Electricity resources: fossil and nuclear fuels

Student activity • observation and reasoning

YEAR 10 / LESSON 30 / PHYSICS ONLY

The question

Which parts of fossil-fuel and nuclear electricity generation are similar?

Build two annotated process diagrams and compare reliability, emissions and waste without confusing a fuel resource with electricity.

Equipment

- Booklet, pencil, ruler and labelled process-diagram cards

Desk-based diagram and evidence activity. No fuels are burned and no radioactive sources, steam boilers or mains circuits are used.

Course coverage: Physics only: 4.18P, 4.19P. Non-renewable electricity resources.

Plan, model or apparatus sketch

Draw a labelled setup or force diagram; include the measured quantities.

Method and reasoning

Read the whole sequence before starting

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1. Draw a fossil-fuel thermal power station: fuel, heating water, steam turbine, generator, electrical transfer and cooling system.

2. Draw a nuclear fission station with a reactor providing heating. Keep the turbine and generator functions distinct from the reactor.

3. Label the initial energy stores and the transfer pathways. Show that a generator does not create energy and that not all input energy becomes useful electrical output.

4. Compare fuel availability, controllability, operational carbon dioxide emissions, waste, construction and decommissioning. Distinguish operational emissions from whole-life emissions.

5. Use a labelled practice case: 1 000 MJ input yields 350 MJ electrical output. Calculate efficiency and account for the remaining energy.

6. Write a recommendation for a fictional town needing a steady supply, with two reasons and one limitation. State that a real decision needs location-specific evidence.

Cleanup

- Return cards and retain the completed comparisons.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Practice numbers are invented: 1 000 MJ input and 350 MJ useful electrical output. Fossil fuels and uranium are non-renewable on human timescales. Nuclear generation has low operational carbon dioxide emissions but produces radioactive waste requiring controlled management.

Feature	Fossil fuel	Nuclear
Initial resource		
Heating process		
Turbine / generator		
Emissions and waste		
Reliability / limitation		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. What does the turbine do?

2. What does the generator do?

3. What replaces combustion in a nuclear station?

4. Calculate the practice efficiency.

5. Does low operational carbon dioxide mean no environmental impact?

6. Why are both fuels non-renewable?