**Solar Energy Design Project (POE)**

Assignment

Use the Department of Energy “PV-Watts” solar calculator to design a residential solar system for a client, estimate its cost, and then calculate the economic “payback period” on your client’s investment.

(100 points possible)

Step 1: Design the system

* Open the National Renewable Energy Lab (NREL) “PV-Watts” calculator at <https://pvwatts.nrel.gov/>
* Decide where your client lives (it’s up to you… the App will work anywhere in the world). Enter the “home or business address” and hit “GO”. You can just enter the city if that’s all you have.
* To flip pages, use the “Go To” arrows at either side of the display
* Goal: your client needs to generate 8,500-9,000 kWh/year of “AC energy”. In other words, for the design to meet the client’s requirements, the “Results” page of PV-Watts needs to show a total AC energy output of 8,500-9,000 kWh per year. If your client lives in Seattle or London, it will take more solar panels to achieve this energy output (and cost more as a result). If they live in the Southwestern U.S. or North Africa, it will take fewer solar panels (and cost less as a result).
* Start your design on the “System Info” page. You might, for example, start with a value of “6.0 kW” for your DC System Size. Use “Standard” for your module type. Use “Fixed roof mount” for Array Type. The App will automatically calculate “System Losses, Tilt, and Azimuth”. You can open “Advanced Parameters” and play with those values if you like. You can look-up the definition of any of these terms on the App.
* Click on the “Loss calculator” button. Click on “help” and take the time to familiarize yourself with items on the “Losses Breakdown”.
* On the Loss calculator breakdown, enter a reasonable value for “Age (%)”. As a photovoltaic (PV) solar system ages, the output declines by approximately 1%-3% per year. It’s a good idea to enter “10” or “20” in the Age(%) cell to account for this decline. Solar companies will usually guarantee no less than 80% output, so “20” would represent the maximum decline.
* After you are satisfied with all the values entered into the “System Info” portion, advance the arrow to “Go to PV Watts results”. The number shown at the top is your AC energy output in kWh/year. You can also see it broken-down by month.
* Your target AC energy output needs to be 8,500-9,000 kWh/year. Go back to the “System Info” screen and change the “DC System Size” up or down (as the case may be) so that you can achieve an AC energy output in the range of 8,500-9,000 kWh/year.

Step 2: Graph the results and calculate the “payback period”

* Download the results (“Monthly”) on Excel, and graph the monthly AC energy output. Then use Excel to calculate the “payback period” on your client’s investment. Use an installed cost of $3.50/Watt of “DC System Size”. (note this is NOT the same as $3.50/kWh of “AC energy output”). Watch the video on how I did the Excel portion of the assignment…

Step 3: Provide a layout sketch for the client’s “roof”. Check to make sure it will fit!

* Pull-up the Coronado house plans we used in a previous assignment. These plans are posted on the Student Portal.
* Go to sheet A2-2, “Roof Plan”. Sketch a “proposed layout” of the system on the south-facing roof. Verify that it will fit! You will need to refer to other sheets (A2-1 for example) to get the dimensions of the roof.
* Search the Internet for images of “Residential roof mount solar systems” to see how these systems are typically laid-out on a rooftop.
* Assume each panel is approximately 4’ long x 2’ wide, and generates 100 Watts of DC power. In other words, if the client needs a “DC System Size” of 6.0 kW to meet their requirements, then they will need 6,000 ÷ 100 = 60 solar panels…. each having dimensions of 4’ x 2’.

Deliverables

Turn in the following deliverables by the due date:

1. The “Results” page - printed from PV-Watts
2. The Excel graph showing “AC energy output” by month, together with the “payback period” calculation
3. The proposed roof layout sketched onto Sheet A2-2 of the Coronado house plans. You can print that sheet yourself, or you can use the image provided below.

As always, package these in a professional manner with your name and date! (3 pts)

