solar system.
- Racking System – How the panels are affixed to the roof.
- Inverters – Devices which take solar DC (Direct Current) power and convert it into AC (Alternating Current) for your electric panel.

Netmetering



Types of Electric Solar Systems 1

Grid-Tied System.

- Solar feeds DC electricity to an inverter which converts this energy to AC, which is fed to your electric panel. You use as much of this electricity, as you can and the excess goes through Netmeter and onto the grid
- Unused, excess kWhs that are put on the grid are then credited when used. Your bill will show how much was put on and taken off; you are charged the difference. If grid goes down, renewable energy systems must, by code, shut down

Types of Electric Solar Systems 2

Grid-Tied with Battery Backup

- Home is connected to the grid (Utility Company).
- Some utilities are not as reliable, at times due to weather; if system is setup properly, solar systems can still work, during outages, and generate power for critical loads in home or business.
- Some Utilities charge “Peak Demand Fees” or “Time of Use Fees” to offset costs of grid being used as storage for unused kWhs. Batteries are added to lower or eliminate these fees.

Types of Electric Solar Systems 3

Off Grid System

- **ALL** electricity is supplied by either, or both wind and solar systems, which are connected to batteries by a Charge Controller. The Charge Controller charges the batteries. An inverter converts the Direct Current (DC) battery power to Alternating Current (AC) power, which is fed to the electric panel.

Step 1

- Check to determine which roof on your home or business has best area for sun exposure. One possible site is: sunroof.withgoogle.com. Open the site; and insert your address. It will show the area of your roof with best exposure
- Download a compass app on your phone (or if you are old school, get out your compass); determine the azimuth of roof where solar will go
- Look at Potential Shading of Roof. Shading will lower production estimates and increase payoff period.
- Determine what size solar system you need.



Step 2a

Possible Goals with Your Solar.

- Current energy needs only?
- Future energy needs?
- Larger family?
- Tax purposes? For businesses, there can be additional tax incentives.
- Need batteries as a safety net against power shortages?
- Offset Utility costs and fees?
- To Be Green? Offset Climate Change?

Step 2b

The EV (electric car) or Hybrid Question

As many people are considering adding an electric vehicle to their home, or business, question arises: How much energy will it take to power them?

Quick and easy formula:

Take number of miles, driven, and divide by 3.5 miles per kwh. If you drive 1000 miles per month, you will need about 286 kwh, or 3432 kwh per year more production from your system for 12,000 miles. You would need to increase your system ~ 2,100 watts.

