Sources of Electricity

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Wind Power

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Wind turbines produce electricity by harnessing the wind's energy. The wind causes a turbine's blades to rotate, which turn a generator inside the turbine. The generator uses this turning energy to produce electricity.

Wind turbines are expensive to build, but once they are up and running there are minimal costs as they require no fuel.

Facts and Stats

Cost of building 1 large turbine:	£3 million
Environmental impact:	Repays carbon footprint (building and installing) within 6 months, but disrupts wildlife and birds. Causes noise and sight pollution
Area taken up:	Even medium turbines can have blades that are around 48m long, and the turbines need to be properly spaced apart
Amount of kW produced per hour:	1,500

$$\frac{\text{KW x Total hours in a year x capacity factor}}{\text{Average amount of energy one house requires in a year}} = \text{kWh}$$

Advantages

- Provides zero-emission energy
- Pays back cost of installation in energy produced

Disadvantages

- Cannot guarantee consistent wind
- Maintenance costs can be high
- Provides nuisance for wildlife (especially birds) and causes sight pollution
- Needs lots of wide open space

Geothermal Energy

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Geothermal energy stations produce electricity using the Earth's natural heat, which is harvested from underground.

This is done through the construction of shafts down towards very hot rocks which exist beneath certain areas of the Earth's surface. Cold water is pumped down to the hot rocks, which produces hot water, as well as huge amounts of steam. The hot water and steam then rise back up to the surface, powering turbines which generate electricity.

Geothermal energy stations can only be set up in certain places – where extremely hot rocks exist which are not too far below the Earth's surface.

Facts and Stats

Cost of building 1 geothermal energy station:	£18 million
Environmental impact:	Geothermal plants can produce low levels of hydrogen sulfide which reacts with oxygen to produce sulfur dioxide (acid rain)
Area taken up:	945,000 square meters – equivalent to 157 football pitches
Amount of kW produced per hour:	30,000

$$\frac{\text{KW x Total hours in a year x capacity factor}}{\text{Average amount of energy one house requires in a year}} = \text{kWh}$$

Advantages

- Reliable energy source
- Little damage to the environment—no pollution
- Geothermal heat can be used to generate electricity to heat to homes directly

Disadvantages

- There are not many places on earth for geothermal plants
- Plants are very expensive to build and it takes a long time to make invested money back through the free energy

Hydroelectricity

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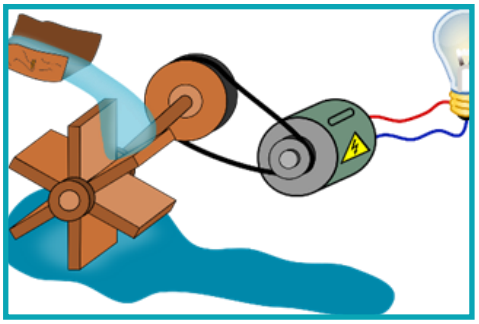
Hydroelectricity generates electricity using energy from the movement of water. There are a few different ways in which this happens.



Most of them involve the construction of dams and pipes which force water to flow quickly through turbines, which then turn and power electricity-producing generators. Another way is for the power of waves to be harnessed – if turbines are installed lengthways across the surfaces of rivers, as the tide comes in, the energy from the waves can be harnessed.

Facts and Stats

Cost of building 1 geothermal energy station:	£20 million
Environmental impact:	4-7 years taken to build so lots of energy used for initial installation. They last between 25-50 years before needing major renovation
Area taken up:	Dam size 3200m2
Amount of kW produced per hour:	500

$$\frac{\text{KW x Total hours in a year x capacity factor}}{\text{Average amount of energy one house requires in a year}} = \text{kWh}$$

Advantages

- Renewable source of energy
- No fuel required, therefore no pollution and small running costs
- Reliable source of energy

Disadvantages

- Loss of habitat for wildlife
- Very expensive to build so takes a while to recoup this cost in free energy
- Unreliable in times of drought

Solar Power

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Solar panels generate electricity using light from the Sun. Solar panels contain silicon crystals which react with light from the Sun to produce an electric current. This current can then be transferred into the National Grid.

Solar panels are initially expensive to install, but require no fuel meaning there are minimal maintenance costs.

Facts and Stats

Cost of building:	£5 million
Environmental impact:	Solar farms take up large spaces and can affect natural habitats for wildlife species
Area taken up:	100,000m2 (19 football pitches)
Amount of kW produced per hour:	5000

$$\frac{\text{KW x Total hours in a year x capacity factor}}{\text{Average amount of energy one house requires in a year}} = \text{kWh}$$

Advantages

- No pollution
- Almost zero running costs once installed
- In certain countries solar power is a very reliable source of energy

Disadvantages

- Solar cells do not generate much energy by themselves—many are needed to generate a considerable amount of power
- Initial costs to install are high
- If there is a sudden increase in demand for energy, output of panels can't be increased due to dependence on the sun

Nuclear Energy

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Nuclear energy originates from the splitting of uranium atoms – a process called fission.

This process generates heat to produce steam, which is used by a turbine generator to generate electricity. As nuclear power plants do not burn fuel, they do not produce greenhouse gas emissions.

Facts and Stats

Cost of building:	£9 billion on average – the power plant being built in Hinckley will cost £20 billion
Environmental impact:	Relatively high carbon footprint during the construction and running of the power plant. The use of uranium as fuel releases high amounts of carbon dioxide during the mining process
Area taken up:	50 acres of land (38 football pitches)
Amount of kW produced per hour:	582,000

$$\frac{\text{KW x Total hours in a year x capacity factor}}{\text{Average amount of energy one house requires in a year}} = \text{kWh}$$

Advantages

- Does not contribute to global warming
- Cost of uranium is very low
- Power station has a very long lifetime, lasting 40-60 years

Disadvantages

- Produces large scale harmful radioactive waste
- More prone to large scale catastrophes
- Nuclear plants are always situated along river banks and coasts as they need cooling water and also return the cooling water back to the river
- Costs of building and safety decommissioning are very high

Capacity Factor

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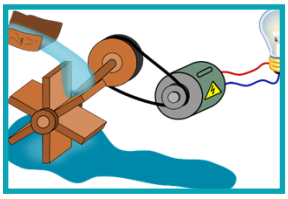
Generation Type		Capacity Factor
Solar Panels		18%
Wind Turbines		25%
Hydroelectric Power Stations		40%
Coal Fired Power Plants		70%
Nuclear Power Plants		89%
Geothermal Power Plants		70%

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