

# Socket vs. Solar: Worksheet answers

Energy data (Watts)		Solar supply (Watts)	
Fan on <u>low speed</u>	<i>roughly 8 W</i>	Morning	75
Fan on <u>high speed</u>	<i>roughly 12 W</i>	Midday	300
1 fan = single household 25 fans = a suburb		Night	0

## Part A: Write algebraic expressions

**Q1. Write an algebraic formula for the energy used by one household (1 fan) after X hours in:**

- Slow Speed

$$\text{Energy} = 8X \cdot 60 \cdot 60 = 28800X$$

- High Speed

$$\text{Energy} = 12X \cdot 60 \cdot 60 = 43200X$$

**Q2. Scale up for the suburb of 25 fans. Write a formula for the total energy use after X hours in:**

- Slow Speed

$$\text{Energy} = 28800X \cdot 25 = 720000X$$

- High Speed

$$\text{Energy} = 43200X \cdot 25 = 1080000X$$

## Part B: Substitution practice

**Q3. If all fans run for 3 hours, calculate the total energy used in:**

- Slow Speed

Energy =  $720000X$ , therefore when  $X = 3$ , Energy =  $2160000\text{j}$  or  $2160\text{kJ}$

- High Speed

Energy =  $1080000X$ , therefore when  $X = 3$ , Energy =  $3240000\text{j}$ , or  $3240\text{kJ}$

**Q4. What is the maximum number of fans running at slow speed that can be fully powered by 300W of solar power during midday?**

The solar is producing 300w for 60 minutes or 3600 seconds.

This means that the solar is producing 1080000j of energy.

To power one fan at slow speed, it would need  $8 \times 60 \times 60\text{j} = 28800\text{j}$ .

To power  $X$  fans for the hour, we will need  $28800 \times X$  j of energy.

Setting this equal to the total power gives us  $1080000 = 28800X$ .

Solving for  $X$  gives us  $1080000/28800 = X = 37.5$ .

So the maximum number is 37 fans.

## Part C: Energy supply

**Q5. If we want to have 25 fans running, how much of that energy will be covered by the solar panels at each of the following times of day? Give your answer in watts:**

### a) Morning

Low Speed (200) – Solar (75) → 125 W gap.

High Speed (300 – 75) → 225W gap.

### b) Midday

Low Speed (200) – Solar (300) → fully covered, no gap.

High Speed (300 – 300) → fully covered, no gap.

### c) Evening

Low Speed (200 – 0) → 200 W gap.

High Speed (300 – 0) → 300 W gap.

## Part D: Extensions

**Q6. In the morning, how many people would have to turn their high-powered fans off for energy demand to be fully covered by solar?**

In the morning, High Speed (300 – 75 ) → 225 W gap

High speed fan = 12W

Therefore 19 fans need to be turned off.

**Q7. In the evening, solar provides 0 W.**

**What are two other renewable solutions that could meet demand without fossil fuels?**

- Batteries (store daytime solar for night use)
- Wind power (often blows more at night)
- Hydro (water storage releasing at night)

**Q8. Besides running fans at lower speeds, what other actions could households take to lower their energy use?**

Examples:

- Switch off appliances not in use
- Use energy-efficient appliances (fridges, heaters)
- Shift usage to daytime (run dishwasher when solar is available)
- Improve insulation to reduce heating/cooling load