futureme
North East Collaborative Outreach Programme

nustem

Energy Resources

Natural gas is the most widely-used fuel in the UK. Almost half of the gas we use for energy purposes is imported through pipes from Europe.

Gas pipes can be hundreds of kilometres long. They are designed and constructed in a way that minimises the risk of gas leaking or causing explosions. Penspen, based in Newcastle-upon-Tyne, is a company which helps manage pipelines for gas companies by carrying out risk assessments, maintenance, and emergency repairs.

Keeping gas pipelines in good and safe condition is an important job in ensuring the UK's energy needs can be met.

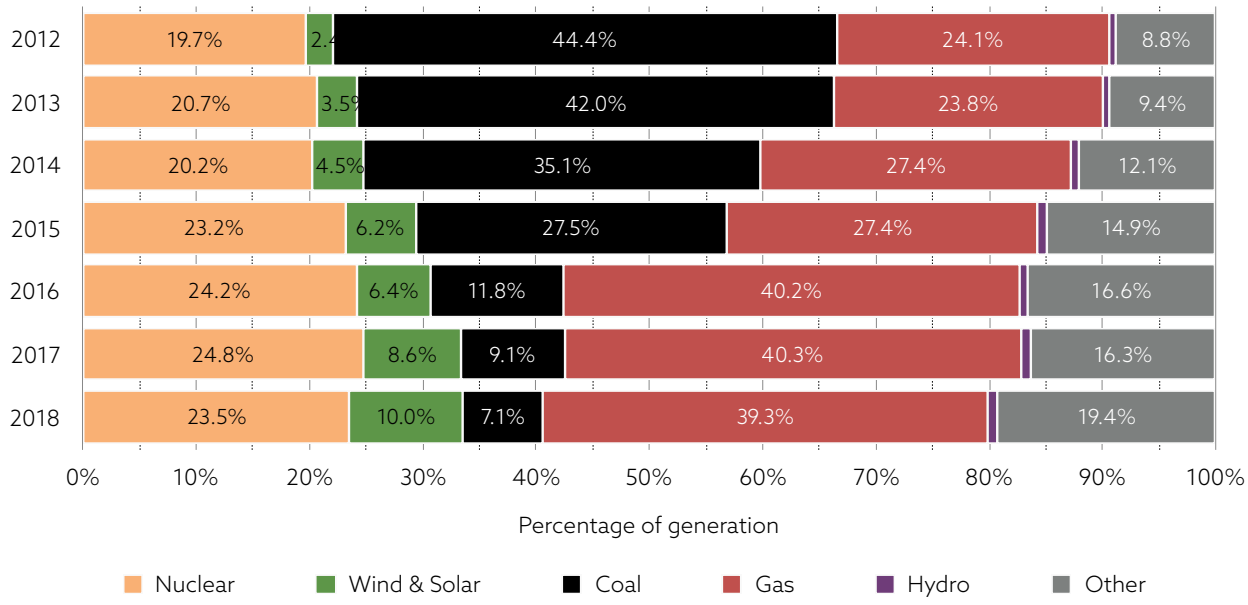
Image credit: courtesy Penspen Ltd.

Pipes used for transporting gas

Know

1. What does it mean if an energy resource is described as "non-renewable"?
2. Write down four examples of non-renewable energy resources.
3. Write down four examples of renewable energy resources.
4. Discuss the environmental impact of using fossil fuels.

Electricity generation fuel inputs: 2012–2018



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Northumbria University NEWCASTLE

Apply

The chart on the previous page shows the different energy resources used to generate electricity in the UK in recent years (data calculated from Department for Business, Energy & Industrial Strategy, Historical Energy Data: https://www.gov.uk/government/statistical-data-sets/historical-electricity-data).

5. Name the year in which there was the largest percentage of gas used in electricity generation.
6. What was the total percentage of electricity generated from nuclear, coal and gas in 2017?
7. Give one advantage and one disadvantage of using solar panels to generate electricity rather than gas fired power stations.
8. Suggest in which year the most pollution due to electricity generation was emitted. Give a reason for your answer.
9. Wind power provides an increasing proportion of the electricity that is generated. A single wind turbine has a maximum power output of 2 MW (2 million watts).
   Calculate the energy output when the turbine generates at maximum power for 2 hours.

Extend

10. The density of natural gas is 0.717 kg/m^3. The average mass of gas arriving from one international gas pipe is 63 000 kg per second.
    Calculate the volume of gas arriving through the pipe every second. Give your answer to 2 significant figures.

Answers: Energy Resources

1. A non-renewable energy resource is one that is *not* being (or cannot be) replenished at the same rate as it is being used (and will eventually run out).
2. Coal, oil, gas, nuclear fuels (uranium and/or plutonium).
3. Any four from: wind, tidal, solar, biofuel, wave, hydroelectric, geothermal.
4. Fossil fuels release CO_2 when burned. This leads to the greenhouse effect, which contributes to climate change / global warming. Burning coal and oil also releases sulfur dioxide which leads to acid rain.
5. 2017
6. 24.8 + 9.1 + 40.3 = 74.2%
7. Advantages: solar is... renewable
   does not produce CO_2
   no costs for fuel (free after initial installation)
   no transportation costs or production of CO_2 from transport of fuel.
   Disadvantages: solar is... not available at all times
   an unreliable source
   can only work in sunny places
   needs a lot of solar panels to generate much electricity
8. 2012 – highest percentage of coal and highest percentage of natural gas used.
9. Rearrangement: $\text{Power} = \text{Energy}/\text{Time}$

$$E = P \times t$$
$$E = 2\,000\,000 \times (2 \times 60 \times 60)$$
$$= 1.44 \times 10^{10}\ \text{J}$$

10. Rearrangement: $\text{Density} = \text{Mass}/\text{Volume}$
    $\text{Volume} = \text{Mass}/\text{Density}$

$$\text{Volume of gas per second} = \frac{63\,000}{0.717}$$
$$= 88\,000\ \text{m}^3 \ \text{(to 2 sf.)}$$