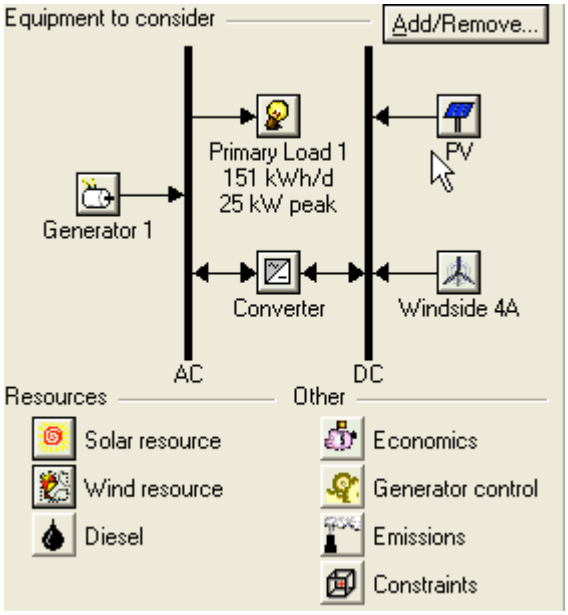
Running on Renewables

Student Handout (Track 1): A Guide to Using the PA Energy File and HOMER

Getting Started:

1. Open the HOMER program on your computer.
2. Select the File Icon to open the PA Energy file. HOMER will open a popup box, go to your desktop and open the PA Energy File.hmr, click Open. HOMER will open the file and create a schematic window as shown below:

From the **Main Window** you will notice the HOMER displays buttons with your components and your load requirements. Also notice in the Resource section displays buttons for your solar, wind and diesel resource. You will also notice that the arrow now connects to the AC load and shows the direction of energy flow.

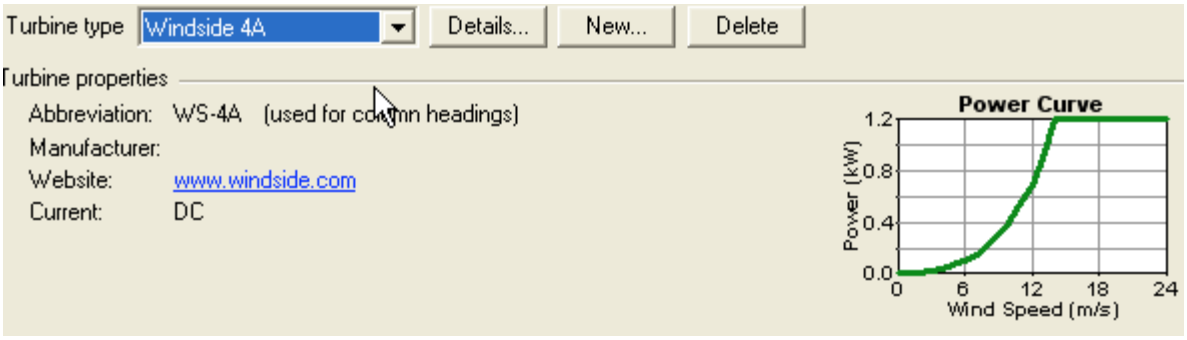


■ Looking at your System's Load

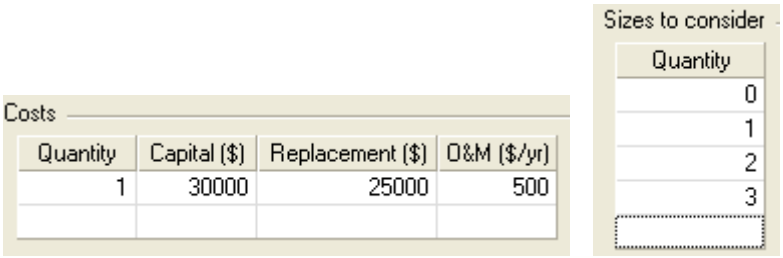
A key piece of information for the model is your school's electricity load—the electricity demand of the system at any one time.

1. Click on the Primary Load 1 Icon
2. You will see that your school uses the most energy from 7:00 a.m. to 4:00 p.m. (Note: Military time is used; i.e., 1:00 p.m. is 13:00)
3. Click "OK", this will close the primary Load Window.
4. Click on the Generator 1 icon to open up the "Generator Inputs" window.
5. You will see that the generator in your school produces 25KW's and cost $10,000.
6. Click "OK" to return to the Main Window.
7. Click on the Wind Turbine icon to open the "Wind Turbine Inputs" window.
8. From the drop down list click through the wind turbines and look at the power curve that is shown on the right side of the screen. Try to find a Wind Turbine that would best maximize your Average Wind Speed (m/s) from your PA city found on your Student Worksheet Track 1 and 2, Question 3 and choose that Turbine.

a. From the example below we can see that the Windside 4A turbine produces 1.2 kW of energy when the Wind speed is at 14m/s. Would this Turbine we a good choice for PA? Probably not since it maximizes its performance at 14m/s.

