Objective: The objective of this experiment is to help the individual become aware of one's own energy use and to give that person some idea of the cost of the energy used.

Theory: The basic working recipe that we shall be using is as follows:

\[ \text{Energy (in KWH)} = \text{Power (in KW)} \times \text{time (in H)} \]

(Note: This is an extremely abbreviated theory. Remember in your laboratory write-up to include all definitions, all equations used, etc. in a flowing, logical development. Specifically, to show where the above recipe comes from, one can start with the definition of “power” and then solve for “energy.”)

Procedure: Most electrical appliances come with a label that lists the power that the device uses. If you cannot find this label, a “default” list which gives the power of various appliances is attached. One can then determine the energy used (in KWH) for various tasks done during the day. Let us, therefore, set aside one day (24.0 H) whereby we keep track of all energy usage (and appropriate times) in the form of an "Energy Diary". Keep track of anything that you do that uses energy: clocks, lights, transportation, hot water usage, television, hair dryer, stereo, telephone, etc. and keep track of the times (for example, how long you watched TV or how long the lights were on). (Note: In your write-up, be sure to also mention how you measured the number of gallons of water usage and also how you measured the number of miles for transportation.)

Sample Calculation: If you watch a 200 W solid state, color TV for 2.0 H (precision to the nearest 6 min), your energy usage is:

\[ \text{Energy Usage} = (0.200 \text{ KW}) \times (2.0 \text{ H}) = 0.40 \text{ KWH} \]

and the Cost of that energy usage (at XCEL's \$0.0900 / KWH):

\[ \text{Cost} = (\$0.0900 / \text{KWH}) \times 0.40 \text{ KWH} = \$0.036 \text{ (or 3.6 cents)} \]

(Note: In you write-up, be sure to include a sample calculation not only for a KWH calculation but also for energy used for gallons of water and also how you measured the number of miles for transportation.)

Data: **Date of Experiment:**

**For Electrical Energy Usage:**

<table>
<thead>
<tr>
<th>Task</th>
<th>Power (KW)</th>
<th>Time Expended (H)</th>
<th>Energy Used (KWH)</th>
<th>Cost ($)</th>
</tr>
</thead>
</table>

**For Water Usage:**

<table>
<thead>
<tr>
<th>Task</th>
<th>(KWH/gal)</th>
<th>Gallons Used</th>
<th>Energy Used (KWH)</th>
<th>Cost ($)</th>
</tr>
</thead>
</table>

**For Transportation:**

<table>
<thead>
<tr>
<th>Task</th>
<th>(KWH/mi)</th>
<th>Miles Traveled</th>
<th>Energy Used (KWH)</th>
<th>Cost ($)</th>
</tr>
</thead>
</table>

Additional Information on Energy Usage

Transportation: Automobile - medium size 1.9 KWH/mi
small size 0.96 KWH/mi
City Bus - 0.66 KWH/mi
Motorcycle - 0.62 KWH/mi
Snowmobile - 1.00 KWH/mi

Telephone, iPods, Cell Phones - 40 W (You can either include only the time that you use your phone or just include the time required to charge your phone for the day.)

Cold water usage - 0.010 KWH/gallon
Hot water usage - 0.050 KWH/gallon
Daily Estimate: **Add** to your data an additional 10 KWH for the day to keep the water hot for you.

**Add** to your data 65 KWH as your share of energy supplied to industry (to keep the industries of America going and as your energy cost of clothes, buildings, pencil, paper, etc.).

**Add** to your data 7 KWH as your cost of producing the food for your body for the day. (You might want to adjust this if you eat a lot or vice versa.)

**Add** to your data 30 KWH to keep the grocery stores, movie theaters, shopping centers, filling stations, churches, schools, bars, and other commercial establishments open.

**Add** to your data 40 KWH as your share of the heat for your dwelling place(s). (People at Sorin or other residence halls who open windows to regulate their heat should use 60 KWH.) (You also may wish to adjust this depending on your conservation habits.)

Please note: When trying to obtain wattage from various labels that you are using, the following "recipe" may prove helpful: \[ \text{Power (in W)} = \text{Voltage (in volts)} \times \text{Current (in Amps)}. \]

**Results:**
1) State the total number of gallons of water you used on your energy day.
2) State the total number of miles traveled by you on your energy day.
3) Add ALL KWHs to get your TOTAL ENERGY USAGE for your energy day.
4) Find your total energy cost in $.
5) Other questions (to include in your results):
   a) If 1.000 KWH = 3413 BTU, how many BTU's have you used?
   b) If 1.000 cubic ft of natural gas = 1032 BTU, how many cubic ft of natural gas (equivalent) have you used?
   c) If 1.000 lb coal = 11,000 BTU, how many lbs of coal (equivalent) have you used?

Please write up this lab in accord with the Laboratory Write-Up Procedure listed in Lab 2 "Power" Lab.

The following chart that lists the average wattage of various appliances may prove helpful; please use if necessary. This chart is from a late 70s reference, but the wattages are similar. The internet may also prove helpful in order to obtain wattages for various appliances. Please assume that the wattage is listed with a precision to the nearest watt. (Good luck & enjoy!)