

AI Design Contest – Activity 2: Measuring Home Device Operations

Team Name:

Team Member Names:

Purpose:

- Team will select 8 electric appliances/devices found in their homes and use the provided power measurement device to collect power consumption data from those appliances manually.
- Team will approximate the “on”/“off” power schedule of each appliance over a 24-hr period and record each appliance’s power consumption at different time points during the “on” and “off” states.
- Teams will plot their recorded data to create three multiple-line graphs displaying individual appliance contributions to the total power consumption over a 24-hr period.
- Teams will apply the relationship between power and energy to calculate the total energy consumed by each appliance over a 24-hr period.
- Teams will discuss key features of their visually represented data.
- **Teams should use this activity to learn how the measured power usage and “on”/“off” power schedules of individual household appliances contribute to the total energy consumption of their home.**

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Part 1: Inventory of Devices/Appliances Found in Your Home:

As you think about power usage in your home, imagine the electronic devices you have in each room, like TVs, toasters, or computers. Consider how some, like a toaster, are only active for 15 minutes before breakfast. Meanwhile, others, like night lights, remain on overnight for more than 8 hours while you sleep.

Instructions: Your team will identify 8 devices in total around your homes. Choose 4 devices that are usually used for a short amount of time (up to 1 hour) and 4 devices that are usually used for a long amount of time (4 hours or more). **Each team member should provide at least 1 device for each type. For teams of three, each member will do 1-2 devices.** Write them down in Table 2.1 below.

Device Number	Device Type	Device Name
1	Short-Term Device (up to 1 hour)	
2	Short-Term Device (up to 1 hour)	
3	Short-Term Device (up to 1 hour)	
4	Short-Term Device (up to 1 hour)	
5	Long-Term Device (4 hours or more)	
6	Long-Term Device (4 hours or more)	
7	Long-Term Device (4 hours or more)	
8	Long-Term Device (4 hours or more)	

Some devices use more power and consume more energy than others. One way to save energy is to unplug devices when they are not in use, but sometimes, you might leave devices plugged in even when they are off.

Instructions: Using the list below, rank your devices from 1-8 based on which you think consume the most energy. 1 is the device that you think consumes the most energy. 8 is the device that you think consumes the least energy.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

Instructions: Justify why your team thinks certain devices consume more or less energy than others. Write two or more sentences for your answer in the space below.

Write here:

Part 2: Measuring and Recording Device Power Schedules

Your team received a [Digital Power Monitor](#) from your teacher to collect data on the 8 devices you chose in the table above.

Instructions: Now, you will measure the power usage of your 8 devices and record your data to create a 24-hr home device power schedule.

In Table 2.2 below, “Dev 1” - “Dev 4” represent the 4 Short-Term devices and “Dev 5” - “Dev 8” represent the 4 Long-Term. [Watch this video](#), to use your digital power monitor to measure your home devices and follow the instructions below to record your data in Table 2.2.

WE ARE NOT MEASURING DEVICES FOR 24 HOURS. WE ARE COLLECTING 2 DATA POINTS PER DEVICE (“ON” AND “OFF”) TO MAKE AN ESTIMATED 24-HOUR POWER SCHEDULE.

Measuring Power Usage

1. Find the home device you want to measure.
2. If it is plugged in, turn it off and unplug it from the wall outlet.
3. Plug the power monitor into the wall outlet. If the outlet is hard to reach, you may need to ask your parent or guardian for help.
4. Use the first mode of the power monitor (W).
 - a. You will see a timer at the top, the device’s wattage value in the middle with a “W” under it, and a cost number at the bottom.
5. Now, plug your device into the outlet on the power monitor.
6. Measure the wattage values of your device while your device is turned “on” and “off” and proceed to step 7.
 - a. We want to measure power usage when devices are off because sometimes devices consume energy even while they are not in use.



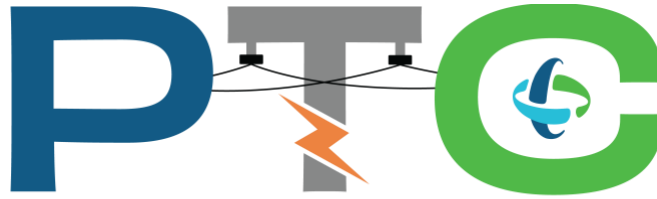
Recording your Data

Follow steps 7-9 to record your data in Table 2.2 on the following page.

