

Energy

Energy is the ability to do work and is measured in joules (J) or kilojoules (KJ)

1KJ = 1000J

Sources of Energy

Non-Renewable Energy Sources

Fossil Fuels

Fossil fuels are created over millions of years and come from the decomposed and compressed remnants of organic material such as animals and plants.

The pressure and heat in the Earth's crust converted these remains into fossil fuels such as oil, natural gas and coal

Fossil fuels are relatively cheap, easily harnessed from nature and easy to store, however they have been proven to have a negative effect of the global climate.

Advantages of fossil fuels:

- Cheap
- Easily sourced
- Easy to store
- Provide employment

Disadvantages of fossil fuels:

- Directly contribute to global warming
- Can contaminate water
- Extraction of raw materials can often be dangerous for those involved

Fracking is a method of gaining access to natural resources such as oil and natural gas. It involves injecting sand, water or pressurized chemicals deep into the ground creating large

cracks in rocks. It has been met with wide public protest as it has been linked to environmental issues such as water contamination.

Nuclear Energy

Nuclear energy is the energy harnessed by nuclear fission. Nuclear fission refers to the huge amount of energy released when the nucleus of an atom breaks apart.

Advantages of nuclear energy:

- A small amount of initial fuel can create a very large amount of energy
- No greenhouse gasses are emitted
- Relatively cheap and clean

Disadvantages of nuclear energy:

- Raw materials emit radiation which is harmful to humans and the environment
- Waste materials remain radioactive for thousands of years after use and require special protective storage.
- Initial starting materials are very expensive
- Accidents involving nuclear energy and nuclear power plants can be catastrophic and have lasting effects

Renewable Energy Sources

Wind Energy

Wind energy is harnessed by turbines. Each turbine is connected to a generator which converts the mechanical energy into electric energy.

Advantages of wind energy:

- Wind itself is free
- Clean source of energy
- Maintenance of turbines provide employment

Disadvantages of wind energy:

- Wind energy is difficult to store
- Energy is not available at a constant rate
- High initial cost to erect turbines
- Many people do not like to visual impact of the turbines on the landscape

Many companies choose to locate windfarms offshore so that they pose minimal visual impact to the environment and are exposed to strong winds.

Solar Energy

Solar energy is energy harnessed from the sunlight and converted into energy. Photovoltaic cells allow for the generation of electricity while standard solar panels produce water.

Advantages of Solar Energy:

- Unlimited source of energy
- Cause no pollution
- Can be installed in non-invasive areas such as roofs

Disadvantages of Solar Energy:

- Only work during the day
- Photovoltaic cells are relatively inefficient
- Large areas of land are required for substantial generation of energy
- Difficult to store

Hydroelectric Power (HEP)

HEP is generated when fast flowing water turns a turbine which is connected to a generator which converts mechanical energy to electrical energy.

Advantages of HEP:

- Renewable
- Cheap
- Clean
- Relatively easy to store (in a reservoir)

Disadvantages of HEP:

- Flooding can be an often occurrence near HEP plants
- Large volumes of water are needed to generate a relatively small amount of power

Tidal barriers and wave machines are also used in open bodies of water and at river mouths to generate electrical energy from the kinetic energy of the moving water. These man made structures can pose a threat to marine life, especially in estuaries and rivers.

Biomass Energy

Biomass energy comes from living or recently deceased biological material. Farm waste being converted to methane gas and sugar cane being grown for its oil for use in alcohols and fuels are all examples of biomass energy production.

Advantages of Biomass Energy:

- Allows for waste material to be put to good use
- Cheap
- Renewable

Disadvantages of Biomass Energy:

- Contributes to global warming
- May not be available all year round
- Can be difficult to collect and store

Geothermal Energy

Geothermal energy is harnessed from heat beneath the Earth's surface. It often involved drilling deep into geothermal reservoirs. The hot water then rises to the surface as steam or as water which can be used to heat homes.

Advantages of Geothermal Energy:

- Clean
- Power stations do not require a lot of land
- No initial fuel is required
- Cheap

Disadvantages of Geothermal Energy:

- Not suitable in a lot of locations
- Can disrupt underground deposits of dangerous or hazardous materials

Forms of Energy:

- Mechanical
 - Kinetic
 - Potential
- Chemical
- Electrical
- Heat
- Sound
- Magnetic
- Light

The principle of conservation of energy states that energy can neither be created nor destroyed, but only changed from one form to another.

Microgeneration refers to small scale generation of heat or electrical energy, generally on private land by an individual, community or small business. Microgenerators usually consists of either wind turbines, solar-electric panels or small scale HEP stations.

Energy Efficiency

$$\% \text{ Efficiency} = (\text{energy out/energy in}) \times 100$$

Light Bulbs

Many bulbs are very inefficient and lose a lot of energy in the form of heat to the surrounding environment.

Filament Bulbs

Filament bulbs have a tungsten filament wire inside and as an electrical current flows through the wire it begins to glow and emit light.

CFL (Compact Fluorescent Lamp) Bulbs

Contain a mixture of gases that emit light when supplied with an electrical current. They are nearly 4 times more efficient than filament bulbs but contain toxic chemicals which can be released when broke.

Incandescent Bulbs

Also contain a wire filament which glows when heated, however they lose about 95% of their energy in the form of heat loss to the surrounding environment and only 5% of the energy goes to emitting light.

LED (Light Emitting Diode)

One of the most environmentally friendly light sources on the market. LEDs require a very small current to light and do not heat up or contain toxic chemicals.

BER - Building Energy Rating

Certificate indicating the energy performance of a building. Buildings are scored on a scaled of A-G with A rated buildings being the most efficient and G rated being the least.

Petrol vs Diesel

Diesel engines are considered more efficient than petrol engines, especially on longer commutes. Diesel engines produce less carbon dioxide emissions however they do produce other pollutants.

Hybrid cars combine combustion engines with electric motors and batteries. The government are encouraging the purchase of such cars by issuing tax incentives and subsidised charging points nationwide.

Electric Cars

Electric car technology is on the rise however most electric cars still have a much more limited range than their traditional diesel, petrol or hybrid counterparts. Electric cars are often more expensive to purchase, however they will not have to continued expense of petrol or diesel. Electric cars can now recharge their batteries on the go by harsh breaking and accelerating.

The car company Tesla is currently leading the stride in producing affordable consumer entry electrical cars with their *Tesla Model 3*.