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SOURCES AND METHODOLOGY USED IN SUN FOUNDATION WEBSITE

CONVERTING UNIT ELECTRICITY (KWH) TO CO2 MITIGATION

We are asking user to input daily electricity consumption in standard unit (kWh) based on requirements. As per Central Electricity Authority, India in their Research Paper CO2 Baseline Database for the Indian Power Sector (insert link- http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver10.pdf) , the relation between CO2 and kWh can be calculated.

CALCULATING CO2 (IN METRIC TONS) MITIGATION TO PLANTATION EQUIVALENT

As per SPIN- MNRE, we can derive the relation between **CO2 (in metric tons) mitigation and equivalent plantation of Teak tree.**

Find out more detail here (insert link- https://solarrooftop.gov.in/rooftop_calculator)

ESTABLISHING RELATIONSHIP BETWEEN CO2 GENERATION AND PASSENGER VEHICLES

As per The California Air Resources Board (CARB) (insert link- https://www.arb.ca.gov/cc/factsheets/1mmtconversion.pdf), one million metric tons (1MMT) is equivalent to 216,000 Passenger cars not driven for 1 year.

SUN FOUNDATION CALCULATOR

CALCULATE YOUR ELECTRICITY LOAD

Most household appliances have a wattage label on the back or bottom. This label lists the maximum amount of power the appliance can draw. To estimate total energy use, you'll want to convert this to kilowatt hours, or kWh.
Estimate Kilowatt Hours from Appliance Label-

- Most high power appliances have an energy label on the back or base of the appliance. Look here to find the wattage or "W"
- Calculate electricity consumption by simply multiplying wattage with number of hours used each day.
- Add wattages from all the appliances
- Divide by 1000 to estimate kWh required to power your home/house/office/institution. This is your daily requirement of electricity.

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You can also use our calculator to estimate the power requirement:

APPLIANCE	AVERAGE KWH
100 W light bulb (incandescent)	100 W
LED Light Bulb	10W
32' LED Color TV	40 W
Ceiling Fan	50W
Clothes Dryer	2000W
Coffee Maker	1100W
Desktop Computer	250W
Laptop Computer	75W
Electric Heater Fan	2500W
Electric Kettle	2100W
Electric Shaver	17W
Refrigerator	150W
Gaming PC	450W
Hair Blow Dryer	2100W
Home Air Conditioner	2500W
Inverted Air Conditioner	1500W
Home Sound System	95W
Microwave	1100W
Oven	2150W
Toaster	1300W
Vacuum Cleaner	450W
Washing Machine	500W
Gross electricity (in kWh) required per day	

*Please note that above values are indicative. Wattage capacity of appliances vary brand to brand. Here we have taken the mean from most used appliances. To calculate the actual power load of your home/school/institution, we encourage you to see the wattage from appliances itself.

For more information, please visit https://www.daftlogic.com/information-appliance-power-consumption.htm

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CALCULATION OF SOLAR POWER PLANT GENERATION OF ELECTRICITY

The power output of a rooftop solar system is dependent on several factors such as
Location, Orientation of the roof, Panel efficiency, Ambient Temperature

- Location- Your location determines the amount of solar insolation (sunlight falling on the panel per day).
    - The approximate solar insolation at your location can be ascertained by entering the latitude and longitude of your location at the NASA website
    - To be absolutely certain of solar insolation at a particular site we would have to place sensors on-site that measure the actual insolation received over a period of time. This is both an expensive and time consuming process

ORIENTATION OF THE ROOF:

In the northern hemisphere a south-facing roof is ideal as the sun is always to the south if you are in the temperate zone and predominantly in the south for many parts of the tropical zone.

If a south-facing roof is not available an east-west facing roof could also be considered (as it will cover the sun's movement across the sky from east to west during the day). As the output of the solar plant reduces in proportion to a horizontal angle greater than 15% from due south, the output for the particular site should be calculated and assessed to understand the impact on power generation from an east-west facing roof.

Solar PV plants are not restricted to flat roofs – they can be mounted on sloped roofs as well, with a correction in the angle of mounting for the slope of the roof

Panel efficiency- Efficiency of the panel is calculated as ratio of capacity of the panel (KWp) with respect to the size (area) of the panel (m^2), expressed as a percentage. This table illustrates the calculation for different panel capacities having the same size:e:

Panel Capacity (Wp)	Panel size (m^2)	Panel efficiency [Wp/(1,000*m^2)]
200	1.61	12.42%
225	1.61	13.98%
250	1.61	15.53%

NOTE: Efficiency of a solar panel is calculated with respect to the size of the panel, and therefore the efficiency percentage is relevant only to the area occupied by the panel. If two panels have the same capacity rating (Wp), their power output is the same even if their efficiencies are different.

TO ILLUSTRATE: A 1KW rooftop solar plant will produce the same power output whether it uses lower or higher efficiency panels. The area occupied by the plant with lower efficiency panels will be greater than the area occupied by the plant with higher efficiency panels, but the power output is the same.

AMBIENT TEMPERATURE- The rated capacity, or power, of a solar panel (e.g. 250 Wp) is measured at 25°C. The effect of temperature on the solar panel's power is measured by its thermal coefficient, expressed as %/K or %/°C. It denotes the % change in power for 1 degree change in Kelvin or Celsius (both are the same on a unit level) above 25°C. A negative (-) sign indicates the direction of the change.

A temperature coefficient of -0.447 indicates that every 1°C **increase** in temperature over 25°C will cause a 0.447% **decrease** in power. Equally, every 1°C **decrease** in temperature over 25°C will cause a 0.447% **increase** in power. This is illustrated in this table:

Rated panel capacity (Wp)	Temperate (° C)	Temperature Coefficient	Effective panel capacity (Wp)	Change in Wp
250	20	-0.45%	255.59	102.24%
250	25	-0.45%	250.00	100.00%
250	35	-0.45%	238.83	95.53%
250	45	-0.45%	227.65	91.06%

Depending on the region and its DNI (a measure of amount of sunlight available), 1 KWp of panel will generate about 1,400-1,600 KWh (units) per year i.e., about 4 KWh per day. This is broadly representative of output from rooftop PV plants in India. It is an average calculated over a year. Generation on individual days at your location will vary based on meteorological conditions.

Read more at: Energy Alternatives India (EAI)- Insert Link -http://www.eai.in/ref/ae/sol/rooftop/power_output
More information also available at MNRE website- (insert link-https://solarrooftop.gov.in/rooftop_calculator)

COST OF SOLAR ROOFTOP SYSTEM – As per Ministry of New and Renewable Energy website (insert link- https://mnre.gov.in/sites/default/files/uploads/FAQs_Grid-Connected-Solar-Rooftop-Systems_0.pdf), average cost of grid-connected rooftop solar system is INR 80 per watt or INR 80 million per MWp capacity.

CALCULATION OF ROOFTOP/SPACE REQUIRED- About 10 square metre area is required to set up 1kWp grid connected rooftop solar system. Source- Ministry of New and Renewable Energy. (insert link- https://mnre.gov.in/sites/default/files/uploads/FAQs_Grid-Connected-Solar-Rooftop-Systems_0.pdf)
One square metre is equivalent to 10.76 square feet.