

# Hydraulic Fracturing or 'Fracking'

## At a glance

	Content summary	National Curriculum links	Activities
<b>Lesson 1</b>	Finding out about fracking as a method of obtaining an energy source	The Earth's resources are limited. Production of carbon dioxide and impact on climate	Activity A: What is 'fracking'?
<b>Lesson 2</b>	Debating whether fracking should or should not be permitted	Presenting reasoned explanations using evidence. Evaluating evidence. Evaluating risks	Activity B: A fracking debate

## Background and National Curriculum links

The activities are designed to take place over one or two Year 7-9 lessons. The activities offer opportunities to discuss how to ensure that the energy needs of a modern society can be met.

### Lesson 1

Students can be introduced to the science involved in fracking, including why this is regarded as controversial as well as potentially advantageous. This can be connected to discussion of the need to satisfy energy requirements to sustain human life on Earth, balancing this with the finite nature of the Earth's resources and the impact of human activity on the climate.

#### National Curriculum

- Understanding that the Earth's resources are limited.
- Production of carbon dioxide and impact on climate.

### Lesson 2

Students can debate fracking using a statement. Two teams of students raise arguments for and against fracking in a structured debate. Everyone votes based on the arguments raised.

#### National Curriculum

- Presenting reasoned explanations using evidence.
- Evaluating evidence.
- Evaluating risks.

## Teacher subject knowledge

For these lessons, it would be helpful to have some understanding and knowledge of the principles of fracking, or shale gas extraction.

## Cross-curricular links: technological developments

The development of fracking as an industry requires relatively new technology. Discussion with technology teachers and perhaps a local STEM Ambassador (see Resources) may help students understand how creativity, invention and testing results in technological progress. Negative arguments about fracking arise because the technology is developing, so faults and imperfections occur. This leads to fracking being widely reported as 'dangerous' or 'hazardous'. Fracking allows discussion of differences between hazards and risks.

Tracing the history of technological developments may be interesting and helpful to illustrate industrial and societal progress. For example, flight relied on technological developments from the early stages of flying balloons in the 1780s. Flying is now regarded as the safest form of transport. Mechanised ground transport started with hand-drawn carts, progressed to using animals to pull a cart, trap or carriage, to Stephenson's Rocket, a precursor of the train in 1829, followed by the internal combustion engine in 1859. All these required trial and error in development.

The impact of burning fossil fuels on climate change can be discussed. Fracking builds on the UK's reliance on fossil fuels. North Sea gas and oil supplies are close to exhaustion, so alternatives are needed. The UK imports large quantities of gas to meet domestic needs for industry, power generation, and domestic heating and cooking. Our society will continue to need energy sources. Students can be prompted to discuss if shale gas can help meet our energy needs alongside renewable resources. Students should consider if banning or permitting fracking is the best option.

## Student background knowledge

Students do not need any specific scientific knowledge. They may wish to draw on knowledge taught in other lessons, for example, geography.

## Resources and timing

Two lessons are recommended. Time is required for students to prepare arguments to raise in the debate in lesson 2.

## Technical requirements

The activities do not require a laboratory.

## Lesson 1

### Activity A: What is 'fracking'?

#### Explore students' prior knowledge

Ask students what they know about fracking. Students may have heard of fracking but not know what it is. They may hold specific views about fracking, even if they don't know what it is. Explain that there will be an opportunity to discuss these views, but the important point is to understand the science first. The discussion can be connected to the balance between satisfying energy needs, depletion of the Earth's finite resources and impact of human activity on climate change.

#### Video about fracking

Students need access to this video, which explains the process:

[https://www.youtube.com/watch?v=Tudal\\_4x4F0](https://www.youtube.com/watch?v=Tudal_4x4F0).

#### The pros and cons of fracking

Provide each student with a copy of the fracking statements on the sheet below.

Ask students to:

- separate the statements into those in favour (supportive) of fracking and those against;
- consider the *quality* of argument in the statements. Identify statements that do not present any evidence.

Review students' opinions about these statements. Table 1 lists arguments in favour of fracking, with comments. Table 2 lists arguments against fracking, with comments.

Table 1: Arguments in favour of fracking.

