Solar Dividends Starter Kit

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Introduction

Of the many guaranteed basic income programs in the world, almost all of them are temporary pilot programs. For any of these pilot programs to become permanent, they face the daunting task of convincing politicians to commit permanent funding for the program from taxes. But to date, no jurisdiction has been willing to do so.

But instead of paying guaranteed incomes from taxes, organizations can make a one-time investment that can generate basic incomes on an ongoing basis. Any good investment can generate regular dividends, but one of the most reliable investments available to everyone is solar energy. An investment in a community solar array that sells its power to customers can generate regular Solar Dividends.

A Solar Dividends project has two parallel activities, both of which require careful attention:

- Building a solar array to generate revenue.
- Creating an organization to manage the solar array and the revenue.

Can solar energy generate enough money to pay for basic incomes? The answer is yes, under the right conditions. Because solar energy is a local resource, those conditions are also local and must be examined on a case-by-case basis. This document provides some guidance on how to examine your local conditions for Solar Dividends.

The Basic Formula

There is a simple formula for determining how much money a solar array can generate for Solar Dividends. The formula just multiplies five factors together:

Annual Solar Dividend for one person =

Array Size x Solar Capacity Factor x 8760 x Sale Price x Economic Efficiency

Array Size	The rated capacity of solar panels, measured in kilowatts per person.
Solar Capacity Factor	The ratio of actual output to rated capacity; encapsulates array exposure, latitude, average clouds, and night hours. A capacity factor of 0.15 says that a 100 watt solar panel outputs an average of 15 watts, when averaged over 24 hours and 365 days in its location. Typical values are 0.15 to 0.20, with higher values in sunny locations.
8760	The number of hours in a year.
Sale Price	What the utility company pays for Solar Dividend electricity, in dollars per kilowatt- hour.
Economic Efficiency	Economic Efficiency the percentage of the sale price that reaches the recipient after subtracting overhead such as loan repayment, maintenance, and administration.

Your job is to examine the factors in this formula and determine what combination of values will work under your local conditions. Some of the factors you have control over, and some you don't.

The two factors you cannot control:

- The solar resource for your region (expressed through the solar capacity factor).
- The number of hours in a year.

The three factors you can control, at least to some degree:

- The size of the solar array.
- The sale price for your electricity.
- The economic efficiency of the delivery of benefits.

The solar capacity factor can also be affected in these ways:

- The solar array is not facing due south (or due north if you are located in the Southern Hemisphere).
- The array tilt is not optimized for your latitude.
- The array receives shade from hills, buildings or vegetation.
- The system loses energy converting and transporting the electricity.

All of these factors can be accounted for as described in the steps below.

Outline of the steps

1. Determine the capacity factor or your local solar resource.
2. Determine the sale price for the electricity you can sell.
3. Determine how to manage the revenue to maximize basic incomes.
4. Determine a size and location for a solar array.
5. Arrange financing.

