Energy stores & Systems:

Energy transferred to objects (which is stored in an object's energy stores) is done via a force doing work (mechanically), work being done by moving charges (electrically), by heating or radiation

System = a group/single object

Closed systems = matter/energy cannot enter/leave
so there's a net energy change of 0

Kettle: electrical energy -> kettle's thermal energy store -> heating -> water's thermal energy store

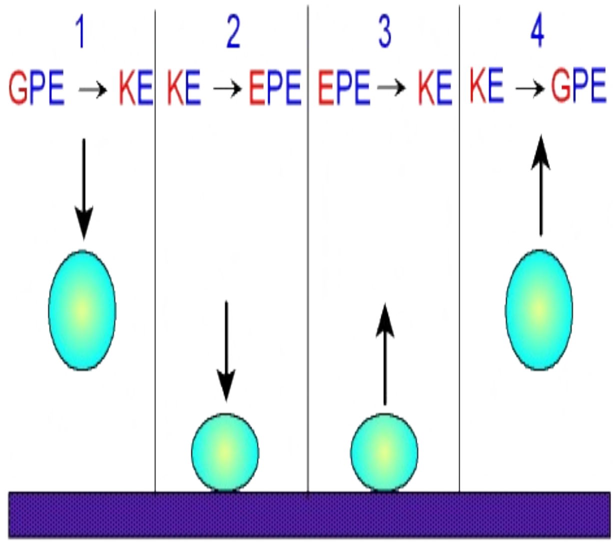
Work done = energy transferred (via a current flowing or a force moving objects)

Human throwing a ball up: chemical energy store of arm -> kinetic energy store of ball
Ball thrown downwards: gravity accelerates ball so gravitational potential energy -> kinetic energy store of ball

Car decelerating: friction between brakes & tyres -> wheel's kinetic stores -> thermal energy stores of environment

Car collision: car's kinetic energy store -> stationary object's elastic & thermal energy stores

Energy stores
Light
Sound
Kinetic
Gravitational
Chemical
Heat
Electrical
Magnetic
Elastic



Kinetic Energy:

Moving objects have energy in their kinetic energy stores
Large object (more mass) & fast (high speed) = more kinetic energy stored

$Ek = 0.5mv^2$

Mass = kg
Speed = m/s^2
Energy = J

Gravitational potential energy:

Lifting objects = gpe transferred
Higher object = more gpe needed 2 lift

$Ep = mgh$

Mass = kg
Gravitational field strength = N/kg
Height = m
Energy = J

Falling objects: gpe -> kinetic energy stores
Energy lost from gpe store = energy gained in kinetic energy store (no air resistance)

Elastic potential energy:

Stretching/Squashing objects= elastic energy transfer 2 object up 2 limit of proportionality

$Ee = 0.5ke^2$

Spring constant = N/m
Extension = m
Energy = J

Specific heat capacity:

Amount of energy needed 2 raise the temp of 1kg of substance by 1 degrees cel

$\Delta E = mc\Delta\theta$

Change in thermal energy= J
Mass = kg
Specific heat capacity = J/kg degrees cel
Temp change = degrees cel

Conservation of energy:

Energy cannot be created/destroyed, only transferred to an object so energy is stored/ dissipated

Dissipated energy = 'wasted' energy (no useful energy store) e.g. mobile phones: chemical energy of battery -> thermal energy store of phone (wasted)

Closed systems: a sealed flask with hot soup & a cold spoon (soup cools slightly when thermal energy is transferred 2 spoon) = net energy change of 0!