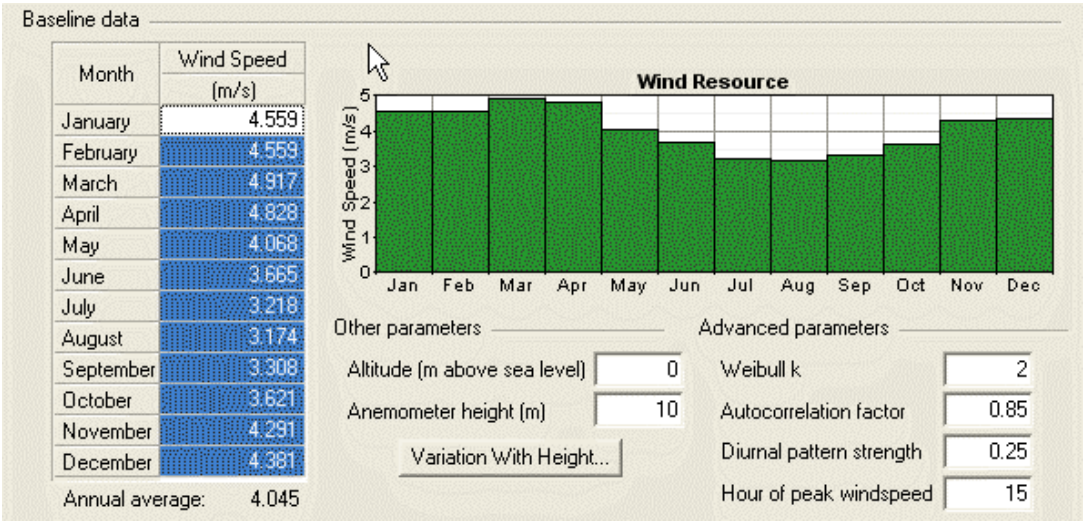


9. After choosing your Wind Turbine input the following values in for the Costs:

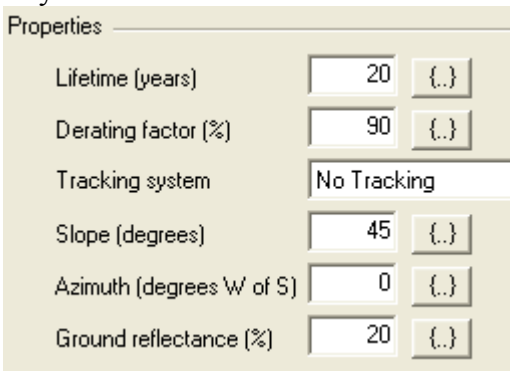


10. Click "OK" to return to the Main Window.
11. Click on the Wind Resource  to open the Wind Resource inputs window.
12. For Data Source choose to enter monthly averages

13. Next, type in your monthly data from your <u>Student Worksheet Tracks 1 and 2 Question 2</u> for Wind Speed (m/s). Please refer to your chart for your cities Wind Speed (m/s). You will also notice that HOMER creates a Wind Resource graph on the right.



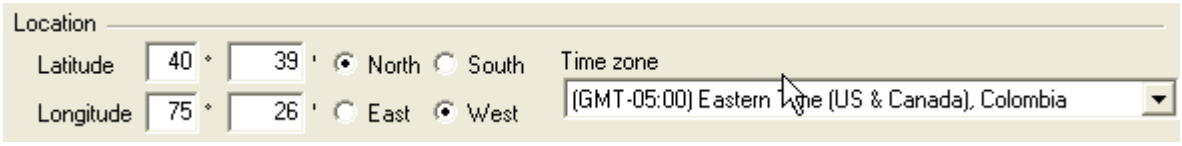
14. Click “OK” to return to the Main window.
15. Click on the Photovoltaic icon  to open up the “Photovoltaic Inputs” window.
16. You will see that your school will be using a 10 KW PV array and the cost for this solar cell is $35,000.
17. Under the Properties for “Slope (degrees)” type in 45, this will simulate the pitch of the roof of your school.



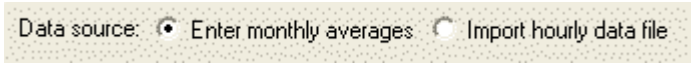
18. Click “OK” to return to the Main Window.
19. Click on the Solar Resource icon  to open the Solar Resource inputs window.

20. Type in your latitude and longitude data from your Student Worksheet Track 1 and 2 Questions 4-5 into HOMER, and choose the Eastern Time Zone, US & Canada from the drop box:

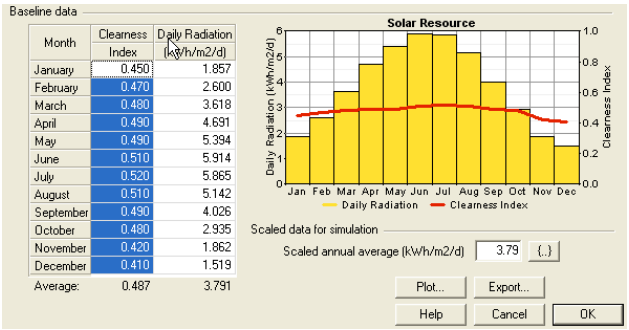
    For example: Allentown has a latitude of 40°, 39 North, and a longitude of 75°, 26 West as shown below.