Step 3

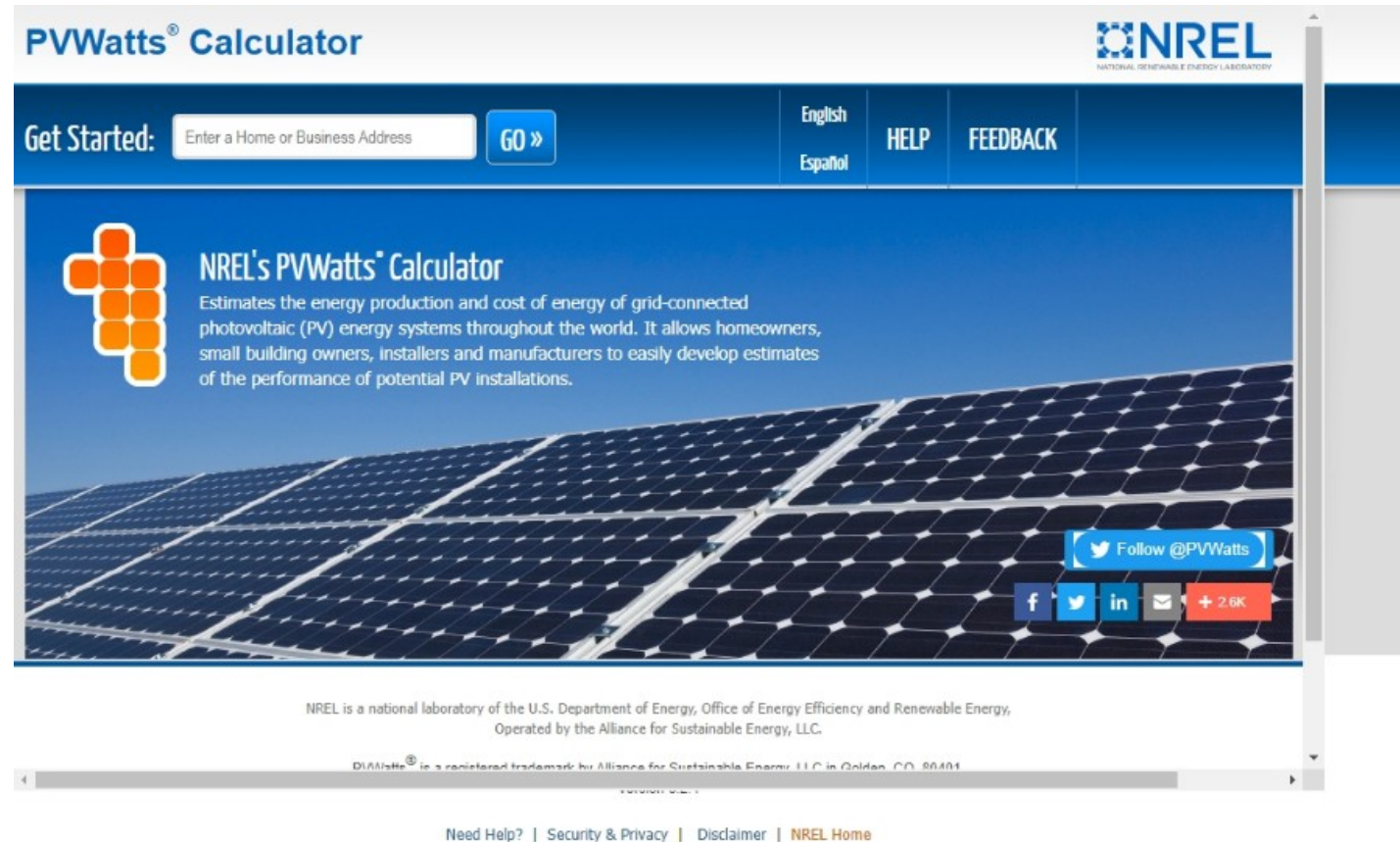
NREL is The National Renewable Energy Lab in Golden, CO. They have been testing renewable energy sources for over 40 years and set the standards for the equipment.

NREL website to calculate production at your home

PVWatts Calculator <https://pvwatts.nrel.gov>

- NREL's PVWatts[®] Calculator ... Estimates the energy production and cost of energy of grid-connected photovoltaic (PV) energy systems throughout the world.
- Do not be concerned if you do not know, the pitch nor exact orientation of your home, relative to due south. Because no one can predict exactly how much sun will shine, notice the calculation shows a range. For your feasibility study, you are trying to determine, if solar is a viable option; this calculation is close enough to help you make that informed decision.

What you will see at PV Watts Calculator website



The screenshot displays the PVWatts Calculator website interface. At the top left, the text "PVWatts® Calculator" is visible. On the right side of the top navigation bar is the NREL logo, which includes the text "NREL" and "NATIONAL RENEWABLE ENERGY LABORATORY". Below the main header, there is a "Get Started:" section with a text input field containing "Enter a Home or Business Address" and a blue "GO »" button. To the right of this are links for "English", "Español", "HELP", and "FEEDBACK". The main content area features a large background image of solar panels. On the left side of this area is an orange icon of a solar cell grid. To its right, the text reads "NREL's PVWatts® Calculator" followed by a description: "Estimates the energy production and cost of energy of grid-connected photovoltaic (PV) energy systems throughout the world. It allows homeowners, small building owners, installers and manufacturers to easily develop estimates of the performance of potential PV installations." In the bottom right corner of the main content area, there is a blue "Follow @PVWatts" button and a row of social media icons for Facebook, Twitter, LinkedIn, and Email, with a red button showing "+ 2.6K". At the bottom of the page, there is a footer with the text: "NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Operated by the Alliance for Sustainable Energy, LLC." and "DIAA/btt® is a registered trademark by Alliance for Sustainable Energy, LLC in Golden, CO, 80401". At the very bottom, there are links for "Need Help?", "Security & Privacy", "Disclaimer", and "NREL Home".

