Estimating Energy Needs

FP 3.2

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Overview of Terms

Term	Definition
Community or Site	The community or site is the location where the solar generator will be used following a disaster / power outage.
Energy Assessment	An energy assessment is a process that helps you determine the amount of energy that a solar generator will need to provide for your site following a disaster.
Load	A load is an appliance or product that uses electricity.
Load Profile	A load profile is more detail about how a load will be used (at night, during the day, etc.)

Matching a Solar Generator to Your Needs

First Step: Identifying Needs

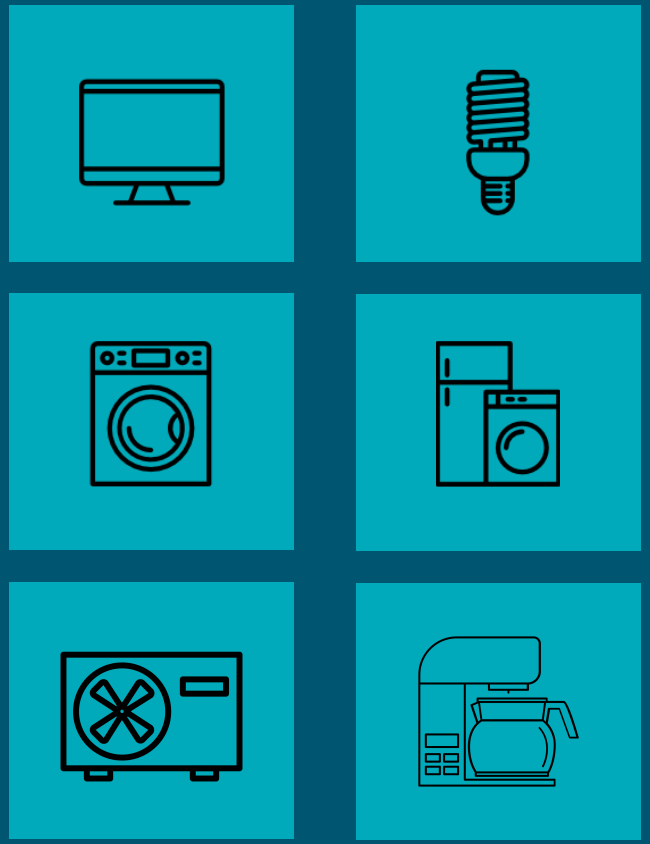
One of the first things people wonder about when it comes to solar generators and their own communities is what electrical appliances and products the generator will be able to power.

It is important to take a step back and actually turn the question around and ask “what is going to be most important to power following a disaster in my community?”.

Doing this allows you to think more clearly about what is needed, so that a solar generator can be provided that best fits your community needs.

What Do You Want To Power?

- What is the purpose of your generator?
- What are your loads?



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Estimating Hours

When thinking about load profiles for each appliance or product, consider how much of the day the different appliances will be used. Is it for 5 minutes, 1 hour, all night long, or...?

Appliances That Cycle On and Off

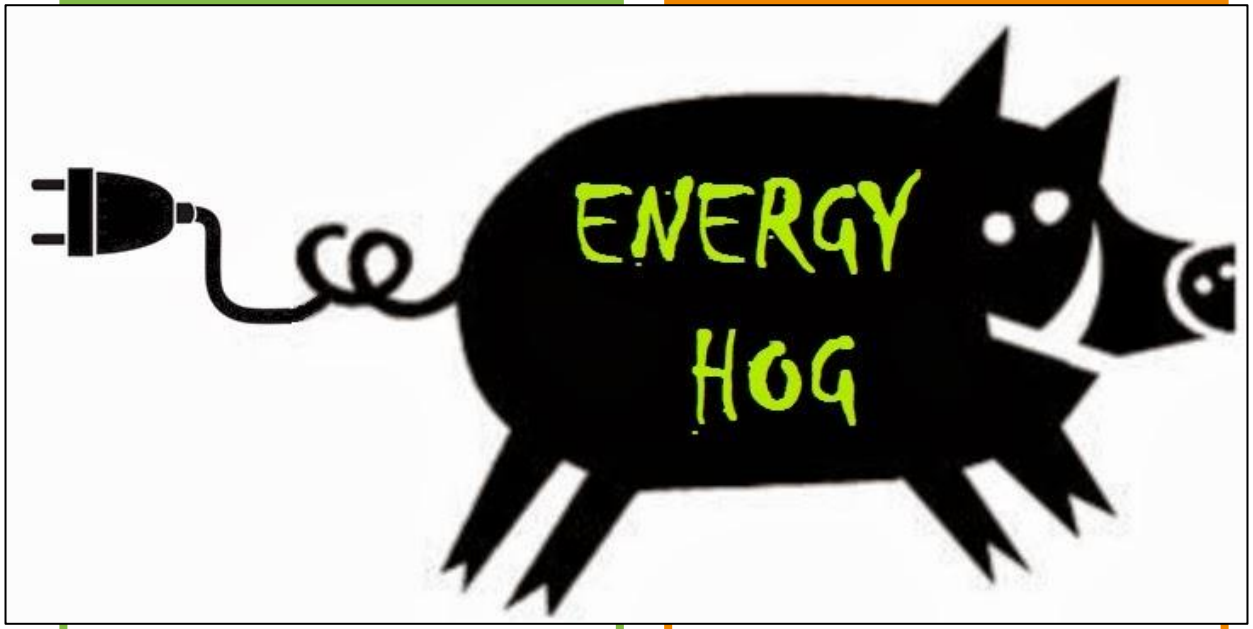
Some appliances aren't like a fan or a light, where they are either on, or off, making the energy calculations simple.