WE ARE NOT MEASURING DEVICES FOR 24 HOURS. WE ARE COLLECTING 2 DATA POINTS PER DEVICE (“ON” AND “OFF”) TO MAKE AN ESTIMATED 24-HOUR POWER SCHEDULE.

NOTE: “Start” and “End” values represent the beginning and end of a 1-hr time slot in a 24-hour day. Hours 0 - 11 hr correspond to 12:00am -11:00am. Hours 12 – 23 correspond to 12:00pm - 11:00pm.

7. In **each empty cell** of the table, you will enter either the “on” or “off” wattage value of each device.
 - a. If your device is not plugged in during a time slot, enter “0” into that cell.
 - b. Estimate when you think a device is “on” or “off” during each time slot.
 - i. For example, if you measure a washer machine, estimate what times your family does the laundry and how long it takes. If you measure a lamp, try to approximate what times and how many hours the lamp is turned on in a 24-hour period.
 - c. If the measured wattage of your device changes, record the highest value you measured.
 - d. Round your time slots to the nearest whole hour.
 - e. See “Dev 0” for an example of how you might fill out a column in your table.



Powering the Community

Part 3: Graphing Your Home Device Power Schedule

Now you will use your power-vs.-time data to create graphs in Microsoft Excel to visualize trends and compare the power usage of your different home devices.

Instructions: In the “Activity 2” folder under “Files”, open the Excel file called “PTC_24_MS_2_Graphing Power Schedules.xlsx”. Follow the steps below, or [watch this video](#), to transfer and graph your power schedule.

Graphing All Devices

1. Select “(1) All Devices” tab at the bottom of the Excel spreadsheet to start.
 - a. There are 4 tabs: (1) All Devices, (2) Short-Term Devices, (3) Long-Term Devices, and (4) New Power Schedule. **We will only use (1), (2), and (3) in Activity 2.**
2. Scroll up to your 24-hr Power Schedule for Home Devices (Table 2.2) in this Activity Document.
3. **Click and drag to select** all of the data points for Dev 1 through Dev 8.

Start (hr)	End (hr)	Dev 1 (W)	Dev 2 (W)	Dev 3 (W)	Dev 4 (W)	Dev 5 (W)	Dev 6 (W)	Dev 7 (W)	Dev 8 (W)	Dev 0 (W)
0	1	10	25	0	0	0	15	0	0	0
1	2	10	25	0	0	5	15	0	0	0
2	3	10	25	0	0	5	0	0	0	0
3	4	10	0	0	20	5	0	0	0	20
4	5	10	0	0	20	5	15	0	0	20
5	6	10	0	0	0	5	15	0	0	20
6	7	10	0	0	0	5	0	0	0	0
7	8	10	0	0	0	5	0	0	0	0
8	9	0	0	15	0	0	15	0	0	0
9	10	0	0	15	20	0	15	0	30	10
10	11	0	0	15	0	0	0	0	30	10
11	12	0	0	15	0	0	0	0	30	0
12	13	0	25	0	0	0	15	0	30	20
13	14	0	25	0	0	0	15	0	30	20
14	15	0	25	0	0	0	0	0	30	20
15	16	10	0	0	0	5	0	0	30	0
16	17	10	0	0	20	5	15	0	30	0
17	18	10	0	0	20	5	15	0	0	0
18	19	10	0	0	20	5	0	20	0	0
19	20	10	0	0	0	5	0	20	0	30
20	21	10	0	0	0	5	15	20	0	30
21	22	10	0	0	0	0	15	20	0	30
22	23	10	0	0	20	0	0	20	0	30
23	0	10	0	0	20	0	0	20	0	30

4. **Right-click** anywhere within the highlighted section and select “Copy”.

...k at 2:45pm, it says “...
... it down for the time

Dev 3 (W)	Dev 4 (W)	Dev 5 (W)
0	0	0
0	0	5
0	0	5
0	20	5
0	20	5

10. **Copy your “(1) All Devices” graph from Excel into your activity document.**

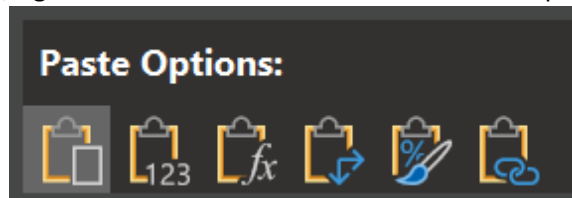
NOTE: The graph to the right of the table automatically updates as you enter your data. Right-click this graph and select “Copy”. Paste the graph in the space below:

Graphing Short-Term and Long-Term Devices

1. While in the “(1) All Devices” tab, click and drag to highlight all of the data for the short-term devices (Dev 1-4): Cell C3 (top left corner) through Cell F27 (bottom right corner). Right-click anywhere within the highlighted section and select “Copy”.