Page With
Predicted Yearly
Production by
NREL

Month	Solar Radiation(kWh / m2 / day)	AC Energy(kWh)	Value(\$)
January	4.27	646	78
February	4.85	663	80
March	6.06	898	108
April	6.57	922	111
May	6.62	949	114
June	6.95	910	109
July	6.47	879	106
August	6.59	881	106
September	6.17	823	99
October	5.36	755	91
November	4.50	647	78
December	3.84	590	71
Annual	5.69	9,563	\$ 1,151

Step 4

- NREL typically calculates that one needs to take the DC wattage of the solar system and multiply by $\sim 75\%$; that produces the approximate AC wattage per hour. (i.e.: a 6,000 VDC watt solar system $\times \sim 75\% = 4,500$ AC watts , or 4.5 KW/hour (AC)).
- NREL calculates the production for our area at about 6 hours per day; from 9:00 am to 3:00 pm

Step 5

For our example:

- A 6,000 VDC watt system will generate ~ 4.5 kWh (AC) X 6 hours, or 27 kWh (AC) per day. For the year, that system will generate ~ 365days x 27 kWh or ~9855 kWh/year (AC) .

Step 6

Contact your Utility Company to get your month-by-month Kwh usage, for the last twelve months. Typically, along the Front Range of Colorado, a 2,000 square foot home uses about 600 kWh/month; 12 months @ 600 kWh/ month is 7,200 kWh/year.

- Compare the monthly usage to the predicted monthly solar totals, from NREL website. Adjust system size accordingly.

Step 7

How to Determine Possible Payback:

- 6,000 Watt system production: $9,855 \text{ kwh/year} \times \$0.12/\text{kWh}$ (average cost in Colorado) = $\$1,182.60/\text{year}$ savings
- Cost of a 6,000 Watt system @ $\$3.50/\text{watt}$ = $\$21,000$
- $\$21,000 / \$1,182.60 = 17.75$ years pay off, with no Federal Tax Credit.
- With Federal tax credit of 26% ($\$5,460$), cost would drop to price to $\$15,540 / \$1,182.60 = 13.15$ years to recoup investment.
- Price increases by Utility Company will shorten pay off time

Step 8

- Be conservative in your estimates. Do NOT believe “Pie-In-The-Sky” payoff estimates. If system generates more energy than expected and gets paid off quicker, that is better. Consider it a bonus.
- If the numbers for purchasing a solar system, do not work out, it is better to find out before you purchase.



Step 9

- Now that you have done your own feasibility study, and you have an idea of how much solar will fit on your home and how much you need:



Get BIDS!

From multiple companies

Let the Salesmen give their “pitch”

Ask questions. Even ones you might
might know the answers to.

Are they being truthful?



Step 10

Questions to Ask Salesperson

1. Warranties? Get in Writing.
 - A. Panels. Type and Size
 - B. Inverters: Type
 - C. Installation Labor
2. Permits, Utility and Building Department, and Engineering Included?
3. Installers NABCEP certified ?
(North American Board-Certified Energy Practitioners)
4. Monitoring Included?
5. Do They See Any Potential Shading Issues?
6. Include Squirrel guards, to minimize chance of wire chewing?
7. Is your Electric Panel sufficient for adding solar?
8. Time period from signing contract to installation?

Step 11

Solar United Neighbors is a non-profit organization that can help you find a reputable company.

Once you find the right solar company to install your system
You will be on the way to
“making your own energy!”

WELCOME
To The Solar Community!