Power:

Rate of energy transfer/work done

$P = e/t$ $P = W/t$

Power = W
Energy transferred/ work done = J
Time = s

Powerful machine = high energy transfer in a short time period e.g. car with more powerful engine is faster (same rate of energy transfer just quicker)

Conduction:

When vibrating particles transfer energy 2 other particles
Heating entails a thermal energy transfer (thermal -> kinetic energy = particle collisions)

Thermal conductivity = how quick energy is transferred through materials (high = rapid energy transfer)

Convection:

When particles move from hot 2 cold regions
Liquids & gases:
thermal energy -> particles -> kinetic energy -> collisions -> more space between particles -> low density -> warm regions rise above cooler regions

Convection currents:

Radiators: conduction transfers energy from the radiator to atmosphere, air near radiator warms & rises then cool, dense air sinks & replaces rising air in a current!

Reducing 'wasted energy':

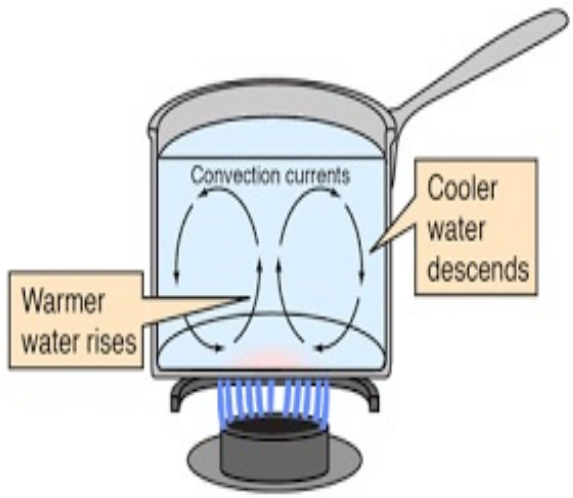
Lubrication to reduce friction e.g. oil
Homes: thick walls with low thermal conductivity 2 slow rate of energy transfer
Cavity (foam) walls/ double glazing: air gap reduces convection
Loft insulation reduces convection currents

Efficiency:

Less energy transfer to useful stores = more efficient device
Can: insulate, lubricate or make objects streamlined to enhance efficiency

E= useful output/ total input

NO device = 100% efficient (transfer energy 2 thermal stores) except electric heaters (all energy transferred to thermal stores so ultimately efficient)
All energy is eventually transferred 2 thermal stores

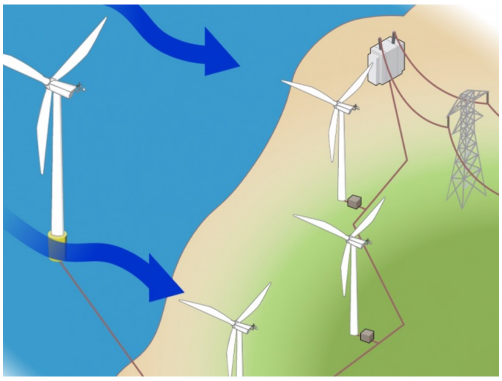


Energy resources & Uses:

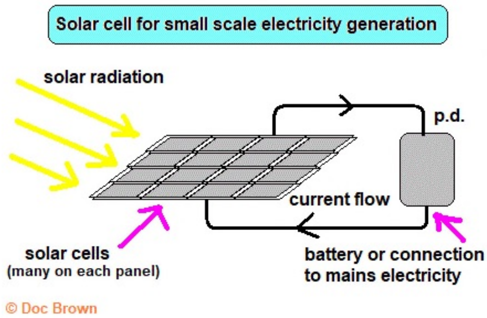
Renewables incl: solar, wind, biofuels; emit less carbon but unreliable so don't dominate energy mix

E.g. bio-fuel vehicles, geothermal heat pumps, solar for heating buildings

Wind: wind rotates blades so generators produce electricity;
pros- no atmospheric pollution, renewable, minimal running cost,
cons- visual/noise pollution, unreliable, high initial cost