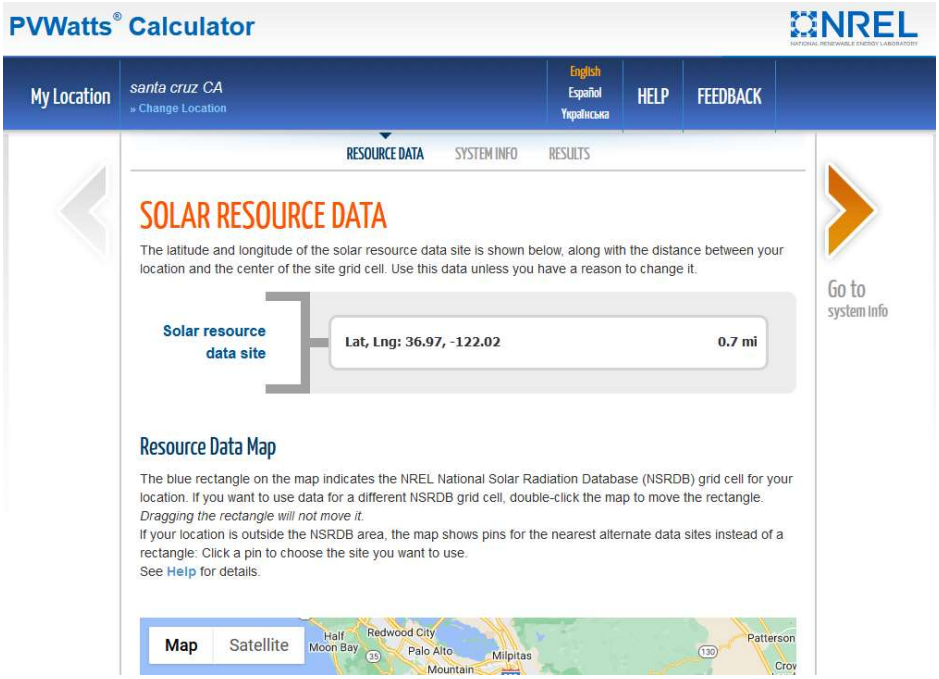
Details of the Steps

Step 1: Determine your local solar resource

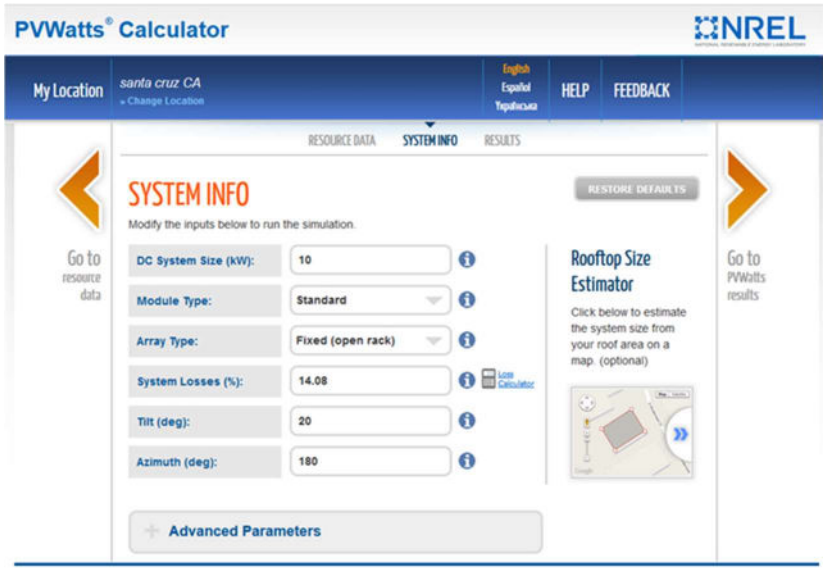
You can use the online PVWatts Calculator to determine your solar resource. The Calculator is run by the US National Renewable Energy Laboratory and can determine the energy output of a solar array anywhere in the US and in many places around the world.

https://pvwatts.nrel.gov/

a. You first enter your location in the Getting Started box and click on Go. The location can be a specific address, or a city if you don't have a specific location yet. That connects you to the history of solar data for your location and shows results like this:



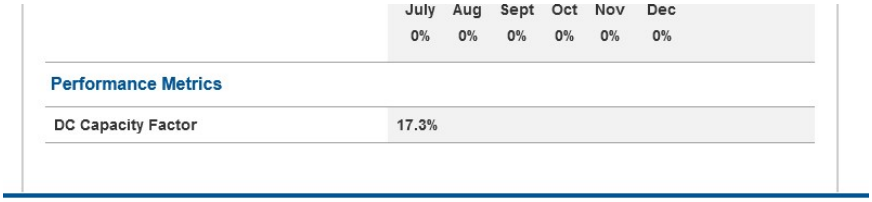
b. Click on "Go to system info" for the next step. That screen looks like this:



c. Enter information about a typical solar array for that location. You can use a sample size of 10 kW to get started, which you can then scale up proportionally as needed. The capacity factor is the same regardless of the size of the system. You can just accept the other system values as default values until you have a specific array in mind.

d. Click on “Go to PVWatts results”.

e. At the bottom of the results page, make a note of the “DC Capacity Factor”. Use this as the initial number in the formula for Solar Dividends. You will refine this value later when you have a specific array location and design.



	July	Aug	Sept	Oct	Nov	Dec
	0%	0%	0%	0%	0%	0%
Performance Metrics						
DC Capacity Factor	17.3%					

Step 2: Determine the sale price of your electricity.

This can be the most difficult factor to determine. The pricing of electricity, called tariffs, is highly variable, and most utility companies have complex pricing tables for different circumstances. Your goal is to maximize the price you get for the power your array produces so as to maximize the basic incomes it supports.

You will need to research the retail rate tables from your local utility. Those will show how the rates vary according to customer type (household, commercial, industrial), time of day, and tiered pricing (low for the first set of kilowatt-hours consumed, higher for consumption beyond that).

Most utility companies make available their tariff structures on their websites. If not, you will need to contact a utility representative to get that information. As a starting point in the US, you can look up the average retail rate for electricity in your state here: https://www.eia.gov/electricity/state/

Utility companies prefer to buy electricity from producers at low wholesale rates and sell the electricity to consumers at higher retail rates. If you can only sell at wholesale rates, you will need a larger array.

The best arrangement would allow you to sell your electricity at closer to retail rates directly to consumers. That can be done through a Power Purchase Agreement, where an electricity consumer contracts to purchase their electricity from you. Here are some resources for learning more about Power Purchase Agreements:

- Wikipedia “Power Purchase Agreement” article. [https://en.wikipedia.org/wiki/Power_purchase_agreement]
- US EPA “Solar Power Purchase Agreements” [https://www.epa.gov/green-power-markets/solar-power-purchase-agreements]

If your location has a municipal utility or an electrical cooperative, then you might be able to arrange better rates than through a commercial utility.