A fridge, a water pump, a water heater, and some other heating or compressor-based loads, are plugged in all the time, and turn on and off at different intervals.

Therefore, when estimating their energy consumption, it's best to take the number of hours that the appliance will be plugged in and multiply that number by one of the fractions to the right as a way to estimate how much of the time it actually is running at its rated power.

Load /Appliance	# Hours Plugged In	Fraction of Time It's "On"
Refrigerator	24	1/3
Chest Freezer	24	1/3
Water Heater (Tankless)	24	1/12
Water Heater (Standby)	24	1/6
Water Pump	24	1/12

Energy Efficiency Matters!



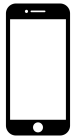
Small-Scale Refrigeration
Vaccine/Mini Fridges, Chest Freezers

CHALLENGING + EXPENSIVE

Heat
Electric Stoves, Space Heaters, Dryers, Water Heaters

3-Phase Loads
Reefer Trucks, Containers

Example: Loads & Load Profiles



Load	#	Night/Day	Load Profile
Coffee Machine	1	Daytime	Used to make and keep coffee hot from 7AM-Noon (5 Hours)
Cell Phone Charging	20	Nighttime	Charging predominantly happens over night, between 9:00 PM and 9:00 AM (12 hours).
Washing Machine	1	Daytime	Used daily, typically from 10 AM - 4 PM (6 Hours).
LED Light	4	Nighttime	Used at night for a few hours from 7:00 PM - 11:00 PM (4 Hours).

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Calculating Power

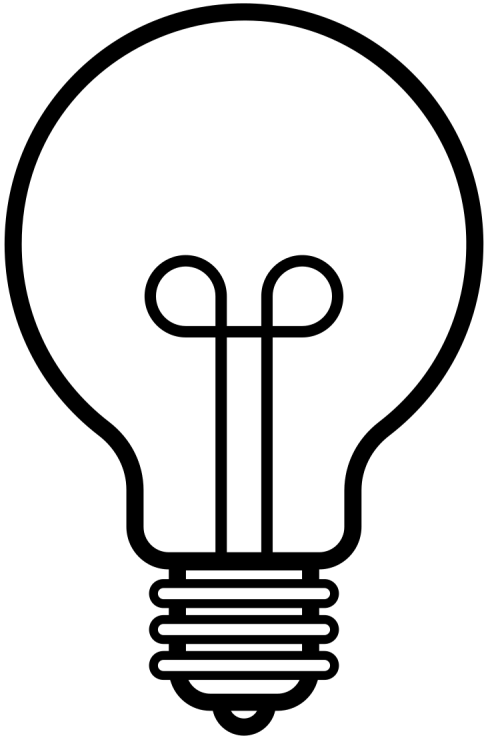
(Wattage)

You may recall from our previous training that the equation you need to know in order to figure out power (wattage), is the following:

Volts * Amps =
Power in Watts

Incandescent Lightbulb Example:

0.5 amps * 120 volts =
60 watts of power



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Calculating Energy

(Watt-Hours)

You may recall from our previous training that the equation you need to know in order to figure out energy (watt-hours), is the following:

Power (Watts) * Time (Hours) = Energy in Watt-Hours

Incandescent Lightbulb Example:

60 Watts * 4 Hours = 240 Watt Hours

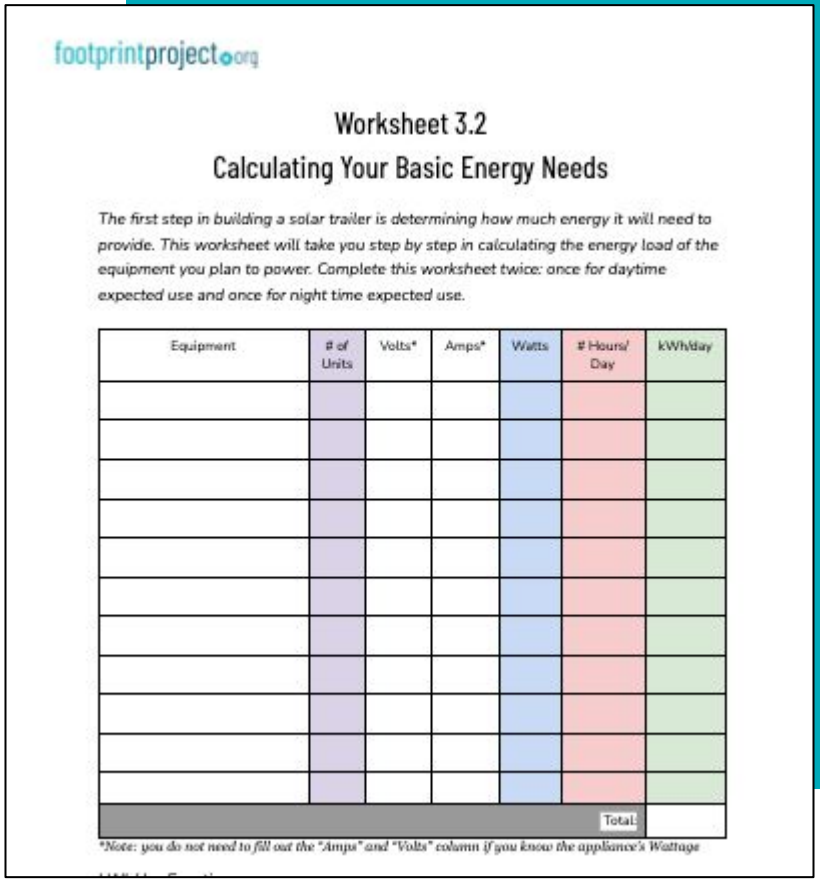
(divide by 1000 to get .240 kilowatt-hours)

Calculating Total Energy Load

- Go through each item on your list to determine its total energy consumption, using the power and energy calculations. Use our worksheet to help!
- After that's done, then add up the total to get your total energy needs!

Activity

Calculating Your Basic Energy Needs



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Worksheet 3.2

Calculating Your Basic Energy Needs

The first step in building a solar trailer 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. Complete this worksheet twice: once for daytime expected use and once for night time expected use.

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

**Note: you do not need to fill out the "Amps" and "Volts" column if you know the appliance's Wattage*

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Try it Yourself!

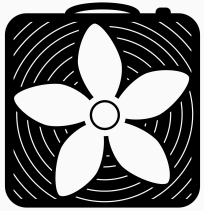
Scenario 1- Day Only

Freddie the Firefighter

DESIGN PURPOSE: power loads for a day use donation distribution center that is open from 9AM to 5PM

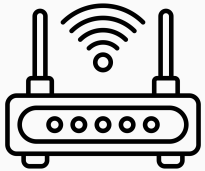
LOADS:

Units: 50
Watts: 6
Hours: 3



Units: 1
Watts: 50
Hours: 8

Units: 2
Volts: 9, Amps: 3
Hours: 5



Units: 1
Watts: 10
Hours: 8

Units: 15
Watts: 65
Hours: 3

GOAL: determine total energy load

Scenario 1: Energy Load

Equipment	# Units	Volts	Amps	Watts	Hours/Day	kWh/Day
Box Fan	1	–	–	50	8	0.4
Cell Phone Charger	50	–	–	6	3	0.9
Computer	15	–	–	65	3	2.9
Wifi Hotspot	1	–	–	10	8	0.08
CPAP Batteries	2	9	3	27	5	0.27
					Total:	**4.55**

TOTAL ENERGY LOAD = 5 kWh/Day (Note: Always Round Up!)

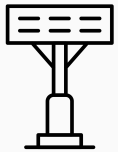
Try it Yourself!

Scenario 2 - Day/Night

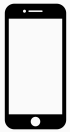
Freddie the Firefighter

DESIGN PURPOSE: scale up distribution center and be open 24/7!

LOADS:

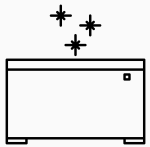


Units: 1
Watts: 500
Hours: 16



Units: 80
(40 Day & 40 Night)
Watts: 6
Hours: 3

Units: 1
Watts: 50
Hours: 8



Units: 1
Watts: 350
Hours: 24

Units: 2
Volts: 9
Amps: 3
Hours: 5

Units: 1
Watts: 10
Hours: 24

Units: 15
Watts: 65
Hours: 3

GOAL: determine total energy load

Scenario 2: Energy Load

Equipment	# Units	Volts	Amps	Watts	Hours/ Day	Hours/ Night	kWh/ Day	kWh/ Night
Box Fan	1	–	–	50	8	0	0.4	0
Cell Phone Charger	40	–	–	6	3	3	0.72	0.72
Computer	15	–	–	65	3	3	2.92	2.92
Wifi Hotspot	1	–	–	10	8	16	0.08	0.16
CPAP Batteries	2	9	3	27	5	0	0.27	0
Chest Freezer	1	–	–	350	8/3=2.7	16/3=5.3	0.93	1.87
LED Light Tower	1	–	–	500	0	16	0	8
					Total:		**5.32**	**13.67**

TOTAL ENERGY LOAD = 6 kWh/Day, 14 kWh/Night

Thank You!