Kill A Watt Activity

Kill A Watt® Monitor Instructions

Kill A Watt® Monitor

The Kill A Watt® monitor allows users to measure and monitor the power consumption of any standard electrical device. You can obtain instantaneous readings of voltage (volts), current (amps), line frequency (Hz), and electric power being used (watts). You can also obtain the actual amount of power consumed in kilowatt-hours (kWh) by any electrical device over a period of time from 1 minute to 9,999 hours. One kilowatt equals 1,000 watts.

Operating Instructions

1. Plug the Kill A Watt® monitor into any standard grounded outlet or extension cord.
2. Plug the electrical device or appliance to be tested into the AC Power Outlet Receptacle of the Kill A Watt® monitor.
3. The LCD displays all monitor readings. The unit will begin to accumulate data and powered duration time as soon as the power is applied.
4. Press the Volt button to display the voltage (volts) reading.
5. Press the Amp button to display the current (amps) reading.
6. The Watt and VA button is a toggle function key. Press the button once to display the Watt reading; press the button again to display the VA (volts x amps) reading. The Watt reading, not the VA reading, is the value used to calculate kWh consumption.
7. The Hz and PF button is a toggle function key. Press the button once to display the Frequency (Hz) reading; press the button again to display the power factor (PF) reading.
8. The KWH and Hour button is a toggle function key. Press the button once to display the cumulative energy consumption; press the button again to display the cumulative time elapsed since power was applied.

What is Power Factor (PF)?

We often use the formula **Volts x Amps = Watts** to find the energy consumption of a device. Many AC devices, however, such as motors and magnetic ballasts, do not use all of the power provided to them. The power factor (PF) has a value equal to or less than one, and is used to account for this phenomenon. To determine the actual power consumed by a device, the following formula is used:

Volts x Amps x PF = Watts Consumed

Kill A Watt® Investigation 1

Utility companies measure power consumption in kilowatt-hours (kWh). One 100-watt light bulb consumes 1 kWh (or 1,000 Wh) of electricity in ten hours. If the bulb is turned on an average of 80 hours a month, it consumes 8.0 kWh/month. To determine annual cost, multiply the kWh per month by the number of months used per year by the cost per kWh:

kWh/month x month/year x cost/kWh = annual cost

The average cost of a kWh of electricity for residential consumers is $0.127 (8 kWh/month x 12 months/year x $0.127/kWh = $12.19/year). The average cost of a kWh of electricity for commercial consumers such as schools is $0.11 (8 kWh/month x 9 months/year x $0.11/kWh = $7.92/year).

✪ Objective

Students will determine how much power selected electrical devices use per year.

✔ Procedure

1. Select several different electrical devices in the school and estimate the number of hours they are in use per week. Record your estimates in the table below.
2. Multiply the number of hours each device is used per week by the number of weeks it is used per year. For example, an item used year-round would require multiplying by 52, or the number of weeks in a year. Items only used during the school year or during specific seasons may be used less and would require multiplying by a different factor. A school year is typically around 40 weeks. Multiply and record this number in the table.
3. Use the Kill A Watt® monitor to measure the watts used by each device and record it in the table.
4. Divide the number of watts measured by 1,000 to convert watts into kilowatts.
5. Multiply the hours used per year by the number of kilowatts used. Multiply this number by the cost of a kWh to determine the annual cost of operating the device. Record your answer in the table.

Data

Record your measurements and calculations in the table below.

ELECTRICAL DEVICE	HOURS PER WEEK	HOURS PER YEAR	WATTS MEASURED (W)	KILOWATTS (kW)	RATE ($/kWh)	ANNUAL COST
Laptop	*15*	*600*	*20*	*.02*	*$0.11*	*$1.32*

⁂ Conclusion

- Which electrical device uses the most power?
- Which electrical device uses the least power?
- Which electrical device costs the most to operate each year?
- Which electrical device costs the least to operate each year?

Kill A Watt® Investigation 2

Some electrical devices appear to use more power when they are in active mode than when they are in idle mode. These devices include pencil sharpeners, copiers and printers, clock radios, and others. In addition, some devices such as fans appear to use more power at high speeds than at low speeds.

The Kill A Watt® monitor can be used to measure the power consumption of these electrical devices to determine the difference in consumption when these devices are operating in different modes.

✪ Objective

Students will determine if electrical devices use different amounts of power when they are in different modes or operated at different speeds.

✔ Procedure

1. Select several electrical devices that might consume power at different rates while active and idle or while operating at different speeds. Estimate the average number of hours per week each device is in active use and the average number of hours per week the device is turned on, but idle, by interviewing users. Estimate the values with devices that can operate at different speeds. Record your estimates in the table below.
2. Multiply these values by the number of weeks it is in use per year. Multiply by 52 (total weeks in a year) or 40 (40-week school year) to calculate the average yearly amount of time each device is in use in each mode. Record these values in the table below.
3. Use the Kill A Watt™ monitor to measure the watts used in different modes of operation and record in the table below.
4. Divide the number of watts measured by 1,000 to convert watts into kilowatts.
5. Multiply the hours used per year by the number of kilowatts used. Multiply this number by the cost of a kWh to determine the annual cost of operating the device in each mode. Record your answer in the table.

▦ Data

Record your measurements and calculations in the table below.

ELECTRICAL DEVICE	HOURS PER WEEK	HOURS PER YEAR	WATTS MEASURED (W)	KILOWATTS (kW)	RATE ($/kWh)	ANNUAL COST
Copier (idle)	*36*	*1,440*	*20*	*.02*	*$0.11*	*$3.17*
Copier (active)	*4*	*160*	*1,200*	*1.2*	*$0.11*	*$21.12*

⁂ Conclusion

- Do some devices use more power when they are active than when they are idle?
- Do some devices use more power on high speed than on low speed?

Note: Because some electrical devices cycle on and off without our control, the most accurate way to determine actual power consumption is to use the Kill A Watt® monitor to measure consumption over a 12–24 hour period. Refrigerators, for instance, cycle on and off in response to internal temperature sensors.