

Energy forms, changes and sources

Grade 6 science (Year 7 · Class 6) · Lesson

Quick answer: Energy is the ability to make things change, and it is measured in joules (J). It exists as kinetic, thermal, light, electrical and chemical energy. Energy is never created or destroyed; it is transformed from one form to another. Sources are renewable, like sunlight and wind, or non-renewable, like coal and oil.

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What is energy?

Energy is what makes things happen. Whenever something moves, heats up, glows or switches on, energy is involved. We measure energy in **joules** (symbol J); 1000 J make one kilojoule (kJ). Energy comes in several forms, and one form can change into another.

Definition
Energy is the ability to make something change, such as moving, heating or lighting. Its SI unit is the joule (J).



Kinetic
Rolling ball



Thermal
Hot tea



Light
Sunlight



Electrical
Current



Chemical
Food, fuel

Five forms of energy and an everyday example of each.

Form of energy	What it is	Example
Kinetic	Energy of a moving object	A cricket ball flying through the air
Thermal	Energy of hot objects (their particles move faster)	A pan of boiling water
Light	Energy carried by light	Sunlight on a solar panel
Electrical	Energy carried by an electric current	A phone charger cable in use
Chemical	Energy stored in food, fuel and batteries	Rice, petrol, a torch battery

How does energy change from one form to another?

Energy can be transferred from one object to another and transformed from one form into another. In a torch, the chemical energy stored in the battery becomes electrical energy in the wires, and then light and thermal energy in the bulb. We show this with an **energy chain**.



Total energy at the end equals the energy at the start

An energy chain: the form changes at each stage, the total stays the same.

Key law: conservation of energy

Energy is never created or destroyed. It is only transferred or transformed. The total amount of energy before a change equals the total amount after it.

Why is some energy wasted?

Most devices transform energy into the form we want (**useful** energy) and also into forms we do not want. The unwanted energy is usually thermal energy that spreads into the surroundings. We call it **wasted** energy. It is not lost, but it is no longer useful.

Formula

$$\text{Useful percentage} = (\text{useful energy} \div \text{total energy}) \times 100$$

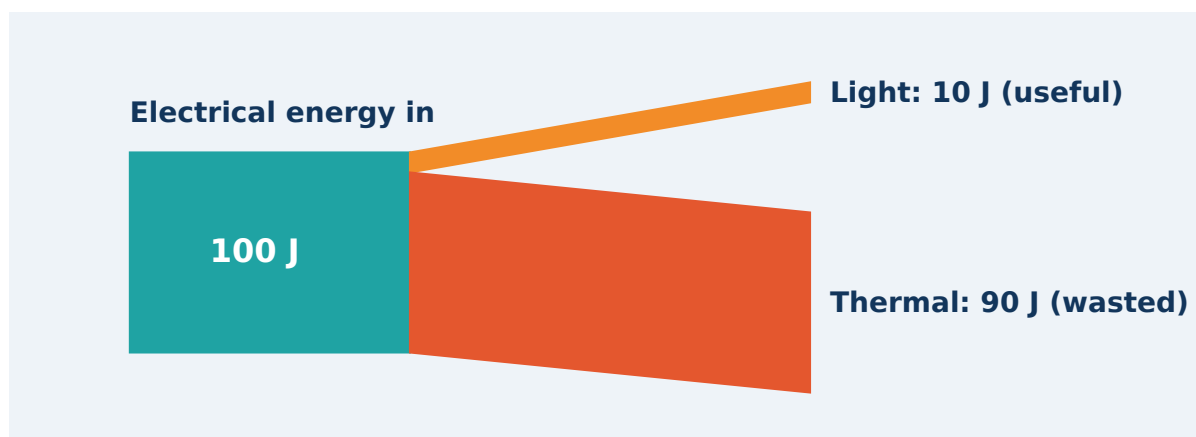
Both energies are in joules (J). The result is a percentage (%). Wasted energy = total energy – useful energy.

Worked example 1

A filament lamp takes in 100 J of electrical energy and gives out 10 J of light. Calculate the wasted energy and the useful percentage.

$$\text{Wasted energy} = 100 - 10 = \mathbf{90 \text{ J}} \text{ (thermal).}$$

$$\text{Useful percentage} = 10 \div 100 \times 100 = \mathbf{10 \%}.$$



The width of each band shows the amount of energy.

Worked example 2

An LED lamp takes in 10 J of electrical energy and gives out 8 J of light. Compare it with the filament lamp.

Useful percentage = $8 \div 10 \times 100 = 80\%$, wasted energy = $10 - 8 = 2$ J. The LED lamp wastes far less energy than the filament lamp, which is only 10 % efficient.

What are renewable and non-renewable energy sources?

An energy source is where the energy we use comes from. Sources are sorted by whether they can be replaced in a human lifetime.

Definition

A **renewable** source is replaced naturally as fast as we use it, such as sunlight, wind and flowing water. A **non-renewable** source takes millions of years to form and will run out, such as coal, oil and natural gas.

Source	Type	Main energy it supplies	Main drawback
Sunlight (solar)	Renewable	Light, then electrical	Needs sunshine; no power at night
Wind	Renewable	Kinetic, then electrical	Needs steady wind
Flowing water (hydro)	Renewable	Kinetic, then electrical	Dams change rivers
Coal	Non-renewable	Chemical, then thermal	Will run out; makes carbon dioxide
Oil and natural gas	Non-renewable	Chemical, then thermal	Will run out; makes carbon dioxide

Common mistake

Energy is not "used up". When a battery goes flat, its chemical energy has been transformed into other forms, mostly thermal energy that spreads into the air. Also,

renewable does not mean unlimited at every moment: solar panels give nothing at night.

Lina's tip

To name a form of energy ask what the object is doing: moving means kinetic, hot means thermal, glowing means light, current in wires means electrical, and food, fuel or a battery means chemical.

Key points to remember

- Energy is measured in joules (J); $1 \text{ kJ} = 1000 \text{ J}$
- Forms: kinetic, thermal, light, electrical, chemical
- Conservation: energy is transformed, never created or destroyed
- Useful percentage = $\text{useful energy} \div \text{total energy} \times 100$
- Renewable sources are replaced naturally; non-renewable ones run out

Energy forms, changes and sources: frequently asked questions

What are the main forms of energy?

Grade 6 science focuses on kinetic energy (movement), thermal energy (heat), light, electrical energy and chemical energy stored in food, fuel and batteries.

What is an energy transformation?

It is a change from one form of energy to another, such as chemical energy in a battery becoming electrical energy and then light. The total amount of energy stays the same.

What does wasted energy mean?

Wasted energy is energy transformed into a form that is not useful, usually thermal energy that spreads into the air. It is not destroyed, but it is hard to use again.

What is the difference between renewable and non-renewable energy?

Renewable sources such as sunlight, wind and flowing water are replaced naturally. Non-renewable sources such as coal, oil and natural gas take millions of years to form and will run out.

How do you calculate the useful percentage of a device?

Divide the useful energy output by the total energy input and multiply by 100. For example, 8 J of light from 10 J of electrical energy gives 80 %.