

BOOKLET 2 • ENERGY AND EFFICIENCY

Forms of Energy

Seven forms, one job: know what goes in and what comes out.

National 5 Engineering Science



LEARNING INTENTION

To identify the forms of energy engineers use, and the input, useful and wasted energy in a system.

Daily Review

SHOW ME BOARDS

- 1 State what is meant by a system.
- 2 Name the three parts of a universal system diagram.
- 3 Identify the input, process and output for an electric kettle.
- 4 State what is meant by a sub-system.
- 5 State the type of control that uses feedback.

By the end of this lesson...

- 1 I can name the seven forms of energy with an engineering example.
- 2 I can name the four forms we calculate at National 5.
- 3 I can identify the input, useful output and wasted energy of a system.
- 4 I can give one reason engineers try to reduce wasted energy.

The Seven Forms of Energy

All seven matter. Four of them we calculate: E_k , E_p , E_e and E_h .

Form of energy	What it is	Engineering example
kinetic	the energy of a moving object	moving vehicle
potential	energy stored when something is raised	raised lift cage
electrical	energy carried by an electric current	current in a motor
heat (thermal)	the energy a hot object has	hot water in a tank
chemical	energy stored in fuels and batteries	petrol, battery
light	energy carried by light	lamp, LED
sound	energy carried by sound waves	buzzer, speaker

Show Me — Name the Form

SHOW ME BOARDS

- 1 A lorry driving along a road.
- 2 Petrol sitting in a fuel tank.
- 3 A buzzer sounding in a circuit.
- 4 A crate held high on a shelf.
- 5 The element inside a hot toaster.

Show Me — Name the Form Again

SHOW ME BOARDS

EXTRA PRACTICE

- 1 A robot arm swinging across a workbench.
- 2 Water held back behind a dam.
- 3 The current flowing through a motor.
- 4 An LED lighting up on a control panel.
- 5 A charged battery in a cordless drill.

Task 1 – Match the Energy Form

Seven examples, seven forms. Write the form beside each.

Two of them are stores, not movement – think carefully.
Use the table on the previous page if you get stuck.

Booklet – “TASK: Match the Energy Form”

Why Energy Matters to Engineers

Almost every engineered product moves, heats, lights or signals – and all of that needs energy.

- Engineers must know what energy goes into a system.
- They must know what useful energy comes out.
- They must know how much is wasted.
- Less waste saves money, resources and the environment.