Dev 1 (W)	Dev 2 (W)	Dev 3 (W)	Dev 4 (W)	Total (W)
10	25	0	0	
10	25	0	0	
10	25	0	0	
10	0	0	20	
10	0	0	20	
10	0	0	0	
10	0	0	0	
10	0	0	0	
0	0	15	0	
0	0	15	20	
0	0	15	0	
0	0	15	0	
0	25	0	0	
0	25	0	0	
10	0	0	0	
10	0	0	20	
10	0	0	20	
10	0	0	20	
10	0	0	0	
10	0	0	0	
10	0	0	0	
10	0	0	20	
10	0	0	20	
170	150	60	160	

2. Now, Click on the “(2) Short-Term Devices” tab.
3. Left-click to select Cell C3 (The cell is highlighted in GOLD).
4. While your cursor is in Cell C3, right-click and select “Paste” under “Paste Options”.



5. **Calculating the Total Power Usage for Short-Term Devices** - The table is set up to calculate the total power usage of short-term devices during each time slot (row); this is displayed in Column G (Total (W)).
 - a. If your table is not auto-populating, please adapt the directions from above in “calculating all devices” (8.a.i) to cells C3:F3 and (8.a.ii) to cells G3:G26.
6. **Calculating the 24-Hour Energy Consumption for Short Term Devices** - The table is also set up to calculate the total energy consumption of each short term device (column) over 24 hours; this is displayed in Row 27 (Total (W h)).
 - a. If your table is not auto-populating, please follow the directions from above in “calculating all devices” for (9.a.i) and adapt (9.a.ii) to cells C27-G27.
7. **REPEAT STEPS 1-6 for Long-Term Devices** in the “(3) Long-Term Devices” tab.

8. Copy your “(2) Short-Term Devices” graph from Excel into your activity document.

NOTE: The graph to the right of the table automatically updates as you enter your data. Right-click this graph and select “Copy”. Paste the graph in the space below:

9. Copy your “(3) Long-Term Devices” graph from Excel into your activity document.

NOTE: The graph to the right of the table automatically updates as you enter your data. Right-click this graph and select “Copy”. Paste the graph in the space below:

Part 4: Analyzing Total Energy Consumption

In your Excel spreadsheets, you calculated how much energy each device consumed in 24 hours. When discussing how to conserve energy in your home, it is important to consider how your home devices consume different proportions of your home's energy.

Instructions:

1. Look at the values for each home device in row 27 of your table in "(1) All Devices." Enter the values into the "Device Energy Consumption" column in Table 2.3 below.
2. Enter the "Total" Energy Consumption for all devices (Cell K27) for each row in "Home Total Energy Consumption (W h)" in Table 2.3.
3. Calculate the percentage of energy used by each device and enter that value into the final column, "Percentage of Energy Used."
 - a. $(\text{Device Energy Consumption} / \text{Home Total Energy Consumption}) * 100\% = \text{Percentage of Energy Used}$. Example: $(35 / 150) * 100\% = 23.3\%$

Device Number	Device Energy Consumption (W h)	Home Total Energy Consumption (W h)	Percentage of Energy Used (%)
1			
2			
3			
4			
5			
6			
7			
8			
Example	35	150	23.3

Instructions: At the beginning of this activity, you ranked your home devices based on which you thought consumed the most energy. Explain how your beginning guesses were similar to or different from the data you calculated in **Table 2.4**. Write at least two sentences for your answer in the space below.

Part 5: Main Takeaways

Instructions: In the space below, write a 1-3 paragraph summary of your main takeaways from this activity. How can what you learned from your home device data be used to improve energy efficiency in your home?

Part 6: Submit this Activity

- Meet with your team's mentor to check your work and make changes as needed.
- Save this document as a PDF with the title **Activity_2_[Team Name].pdf** and then have your **quality engineer** submit your PDF here:

https://ufl.qualtrics.com/jfe/form/SV_0020ZwvCFoQoZj8