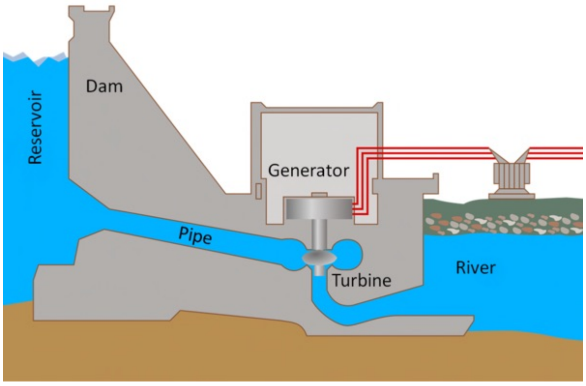


Solar: cells generate electric currents from sunlight;
pros- no pollution, good 4 remote places,
cons- small-scale, unreliable, high initial cost



Geothermal: heat from decay of radioactive elements in earth's core;
pros- low cost, little environmental damage, reliable,
cons- lack suitable locations & not economically viable

HEP: dam flooded & water drawn through turbines,
pros- no pollution, can immediately respond 2 demand surges,
cons- not reliable (drought), costly, floods valleys = methane emissions & loss of habitat



Wave: turbines on the coast,
pros- no pollution,
cons- disturbs sea bed, unreliable (wave size depends on wind speed), small-scale

Tides: barrages = dams across estuaries with spinning turbines,
pros- reliable, no pollution, decent energy generation,
cons- alter habitat, tide height is variable

Biofuels: biomass burnt,
pros: carbon neutral?, reliable,
cons- deforestation, carbon emissions as combustion, food shortage scares

Non-renewables:

Finite incl: natural gas, crude oil, coal; they emit carbon but are reliable

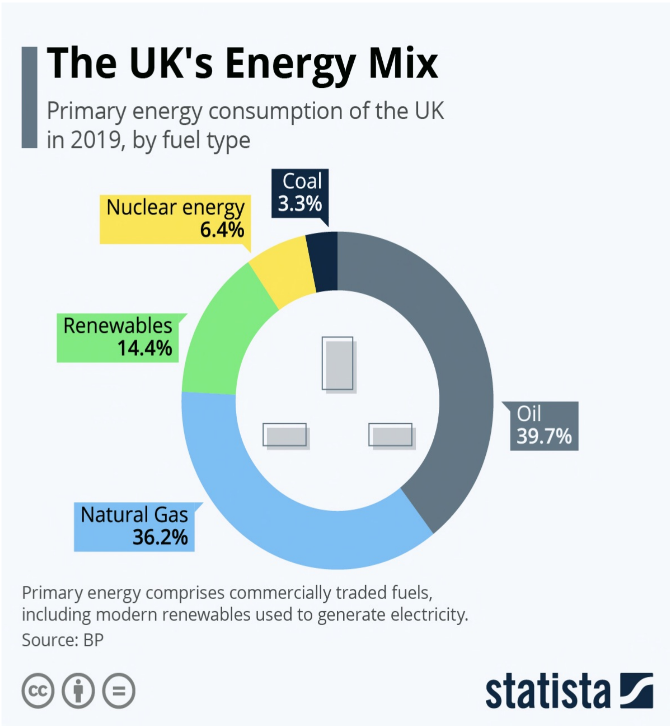
E.g. petrol/diesel vehicles or coal for steam trains
Natural gas for heating radiators or coal for fireplaces

Fossil fuels: reliable & meet current demand surges, cost effective,
BUT open-cast mining = visual pollution, emit carbon so enhance green house effect, sulfur dioxide emissions cause acid rain, oil spillages kill marine life= loss of biodiversity

Nuclear: clean energy but HIGH decommissioning cost & disasters e.g. Chernobyl

Energy Mix & Trends:

Dependance on fossil fuels as population rise = increased demand
UK: pledged 15% renewable energy by 2020



Renewable usage causes:

Global warning scares,
Pressure groups & government care
Hybrid & electric car manufacture

Limits to renewable usage:

Lifestyle changes = costly e.g. electric cars/ solar panels
Research = costly & time consuming
Unreliable
Ethical issues regarding wind site placement 4 local communities
Tax increase to fund renewable projects objections
Political acceptance of the scientific consensus regarding the climate crisis