

National and global energy resources

4.1.3 · Energy · revision notes

The energy resources we use for transport, generating electricity and heating, and how they compare. You need to sort resources into renewable and non-renewable, explain why some are more reliable than others, describe their environmental effects and explain trends in how we use them. Expect short recall questions, data questions and 6-mark 'evaluate' questions.

Key facts

- | | |
|---|---|
| ■ Non-renewable: coal, oil, natural gas (fossil fuels) and nuclear fuel | ■ Renewable: bio-fuel, wind, hydro-electricity, geothermal, tides, the Sun, water waves |
| ■ Renewable = being (or can be) replenished as it is used | ■ Uses: transport, electricity generation, heating |
| ■ Reliable: fossil fuels, nuclear, hydro-electricity, geothermal; tides are predictable | ■ Unreliable: wind, solar, waves (depend on the weather) |
| ■ Burning fossil fuels: carbon dioxide → global warming; sulfur dioxide → acid rain | ■ Nuclear: no carbon dioxide when generating, but long-lasting radioactive waste |

Notes

Energy resources and their uses

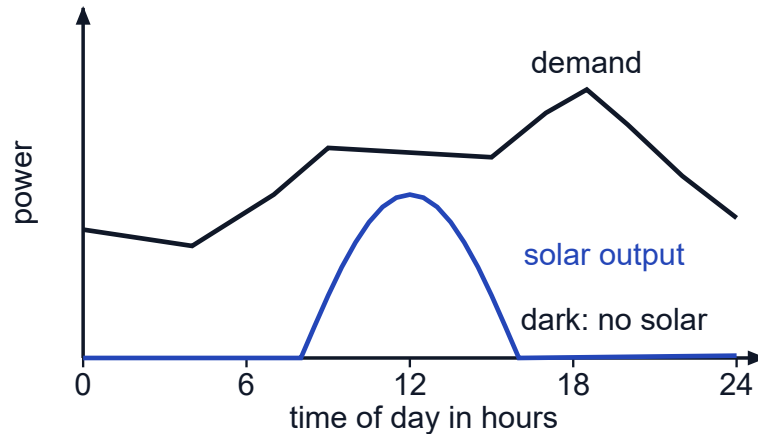
- The main energy resources: fossil fuels (coal, oil and natural gas), nuclear fuel, bio-fuel, wind, hydro-electricity, geothermal, the tides, the Sun and water waves.
- **Transport:** mainly petrol and diesel (from oil), plus bio-fuels and electricity.
- **Electricity generation:** any of the resources can be used.
- **Heating:** mainly natural gas, oil and electricity, plus bio-fuels such as wood, solar water heaters and geothermal.

Renewable or non-renewable

- A **renewable** resource is one that is being (or can be) replenished as it is used: bio-fuel, wind, hydro-electricity, geothermal, the tides, the Sun and water waves.
- **Non-renewable** resources will run out one day: coal, oil, natural gas and nuclear fuel.

Reliability

- Fossil fuels and nuclear fuel are reliable: they can generate electricity at any time. Gas power stations can also be started quickly when demand rises.
- Hydro-electricity and geothermal are reliable too, but only work in suitable places.
- Tides are predictable, but the output changes during the day.
- Wind, solar and waves are unreliable: they depend on the weather (and solar on the time of day), so their output cannot be increased to meet demand.



Sketch (no scale): solar output cannot be increased to meet the evening peak in demand.

Environmental impact

- Burning fossil fuels releases **carbon dioxide**, which contributes to global warming (climate change). Burning coal and oil can also release sulfur dioxide, which causes acid rain.
- Nuclear power releases no carbon dioxide when generating, but it makes radioactive waste that stays dangerous for a very long time.
- Bio-fuels release carbon dioxide when burned, but the plants took in carbon dioxide as they grew. Growing them uses land that could grow food.
- Renewables release no carbon dioxide while running, but still have effects: wind turbines are noisy and spoil views; hydro-electric dams flood valleys and destroy habitats; tidal barrages affect estuary wildlife.

Trends in energy use

- World energy demand keeps rising as the population grows and more countries become industrialised.
- In the UK, much less electricity now comes from coal and much more from renewables, especially wind, to reduce carbon dioxide emissions.
- Science can identify environmental problems, but cannot always deal with them because of political, social, ethical or economic reasons, e.g. cost, or people objecting to a wind farm near them.

How to answer each type of question

Recall: identify renewable resources

1 to 2 marks

Grade 3

1. Remember the only non-renewables are coal, oil, natural gas and nuclear fuel.
2. Tick exactly the number of boxes asked for: an extra tick loses marks.

Example. Which **two** energy resources are renewable?

Tick (✓) **two** boxes.

- ☐ Coal
- ☐ Geothermal
- ☐ Natural gas
- ☐ Nuclear fuel
- ☐ Tides

Model answer. Geothermal (1)

Tides (1)

Explain why a resource is not reliable

2 marks

Grade 5

1. Say what the output depends on: the weather, the time of day or the tides.
2. Link it to demand: the output cannot be increased when more electricity is needed.

Example. Explain why solar panels cannot be relied on to supply electricity on winter evenings.

Model answer. It is dark in the evening (and light levels are low in winter), so the panels generate little or no electricity (1). Their output cannot be increased to meet demand, which is high on winter evenings (1).

Don't lose marks

- ✗ Saying nuclear fuel is renewable, or that nuclear power stations release carbon dioxide or cause acid rain when they generate electricity.
- ✗ Defining renewable as 'can be reused'. It means the resource is replenished as it is used.
- ✗ Saying renewables cause 'no pollution' or 'no environmental impact'. They release no carbon dioxide while running, but they have other effects.
- ✗ Mixing up the effects: carbon dioxide → global warming; sulfur dioxide → acid rain.
- ✗ Vague answers such as 'bad for the environment'. Name the effect.

More tips

Memory tricks

- There are only four non-renewables: coal, oil, gas and nuclear fuel. Everything else on the list is renewable.
- Renewables: 'Some Wild Wet Tides Give Huge Breakers': Sun, Wind, Waves, Tides, Geothermal, Hydro-electricity, Bio-fuel.
- Reliability test: does it depend on the weather? Then it is unreliable. Tides are predictable, but the output still varies.
- If it is burned (fossil fuels or bio-fuel), it releases carbon dioxide.

Exam technique

- In 'evaluate' questions, give points for and against each option, then a conclusion with a reason. A conclusion on its own earns few marks.
- Quote figures from any table or graph in the question.
- Name the gas and its effect: 'carbon dioxide, which contributes to global warming'.
- You don't need to describe how power stations generate electricity: focus on uses, reliability and environmental impact.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3

List the main energy resources

Fossil fuels (coal, oil, gas), nuclear fuel, bio-fuel, wind, hydro-electricity, geothermal, the tides, the Sun and water waves.

Grade 3

Define a renewable energy resource

A resource that is being (or can be) replenished as it is used.

Grade 4

Sort resources into renewable and non-renewable

Coal, oil, gas and nuclear fuel are non-renewable; all the others are renewable.

Grade 4

Link energy resources to their uses

The three main uses are transport, electricity generation and heating.

Grade 5

Explain why some resources are more reliable

Wind, solar and waves depend on the weather (and solar on the time of day); fossil fuels and nuclear do not.

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