

Energy Resources - Summary

Fill out your table using the information provided by Gemini. Use the template provided to show how you got and checked each answer. Hyperlink to the template to show how you filled out your answer.

Energy resource	How it works	Energy transfer involved	Advantages	Disadvantages
Coal / Oil / Gas	We burn coal in a furnace to generate steam. The steam turns a turbine, which generates electricity.	Chemical (in coal) → Heat store in final use (via electricity in wires.).	Cheap, reliable, simple to build.	Contributes to greenhouse gases, and produces acid rain, non-renewable.
Nuclear				
Hydroelectric				
Tidal				
Wave				
Geothermal				
Wind				
Solar				

Coal fired power station

How it works

I asked Gemini:

Please explain simply how a coal power station works

The Gemini answer is below. The following codes have been used:

Wrong information

Correct information

Not completely wrong, but not fully explained or correct to IGCSE standard.

Chat GPT answer	Comments
<p>A coal-fired power station is a type of power station that generates electricity by burning coal to produce steam, which is then used to generate electricity. Here's a simple explanation of how a coal power station works:</p> <ol style="list-style-type: none">Coal is delivered to the power station and is stored in a coal yard.The coal is then transported to a coal crusher, where it is crushed into a fine powder.The coal powder is fed into a boiler, where it is burned to heat water and produce steam.The steam is sent through a network of pipes to a steam turbine.The steam turbine is connected to a generator, which is a machine that converts mechanical energy into electrical energy. As the steam passes through the turbine, it causes the turbine blades to spin, which in turn generates electricity.The electricity is then sent to a transformer, where it is converted to a high voltage and sent through power lines to homes and businesses.	<p>5 isn't too clear. It should say that the steam turns a turbine, and then the turbine turns the generator.</p> <p>6 and 2 aren't needed for IGCSE.</p>

I hope this helps! Let me know if you have any questions.

The energy change involved

I asked Gemini:

Thanks! What are the energy transfers at each stage?

The Gemini answer is below. The following codes have been used:

Wrong information

Correct information

Not completely wrong, but not fully explained or correct to IGCSE standard.

Chat GPT answer	Comments
<p>In a coal-fired power station, energy is transferred from the coal to the steam to the mechanical energy of the spinning turbine blades, and finally to the electrical energy of the generator.</p>	<p>The first sentence mixes up stores of energy with types of energy; it starts by saying the energy in the coal, but then says the mechanical energy which isn't an IGCSE energy type.</p>
<p>In the coal yard, the chemical energy stored in the coal is transferred to the surroundings as heat energy when the coal is burned.</p>	<p>This energy change takes place in the boiler; in the coal yard, the coal isn't burned so the energy is still chemical energy in the coal.</p>

<p>In the coal crusher, the mechanical energy of the crusher's moving parts is used to crush the coal, transferring some of the energy to the coal in the form of kinetic energy.</p>	<p>This would only be true if the coal continued to move after being crushed.</p>
<p>In the boiler, the chemical energy in the coal is transferred to the water, heating it and turning it into steam. This energy transfer is due to the combustion of the coal, which releases heat energy.</p>	<p>The energy change is chemical into heat energy. This answer again mixes up types of heat transfer and physical locations where the energy is present.</p>
<p>In the steam turbine, the energy of the steam is transferred to the turbine blades, causing them to spin and creating mechanical energy.</p>	<p>Firstly energy can never be created, so ‘creating mechanical energy’ is completely wrong. Secondly, at IGCSE we say kinetic energy. The energy change is heat into kinetic as the hot steam moves and spins the turbines.</p>
<p>In the generator, the mechanical energy of the spinning turbine blades is transferred to the generator's rotating coil, producing a fluctuating magnetic field. This magnetic field then produces an electric current in the generator's stationary coil, transferring the energy to the electrical energy of the current.</p>	<p>It should still read kinetic energy, but that kinetic energy is transferred into electrical energy. We don't need to know how it happens until Y11.</p>
<p>In the transformer, the electrical energy of the current is transferred to the</p>	<p>This isn't required until Y11.</p>

transformer's coil, causing a change in the voltage of the electricity. This energy transfer is due to the electromagnetic induction occurring in the transformer.	
--	--

Advantages

I asked Gemini:

<i>what are the advantages of fossil fuel power stations?</i>

The Gemini answer is below. The following codes have been used:

Wrong information

Correct information

Not completely wrong, but not fully explained or correct to IGCSE standard.

Chat GPT answer	Comments
Fossil fuel power stations, such as coal-fired, natural gas, and oil-fired power stations, have several advantages over other types of power stations:	
Fossil fuels are widely available and inexpensive, which makes them a cost-effective energy source.	
Fossil fuel power stations are relatively simple to build and operate, and they can be scaled up or down to meet changing energy demands.	This is mostly true, however coal power stations do take some time to increase or decrease power output.

	Gas power stations can be turned on and off very quickly.
Fossil fuel power stations can be built quickly, so they can be used to meet sudden increases in energy demand.	This isn't really any more true than any other type of power station, and big stations still take several years to build.
Fossil fuel power stations have a high energy density, which means they can generate a lot of electricity from a small amount of fuel.	However nuclear energy is several thousand times more dense than fossil fuels.
Fossil fuel power stations can operate continuously, so they can provide a reliable source of electricity.	
However, it's important to note that fossil fuel power stations also have significant disadvantages, including air pollution, greenhouse gas emissions, and the risk of oil spills and coal mining accidents. These environmental impacts have led to a push towards renewable energy sources, such as solar and wind power, which do not produce greenhouse gases or other types of pollution.	This isn't the question we asked.

Disadvantages

I asked Gemini:

Can you tell me more disadvantages?

The Gemini answer is below. The following codes have been used:

Wrong information

Correct information

Not completely wrong, but not fully explained or correct to IGCSE standard.

Chat GPT answer	Comments
<p>Sure, here are some additional disadvantages of fossil fuel power stations:</p> <p>Fossil fuel power stations emit large amounts of greenhouse gases, such as carbon dioxide and methane, when they burn fossil fuels. These emissions contribute to global warming and climate change.</p>	<p>Methane release is quite unlikely unless there are leaks in gas power stations.</p>
<p>Fossil fuel power stations can produce air pollution, including particulates, sulfur dioxide, nitrogen oxides, and other pollutants. This pollution can have negative impacts on human health, including respiratory and cardiovascular diseases.</p>	<p>This is true, but it misses out that sulfur dioxide and nitrogen dioxide dissolves in clouds to form sulfuric and nitric acid, which cause acid rain and habitat</p>

	destruction.
Fossil fuel power stations rely on finite resources, such as coal, oil, and natural gas, which will eventually run out. This means that we will need to find alternative energy sources in the future.	At IGCSE we should call these non-renewable. Renewal means that it is produced as quickly as we use it.
Fossil fuel power stations can be expensive to build and maintain, as they require significant infrastructure and specialized equipment.	It's interesting that this contradicts the previous answer that said they were cheap!
Fossil fuel power stations can be vulnerable to natural disasters, such as hurricanes and earthquakes, which can disrupt their operation and cause damage.	This is technically true, but also true of any type of power station.
The extraction and transportation of fossil fuels can have negative impacts on the environment and local communities. For example, coal mining can damage ecosystems and lead to soil erosion, and oil spills can harm marine life and coastal communities.	