21. For Data Source select “Enter monthly averages.”



22. Next type in the your data from your Student Worksheet Tracks 1 and 2 Question 6 for Clearness Index (Kt). The Daily Radiation will be automatically calculated by HOMER and you will also notice that HOMER creates a Solar Resource graph on the right.



23. Click “OK” to return to the Main window.

24. Click on the Converter icon  to open up the “Converter Inputs” window.

25. A converter is used to convert DC current to AC current which can be utilized by your school.

26. Your converter is 5 KW's in size and will cost $4000.

27. Click "OK" to return to the Main window.

28. Click on the Diesel icon. 

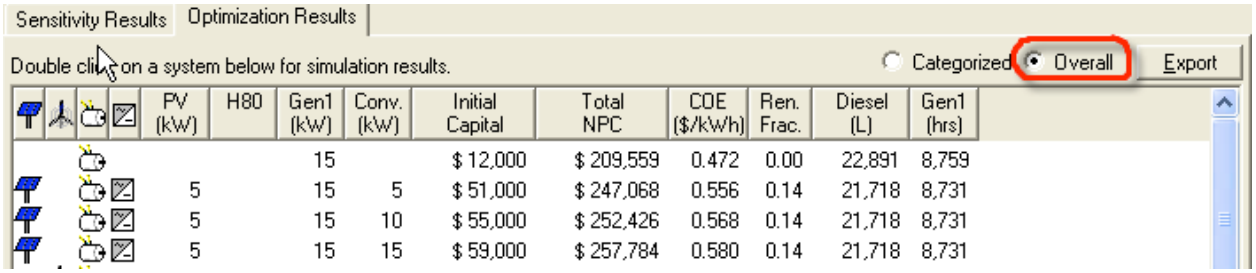
29. Look at the chart below from your Student Worksheet Tracks 1 and 2 Question 7 and change the fuel price to _____ per liter based on the current cost of Diesel per gallon in your town.

30. Click "OK" to return to the Main window.

■ Analyze the System and Examine the Results

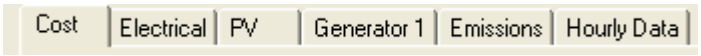
You have just completed setting up HOMER, the software is now ready to calculate and analyze your data to see what is "the best" energy system for your school from least to most expensive. Whether it recommends that your school would benefit from a single solar panel or the installation of a wind turbine….let's sit back and see.

1. Click Calculate  to start the calculation.
2. After the simulation runs click on the "Overall button" to view all possible combinations for each component in the "Optimization Results" window.



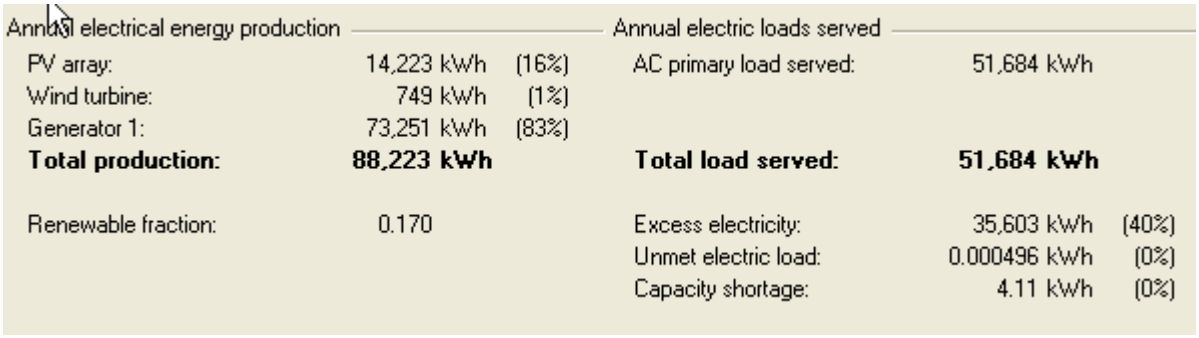
3. Next click on the "Categorized" button in the "Optimization Results" window. This will show you the least expensive option for each different component configuration (e.g., diesel with PV cells, or PV cells with wind turbines).
4. Next choose a system of interest by double-clicking on one of the configurations to open up the "Simulation Results" window, where you can see the complete results of HOMER's analysis.

5. You can explore the results for each of the configurations in the "Categorized" view to determine Cost, Electrical energy production, the efficiency of the generator, and the pollutants created under emissions buy clicking on the different tabs.



6. Double click on a simulation that has all 4 components of the system, a PV cell, a wind turbine a battery and a converter.

7. Next Click on the Electrical Tab…..you should see a window like the one shown below:



8. Notice that this system is relying mostly on the generator for electricity at 83%, next the PV array is 16% and the wind turbine at 1%.

9. Complete the rest of your Student Worksheet Track 1 and 2 from the information calculated by HOMER.