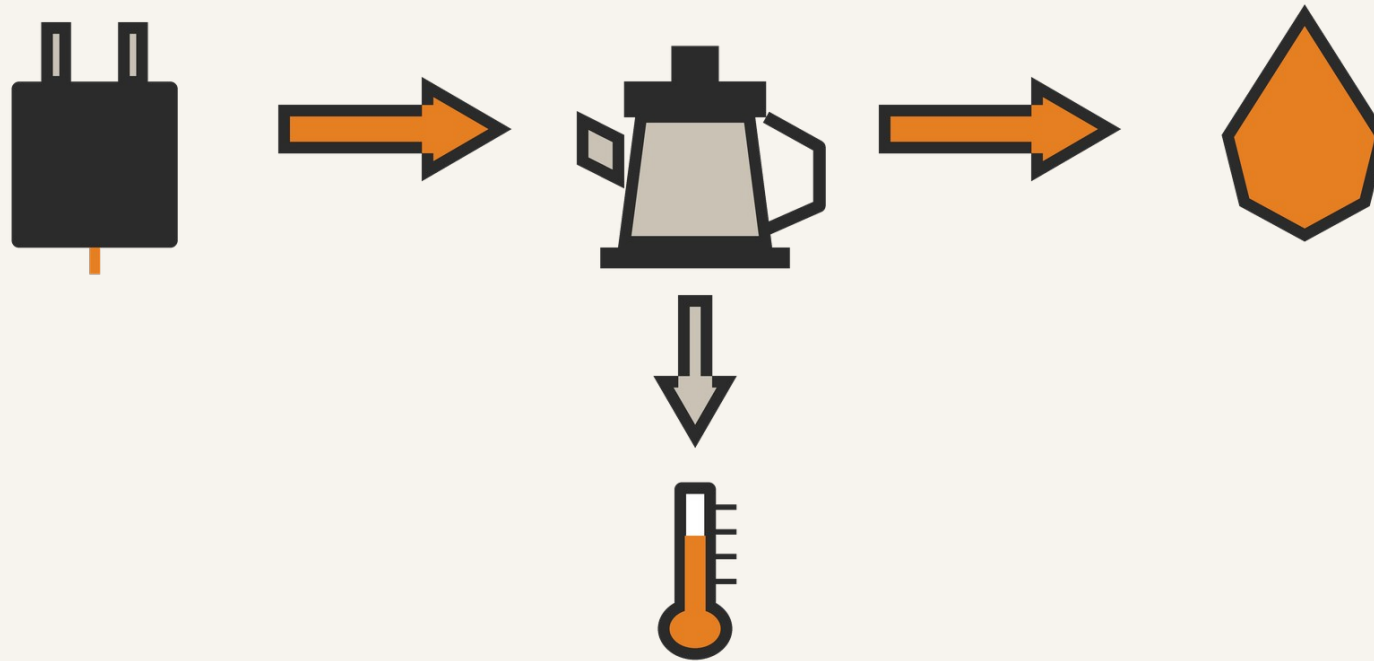
The Words You Will Need

Five words the rest of this booklet is built on.

Word	What it means
energy	the ability to do work or cause change
input energy	the total energy supplied to a system
useful output energy	the energy that does the job the system was designed for
wasted energy	energy transferred to forms or places we do not want
efficiency	how much of the input energy becomes useful output

Inside an Electric Kettle

Electrical energy goes in. Some of it heats the water. The rest escapes.



input: electrical · useful output: heat in the water · wasted: heat and sound

Show Me – Input, Useful or Wasted?

SHOW ME BOARDS

- 1 An electric heater – what is the input energy?
- 2 An electric motor – what is the useful output?
- 3 A torch – name the useful output energy.
- 4 A filament bulb – name one form of wasted energy.
- 5 A hairdryer – name the two useful outputs.

Show Me – Around the Workshop

SHOW ME BOARDS

EXTRA PRACTICE

- 1 A pillar drill – what is the input energy?
- 2 A soldering iron – what is the useful output?
- 3 A workshop extractor fan – name one wasted output.
- 4 A battery-powered screwdriver – what is the input energy?
- 5 A bench grinder – name two forms of wasted energy.

Task 2 – Input, Useful and Wasted

Six systems to fill in. The kettle row is done for you.
Every row needs an input, a useful output and one waste.

The petrol car engine is the odd one out – its input is chemical.

Booklet – “Identify Input, Useful and Wasted”

Watch Out — Wasted Is Not Destroyed

THE MISTAKE

- “The wasted energy is lost.”
- “The bulb destroys the energy it does not use.”
- “Wasted energy just disappears into the air.”

THE CORRECT ANSWER

- It is still energy — it is just not doing the job.
- Energy cannot be destroyed. It is transferred.
- It heats the air. You could measure it if you tried.

Checkpoint

- 1 Name the four forms of energy we calculate at National 5.
- 2 A motor takes in electrical energy. Name its useful output and one waste.
- 3 What + why: why does a filament bulb get hot when its job is to give light?

Exam Practice — Past Papers

2024 Q7(b) — the form of energy lost to friction (1)

2024 Q5(b) — the missing input energy on a turbine diagram (1)

One-mark questions, but only if you name the form exactly.

Find the relationship in the data booklet

LOOKING AHEAD

Conservation of Energy

Energy is never created or destroyed. So where does every joule go?

Plenary – Prove Your I Can... Statements

SHOW ME BOARDS

- 1 Name three forms of energy used in engineering.
- 2 Which four forms do we calculate at National 5?
- 3 What is meant by useful output energy?
- 4 Name one form of wasted energy from an electric motor.
- 5 Give one reason engineers try to reduce waste.

Plenary – More Quick Checks

SHOW ME BOARDS

EXTRA PRACTICE

- 1 What is meant by input energy?
- 2 Name the form of energy stored in a battery.
- 3 Name the form of energy a moving conveyor belt has.
- 4 What is meant by wasted energy?
- 5 Give one form of energy wasted by a hairdryer.

Extension — If You Finish Early

- 1 Rank these by likely waste: LED lamp, filament bulb, electric heater.
- 2 What + why: why is an electric heater almost never called wasteful?
- 3 What + why: why does a phone get warm while it is charging?

Extension — More Challenges

EXTRA PRACTICE

- 1 Name a system whose wasted energy is sound rather than heat.
- 2 What + why: a fan heater wastes sound. Could that ever be useful?
- 3 What + why: why do engineers fit cooling fins to a motor casing?