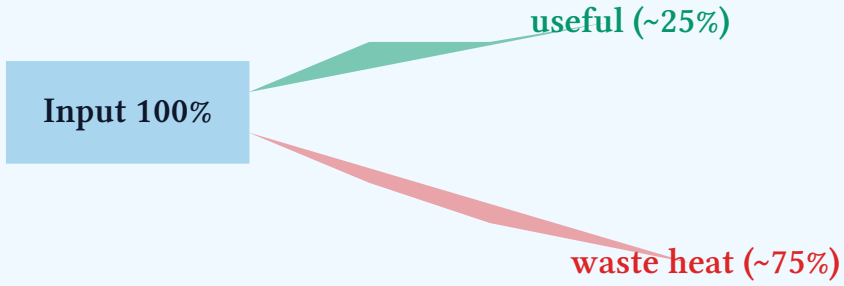
Science 10

Unit B: Energy flow in technological systems

Thermodynamic laws and useful energy

Purpose of a radiator

- Only part of the fuel energy becomes vehicle motion.
- The radiator and exhaust transfer thermal energy to the surroundings.
- Hidden energy, such as heat spread into the surroundings, still counts. It left through the radiator and the exhaust.



ıd law: some energy always spreads to surroundings as thermal eı

Conserved but less useful energy

- Inefficient devices conserve energy but transfer a larger fraction to non-useful outputs, often thermal energy.
- Total energy is conserved, but some spreads to the surroundings and is less available for useful work.
- Outputs sum to input and the second law is explained without saying energy vanished.

Key terms

first law of thermodynamics

Energy is conserved; it changes form or crosses system boundaries.

second law of thermodynamics

Energy transfers spread energy and reduce how much is available for useful work.

useful energy

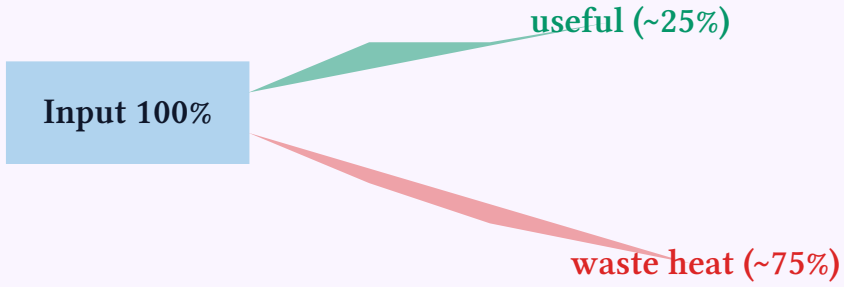
Energy delivered in the form intended for the device's purpose.

thermal transfer

Energy transferred because of a temperature difference.

Transformations in systems

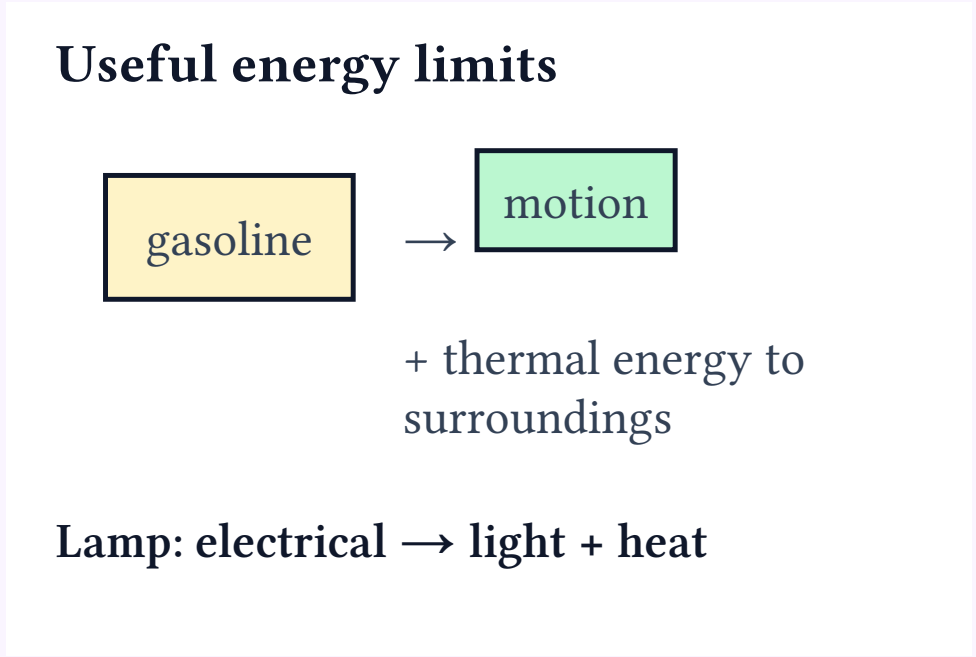
- A car, a refrigerator, a heat pump, and a food chain all move energy, and none of them is pure useful output.
- The first law is a balance of energy in and energy out. The second law says real transfers leave some energy less useful.



ıd law: some energy always spreads to surroundings as thermal eı

Useful energy limits

- The chemical energy in gasoline becomes the car's motion and thermal energy dumped to the surroundings.
- A lamp turns electrical energy into visible light and into thermal energy you can feel at the bulb.



Accounting for 100 joules

- Divide a 100 J input among useful output and thermal or sound transfers, then check the total.
- A complete answer makes the outputs add up to the input and explains the second law without saying the energy vanished.