No.	Statements in favour	Comments
1	In the US and Canada, fracking means that gas supplies can be guaranteed for about 100 years. In the UK we could be self-sufficient in gas supplies.	North Sea gas will run out in about 20 years. The UK already has to import a lot of gas, for example, from Norway and Russia. Being reliant on other countries is risky.
2	The shale gas industry could create up to 64,000 quality jobs in rural areas in the UK.	New jobs may be important in rural areas where employment can be difficult to find.
3	Shale gas from fracking has the potential to be a new domestic energy source.	The amount of energy we need (for example, if everyone drives electric cars) cannot be met from renewable sources. We will need to continue to use some fossil fuels.
4	Fracking will keep gas prices low for domestic consumers.	Rising energy prices are a concern for many people. Finding a way to keep costs low is very important.

Table 1 cont.: Arguments in favour of fracking.

No.	Statements in favour	Comments
5	Gas from fracking generates electricity at half the CO <sub>2</sub> emissions of coal.	Shale gas is an efficient source. Using shale gas maintains our low levels of coal as a source of energy.
6	Any pollution from fracking is because of bad practice. Fracking is not, in itself, risky.	The technology to extract shale gas is developing so it is likely to become more efficient and smoothly operated over time.
7	The amount of water involved in fracking is less than half that required to extract coal by mining.	Coal is the 'dirtiest' fossil fuel. Minimising our use of coal is vital for helping to meet climate change targets.

Table 2: Arguments against fracking.

No.	Statements against	Comments
1	Fracking uses huge amounts of water. Water is expensive to transport. Also, this may cause water shortages where groundwater supplies are used for fracking.	Climate change is already causing alterations to our rainfall patterns. Droughts are likely to be more common than we have experienced previously. We cannot put groundwater supplies at risk.
2	Chemicals that can cause cancer are used in fracking. These may escape and contaminate groundwater around the fracking site.	There have been leaks and contamination of groundwater at fracking sites in Pennsylvania in the United States.
3	Fracking is distracting energy firms and governments from investing in renewable sources of energy, and encouraging continued reliance on fossil fuels.	Investing in fracking at the expense of renewable energy production means that solar, wind and tidal power will be less well-developed, so our reliance on fossil fuels won't change.
4	To deal with the climate crisis, we need to move away from fossil fuels, not making it easier for companies to dig up more.	To reach our climate change goals, serious investment in renewable energy sources is required. See previous point.
5	Fracking is undermining local democracy and its widespread use in England would industrialise our countryside.	Critics say that fracking will increase noise pollution, air pollution, heavy traffic and turn our countryside into industrial areas.
6	There is concern that fracking has caused earth tremors in nearby areas. The tremors are potentially damaging.	Tremors of 2.3, 1.4 and 2.9 magnitude have been recorded in the UK between 2011 – 2019. Fracking sites also damage wildlife habitats. In the UK, 293 fracking licenses in 2015 were at sites of special scientific interest and another 188 were at nature reserves.
7	This is an industry that has not proven its case.	This comment isn't a clear-cut statement, but is the type of phrase that is sometimes used to summarise arguments.

Discuss the difference between a risk and a hazard.

- A hazard is anything that has the potential to cause harm.
- A risk is that a hazard will cause harm to someone or something.

Discuss if fracking is a risk, a hazard or both.

- Fracking is both a risk and a hazard.

Discuss if we should do something even if it is a risk and a hazard. Health and Safety laws offer some protection and risk assessments are needed.

At the end of the lesson, prepare debating teams for the next lesson. See Activity B below.

## Lesson 2

### Activity B: A fracking debate

The debate requires two tables on opposing sides at the front of a room, each with sufficient chairs for the debating team members to sit. An independent chair can take a central position. A lectern for speakers adds solemnity.

Run a class debate on fracking, discussing the motion:

'This class believes that the Government should permit fracking and use of shale gas as an energy source'.

The motion is phrased positively to encourage students to argue both sides.

To run the debate:

1. Invite students to form two teams to debate the topic
  - Pro-fracking – i.e. supporting the motion
  - Anti-fracking – i.e. against the motion
2. Three students can be invited as speakers for each team. They each have a role:
  - a. Speaker - makes the opening statement in speech up to 3 minutes long.
  - b. Questioner - questions the opposing team for up to 5 minutes.
  - c. Summariser – summarises the arguments for up to 3 minutes.

All three team members can respond to questions from anyone present.

3. A running order is:
  - Opening statement by the supporting team.
  - Opening statement by the opposing team.
  - Questions raised of the supporting team by the opposing team.
  - Questions raised of the opposing team by the supporting team.
  - Summary statement by the opposing team.
  - Summary statement by the supporting team.

