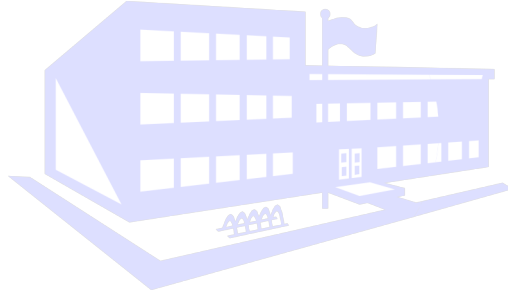


Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Running on Renewables

### Student Worksheet: Tracks 1 & 2



**Mission:** Your school has recently received a “Clean Energy Grant.” The grant will assist your school in the purchase of renewable energy sources such as wind turbines and photovoltaic arrays (solar panels). Your mission is to figure out what renewable energy source/s would best suit your school. You will be using a computer program called HOMER to assist you in simulating the energy needs of your school building. You will then be able to determine what renewable source you would recommend your school to install. To help you complete the mission, you will need to gather some data.

**Directions:** Please fill in the blanks below and save this data for entering into your Student Handout: Track 1 or Track 2 after you have completed questions 1-9.

1. What Pennsylvania City is closest to your hometown in Table 1 (see page 4 of this worksheet): \_\_\_\_\_
2. Please fill in the chart below with your cities Wind Speed(m/s) from Table 1 (see page 4).

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec

3. Using a calculator, find the **Average Wind Speed** (m/s) from your chart: \_\_\_\_\_

Now take a look at Table 2: Latitude and Longitude Coordinates for Pennsylvania Cities (see page 4 of this worksheet) to answer questions 4 and 5.

4. What is the Latitude coordinate for your city? \_\_\_\_\_°, \_\_\_\_\_ North
  5. What is the Longitude coordinate for your city? \_\_\_\_\_°, \_\_\_\_\_ West
- After entering in your city’s location HOMER can determine the amount of electricity produced by a Photovoltaic (PV cell) by calculating the average daily solar radiation that hits the PV cells using the latitude and longitude data.

Now let’s take a look at Table 3: Clearness Index (Kt) for Pennsylvania Cities (see page 4 of this worksheet) to answer question 6. The Clearness Index is a measure of the clearness of the atmosphere.

6. Please fill in the chart below with your city’s **Clearness Index** from Table 3 (see page 4).

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec

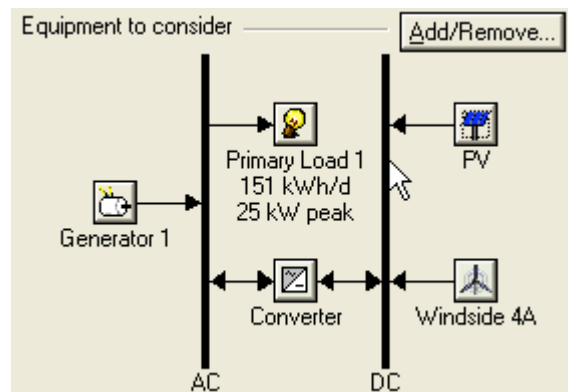
**Directions:** Complete the following questions and save the data for entering into your Student Handout: Track 2.

Let's take a look at the fuel chart converting cost per liter and cost per gallon.

Fuel Cost \$ Liter	Fuel Cost Per Gallon
\$0.30 Liter	\$1.14
\$0.40 Liter	\$1.52
\$0.50 Liter	\$1.90
\$0.60 Liter	\$2.27
\$0.70 Liter	\$2.65
\$0.80 Liter	\$3.03
\$0.90 Liter	\$3.40

- From the chart above convert cost of fuel per gallon in the city where you live to Fuel Cost \$ Liter. You can check the prices at the local gas station or search on the internet for current gas prices. \$0.\_\_\_\_\_ Liter
- How might an increase in the cost of Diesel fuel effect the budget of your school? (Please write your answer below.)