Step 3: Determine how to manage the revenue to maximize basic incomes.

Some kind of organizational entity needs to manage the solar array, receive the money it generates, and the manage the distribution of the money for basic incomes. That entity should have these characteristics:

- **Lasting.** The organization needs to be permanent in order to manage permanent basic income flows.
- **Trusted**. The organization must be managed openly by trustworthy people to avoid fraud and theft or waste of the revenue.
- **Engaged.** The basic income recipients should be able to participate in the organization in order to oversee the management of revenue.

These types of organizations would be suitable:

- A nonprofit.
- A cooperative.
- A local government.

The managing organization will determine the last factor in the Solar Dividends formula: the economic efficiency of the delivery of benefits. That efficiency is measured by the percentage of the incoming solar revenue that actually reaches the basic income recipients. So the following costs have to be managed effectively to maximize this efficiency:

- Organizational management costs (salaries, office expenses, etc.).
- Paying off construction loans for the solar array.
- Any ongoing land lease costs.
- Solar array maintenance costs.
- Maintaining a reserve of funds to buffer bad weather that temporarily cuts solar revenue.

Your goal should be to keep these costs to 10-15% of the solar revenue, so that the economic efficiency can range from 85-90%.

Step 4: Determine the size and location of the solar array.

This step is a balancing act between these factors:

- The targeted number of basic income recipients.
- The targeted monthly basic income amount.
- The available land area.
- Financing.

If you have a specific plot of land in mind, you can determine its area and the size of the solar array it can support. Contact a local solar installer, who can advise you on the potential array size and output. Once you have the array size, you can determine the revenue stream using the information you gathered in steps 1-3, and that will determine how many basic income recipients and their monthly payments.

Starting from the other direction, determine the number of recipients and their monthly payments, and then size a solar array to meet those targets. Once you have the array size, you can look for one or more plots of land to support the array.

You can use the PVWatts calculator again once you have an array size and location in mind. This time you will provide more details about the array size, the orientation, the panel tilt, and estimated shading. Click on the PVWatts HELP button for more information about filling in the necessary information. When you generate the results again, you can see the number of kilowatt-hours generated and the value.

The land area does not have to be solely dedicated to the solar array. Costs can be greatly reduced by employing "dual purpose" methods for solar arrays. The following are some potential sites that would not require purchasing land:

- Parking lots with solar panels mounted on overhead racks.
- Agricultural land combined with solar panels in an "agrivoltaics" operation. For more information on agrivoltaics, see the AgriSolar Clearinghouse https://www.agrisolarclearinghouse.org/
- Highway medians.
- Airport buffer areas.
- Sealed landfill areas.
- Municipal building rooftops.

Each of these would have its own particular jurisdiction and requirements for negotiating access or leasing space for solar panels.

Once you have a location identified, you can measure its area and determine its capacity for solar panels. The layout of panels must take into account the current land use, the lot shape, and spacing between rows to reduce self-shading. This would best be done by a solar contractor, but you can also download this PDF file to use as a guide:

Land-Use Requirements for Solar Power Plants in the United States
https://www.nrel.gov/docs/fy13osti/56290.pdf

Step 5: Arrange financing

Any guaranteed income program has a basic choice to make up front:

a) Use some of the solar revenue to pay off the installation costs.
b) Pay for the solar array installation up front.
c) Pay off the solar construction loan from taxes.

With option a), a loan would be taken out to build the solar array, and some of the revenue generated by selling electricity from the array would be used to pay off the loan over time. This has the advantage of not requiring a large sum of money up front, but it reduces the revenue for guaranteed incomes while the loan is being paid off. Only when the loan period ends can the program maximize the economic efficiency in delivering benefits to its recipients.

The size of the array affects the payback period somewhat. Any solar installation has some fixed costs and some costs that scale with the size of the array. The site and connection requirements will determine the ratio of those two kinds of expenses. For a site with low fixed costs, the revenue will

mostly scale with the number of panels, so the payback period won't be much affected by the size of the array (each panel is paying for itself). For a site with high fixed costs, each panel will have to cover more of the fixed costs, so more panels will be needed to reduce the payback period.

With option b), a lump sum of money for the solar installation would be raised from donations or taxes. By paying off the installation costs up front, the guaranteed income program would not be burdened by loan payments and so could maximize the economic efficiency from the start.

With option c), a local government would take out a construction loan and pay it off over time from tax revenue rather than the solar revenue. If a government was considering using tax money to fund a permanent guaranteed income program, they would have to commit to permanent funding. Instead, they could allocate just a few years of budgeting to pay off the solar loan, and the solar array provides the guaranteed incomes, both during the loan period and long after. This option maximizes the investment of the local government, delivering a permanent guaranteed income program from just a few years of budget allocations.