4. After the speeches and questions, everyone present votes on the motion.
5. Have an independent chair. This could be a sixth form student, another teacher (a senior leader), or a visitor with an interest in STEM issues, such as a STEM Ambassador (see Resources). The chair will keep time and manage the questions fairly.
6. After the vote, the chair will announce the result. The motion is either supported or defeated. Debrief the teams by saying that they are no longer representing their cases. Remember to diffuse arguments that may continue after the lesson.
7. Ask students who are not in the debating teams to write a short account of the debate, as if they are journalists. They could interview team members and the chair about the debate to gather information for their report.

### Resources

- STEM ambassadors are volunteers from a wide range of science, technology and engineering roles who give their time freely to support educational activities. They can be accessed via the STEM Learning Centre:  
<https://www.stem.org.uk/stem-ambassadors>.
- The English-Speaking Union run a debating competition called Schools' Mace. The website includes a video describing the debate format used in this completion.  
[Schools' Mace - ESU](#)
- This webpage gives pros and cons of the fracking process:  
[13 Key Fracking Pros & Cons in the UK \(selectra.co.uk\)](#)

### Extension

- Investigate the history of mining coal. This is often associated with local traditions and communities.



## Activities

### Lesson 1

#### Activity A: What is 'fracking'?

##### The 'fracking' process

Fracking is a shortened form of 'hydraulic fracturing'. This process releases gas and oil deposits from shale rock. Shale is deep under the Earth's surface. Fracking takes place at depths of 1-3 km. The picture below shows a fracking site in the US.

##### What is the difference between a risk and a hazard?

- A hazard is anything that has the potential to cause harm.
- A risk is that a hazard will cause harm to someone or something.

##### Give an example of something that is a 'risk' and something that is a 'hazard'.

- Should we do something even if it is risky and / hazardous? If so, why?  
How can we make something safe to do?

##### Is fracking a risk or a hazard?

##### 'Pros' and 'cons' of fracking

There are arguments for and against fracking.

To find out more about these arguments, a set of statements about fracking is provided.

Discuss which 'side' seems to present the stronger arguments.



Source: [image of fracking uk creative commons - Bing images](#)

Source: [e2dbeb4a-e2dbeb4a-frack-free-zone-signs-blackpool..jpg \(640x444\) \(storage.googleapis.com\)](https://storage.googleapis.com/e2dbeb4a-e2dbeb4a-frack-free-zone-signs-blackpool..jpg)



Which arguments do you agree or disagree with?

Which statements require further evidence to make a decision about agreement/disagreement? Look for statements that:

- sound suspiciously optimistic, e.g. Table 1 statements 1, 2;
- seem to just be saying something for the sake of it, e.g. Table 2 statement 7;
- make very general statements that sound dramatic, e.g. Table 2 statement 5.

Put the statements in a table (like the one below) showing which are 'For' and which are 'Against'. Write what you think about the statements. Do you agree or disagree with the statements? Say why.

Statement	For / against	Comment



## Statements in favour of and against fracking

Fracking uses huge amounts of water. Water is expensive to transport. Also, this may cause water shortages where groundwater supplies are used for fracking.

Fracking is distracting energy firms and governments from investing in renewable sources of energy, and encouraging continued reliance on fossil fuels.

Chemicals that can cause cancer may escape during drilling and contaminate groundwater around the fracking site.

Gas from fracking generates electricity at half the CO<sub>2</sub> emissions of coal.

This is an industry that has not proven its case.

The shale gas industry could create 64,000 quality jobs in the UK.

In the US and Canada fracking means that gas supplies can be guaranteed for about 100 years.

Fracking will keep gas prices low for domestic consumers.

Any pollution from fracking is because of bad practice. Fracking is not, in itself, risky.

To deal with climate change, we need to move away from fossil fuels, not make it easier for companies to dig up more.

Fracking is undermining local democracy and its use in England would industrialise our countryside.

The amount of water involved in fracking is less than half that needed to extract coal by mining.

Fracking has caused earth tremors. This has been distressing for those living nearby. The tremors are potentially damaging.

Shale gas from fracking has the potential to be a new domestic energy source.

Lesson 2:

Activity B: A fracking debate

In class debate the statement:

'This class, believes that the Government should permit fracking and use of shale gas as an energy source'.

To debate means to argue using public-speaking, listening to speeches that present both sides.

The audience will vote on the statement, and the side with the most votes has 'won' the debate.

It is important to listen to the arguments and the quality of evidence used before voting.

After the debate, discuss: *What were the arguments that won or lost the case?*

Remember not to carry on arguing after the lesson!