- In looking at the schematic to the right, please write a brief explanation of the way the energy is flowing in the system in the space below. (Note: Arrows show the energy flow direction.)





**Table 1. Wind Speed in Meter Per Second (m/s) for Pennsylvania Cities**

Table 1. Wind Speed (m/s) Data for Pennsylvania								
Month	Allentown	Bradford	Erie	Harrisburg	Philadelphia	Pittsburgh	Wilkes-Barre	Williamsport
Jan	4.56	4.43	6.12	3.75	4.60	4.74	3.93	4.02
Feb	4.56	4.11	5.50	3.75	4.78	4.51	3.89	3.89
Mar	4.92	4.25	5.63	4.11	5.01	4.69	4.20	4.11
April	4.83	4.11	5.32	4.07	4.83	4.51	4.20	4.20
May	4.07	3.53	4.78	3.31	4.29	3.89	3.75	3.53
June	3.67	3.08	4.51	3.04	3.89	3.49	3.53	3.17
July	3.22	2.64	4.25	2.82	3.58	3.17	3.22	2.82
Aug	3.17	2.59	4.25	2.64	3.58	2.99	3.13	2.73
Sept	3.31	2.86	4.56	2.68	3.75	3.17	3.26	2.77
Oct	3.62	3.40	5.23	2.99	3.89	3.62	3.49	3.04
Nov	4.29	4.11	6.08	3.53	4.34	4.25	3.84	3.67
Dec	4.38	4.29	6.21	3.58	4.47	4.56	3.93	3.89

Source: [http://rredc.nrel.gov/solar/old\\_data/nsrdb/bluebook/state.html](http://rredc.nrel.gov/solar/old_data/nsrdb/bluebook/state.html)

**Table 2: Latitude and Longitude Coordinates for Pennsylvania Cities**

Pennsylvania City	Latitude	Longitude
ALLENTOWN	40°, 39 N	75°, 26 W
BRADFORD	41°, 48 N	78°, 38 W
ERIE	42°, 5 N	80°, 11 W
HARRISBURG	40°, 13 N	76°, 51 W
PHILADELPHIA	39°, 53 N	75°, 15 W
PITTSBURGH	40°, 30 N	80°, 13 W
WILKES-BARRE	41°, 20 N	75°, 44 W
WILLIAMSPORT	41°, 16 N	77°, 3 W

Source: <http://www.i4at.org/lib2/solarrad.htm>

**Table 3: Clearness Index (Kt) by Month of Pennsylvania Cities**

Month	Allentown	Bradford	Erie	Harrisburg	Philadelphia	Pittsburgh	Wilkes-Barre	Williamsport
Jan	0.45	0.44	0.4	0.46	0.45	0.41	0.43	0.43
Feb	0.47	0.48	0.44	0.48	0.48	0.44	0.46	0.46
Mar	0.48	0.48	0.45	0.48	0.49	0.45	0.47	0.47
April	0.49	0.48	0.48	0.49	0.49	0.47	0.48	0.48
May	0.49	0.49	0.51	0.5	0.5	0.49	0.49	0.49
June	0.51	0.51	0.54	0.52	0.52	0.52	0.51	0.51
July	0.52	0.51	0.55	0.52	0.53	0.52	0.52	0.52
Aug	0.51	0.5	0.52	0.51	0.53	0.51	0.51	0.5
Sept	0.49	0.47	0.49	0.5	0.51	0.5	0.48	0.48
Oct	0.48	0.45	0.44	0.49	0.49	0.47	0.46	0.45
Nov	0.42	0.38	0.36	0.43	0.45	0.39	0.39	0.39
Dec	0.41	0.39	0.36	0.42	0.43	0.37	0.38	0.39

Source: [http://rredc.nrel.gov/solar/old\\_data/nsrdb/bluebook/state.html](http://rredc.nrel.gov/solar/old_data/nsrdb/bluebook/state.html)