Worksheet 3.2
Calculating Your Basic Energy Needs

The first step in building a solar generator is determining how much energy it will need to provide. This worksheet will take you step by step in calculating the energy load of the equipment you plan to power.

Equipment	# of Units	Volts*	Amps*	Watts	# Hours/ Day**	# Hours/ Night**	kWh/day	kWh/night
Total:								

**Note: you do not need to fill out the "Amps" and "Volts" column if you know the appliance's wattage.*
***Note: You may want to start with the assumption that daytime hours are from 7:00AM-7:00 PM and nighttime hours are from 7:00 PM - 7:00 AM. This is a baseline to help allocate hours for appliances.*

Step 1: Planning

List all appliances in the worksheet under the “Equipment” column and how many of each you plan to power with your generator in the “# of Units” column. *Note: If you are going to be powering something many times throughout the day, like a phone charger, you may want to put the number of times it’s used under “# of Units”.*

Step 2: Calculating Power Per Appliance

Determine the Power / Wattage required by each appliance. This can be done in two different ways:

1. Recommended: Research each appliance and record the wattage in the “Watts” column. It may be listed on the box the appliance came in or under “specifications” online.

   It is best to use the specific power requirements of the appliance you are planning on using. Otherwise, use the chart below or online resources to estimate.

2. Alternative: if you cannot find the wattage, calculate it yourself:
   a. Volts measure the electrical “pressure”. Find the voltage of your appliance(s) and list this in the “Volts” column.
   b. Amps measure the electrical current, or the flow of electricity. Find the amperage of your appliance(s) and list this in the “Amps” column.
   c. Calculate the Watts of each appliance by multiplying the Volts by the Amps and list it in the “Watts” column

$$Watts = (Volts) * (Amps)$$

WATTAGE OF COMMON APPLIANCES

Appliance	Watts
AC Unit (Window)	900-3250
Box Fan	25-90
Cell Phone Charger	6
Chest Freezer	350
Coffee Machine	600-1200
Computer (Laptop)	65
Computer (Desktop)	200
Electric Blanket	200-400
Electric Kettle	1200
LED Lightbulb (40 Watt equivalent)	10
LED Lightbulb (60 watt equivalent)	13
LED Lightbulb (75 watt equivalent)	18
LED Lightbulb (100 watt equivalent)	23
LED String Lights	1-11
Microwave	600-1200

Appliance	Watts
Power Tool Battery	100-200
Radio	100
Refrigerator/Freezer (Standard)	300-700
Refrigerator (Commercial)	400-650
Space Heater	1500
Speaker (Small Portable)	15-30
Speaker (Large Portable)	120-1300
Table Saw	1100-1800
Toaster	850-1500
Toaster Oven	1200-1400
TV (LCD)	150
Water Heater	4500
Water Pump (1 HP)	1900
Water Pump (2 HP)	2500
Wifi Router	7

Step 3: Estimating Hours of Usage

Estimate hours per day (or night) each appliance uses power. This can be tricky as some appliances, like refrigerators, can be plugged in at all times while only turning on for portions of the day. This information is called the "load profile" for the appliance.

1. For appliances that use power at all times they are "on", estimate the amount of time per day it will be plugged in and turned on.
   [Note: appliances that are plugged in can still use small amounts of power called a "vampire load". Some appliances take a considerable amount of power even while turned "off". Consider committing to unplugging unused appliances or taking this into account in your calculations.]

2. Some appliances (usually containing a compressor) regulate themselves by turning on and off while plugged in.
   Research online or refer to the chart below for estimates on how often the appliances are "on". Multiply this fraction by the number of hours this appliance will be plugged in.

Appliance	Fraction of Time "ON"
Refrigerator	1/3
Chest Freezer	1/3
Water Heater (Tankless)	1/12
Water Heater (Standby)	1/6
Water Pump	1/12
Phone Charger	1/8

Step 4: Calculating Appliance Daily or Nightly Energy Use

Calculate the average kilowatt hours per day (or night) used by each type of appliance by multiplying the number of units, the watts, and the number of hours the appliance is operating. Divide this number by 1000 to get kilowatt hours per day. All of these columns are in the table on page, but this helps spell it out a bit more clearly per type of appliance.

	# Units x		Watts x		hrs/day ÷ 1000 =		kWh/day
↑ Insert # of appliances to be powered at a time		↑ Appliance Power in Watts		↑ Hours Appliance Will be Used Daily (or Nightly)		↑ Daily (or Nightly) Energy Usage of Appliance	

Step 5: Find Total Energy Load

Add up the kWh/day for each appliance and you have the total energy you will need from your system for either day or night! This is considered your total "Energy Load". The next step is to translate that into the number of solar panels and the size of the battery and inverter you will need.