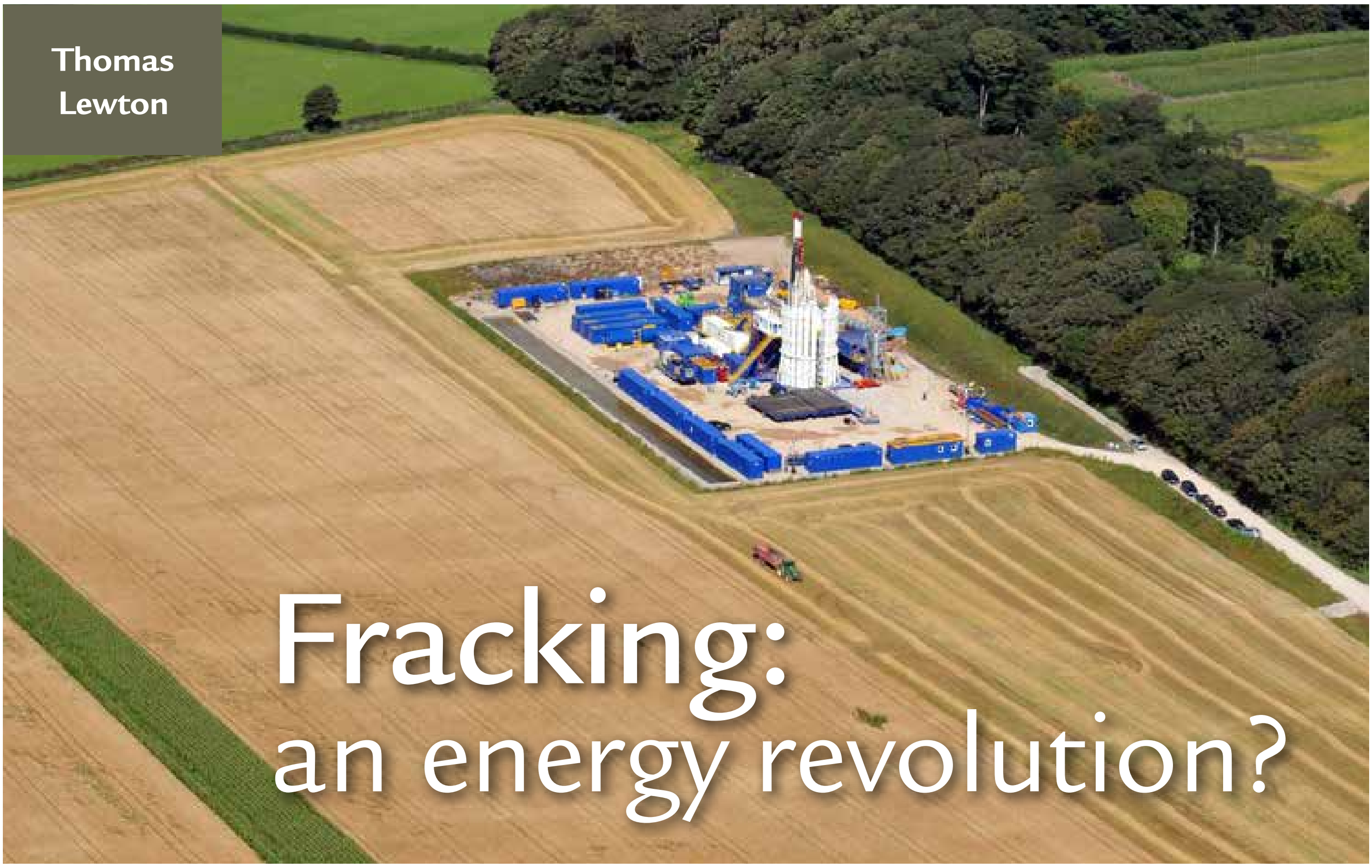
Thomas Lewton



Fracking: an energy revolution?

The UK's first fracking site near Singleton in Lancashire.

In spring 2011 two minor earthquakes were experienced in the Blackpool area of north England. The quakes had magnitudes 1.5 and 2.3, strong enough to be detected by humans and even to make a few houses shake. Such earthquakes are a regular occurrence in the UK, with roughly 20 detected by seismologists each year. But what makes the Blackpool earthquakes different is that they are very likely to have been caused by a manmade activity: fracking.

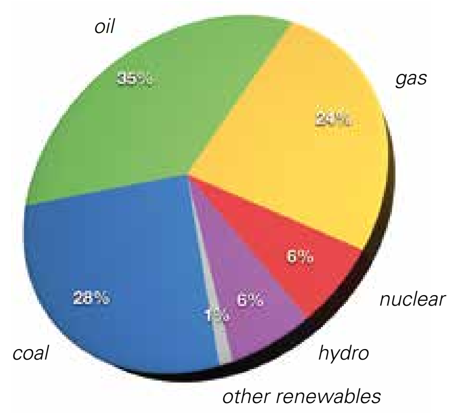
Hydraulic fracturing, commonly known as fracking, is the process of breaking up rocks deep underground using high-pressure water mixed with sand and chemicals. The process has been used for decades in the energy industry to free oil and gas trapped in rock formations. However, recently the technology has received a lot of attention for a new application in releasing natural gas from a type of sedimentary rock called shale.

The impact has been most dramatic in the United States. Over the last five years natural gas production in the US has increased by a quarter. As a result the price of natural gas in the US has halved in only three years, making it a cheaper way to produce electricity than coal.

Yet questions have been raised over the environmental impact and safety of fracking technology. As well as the potential to cause earthquakes, some people believe that fracking is contaminating drinking water. Dramatic images of tap water being set alight have given rise a large and vocal anti-fracking protest movement. All energy sources come with some risk to safety and to the environment, but do those of fracking outweigh the economic benefits?

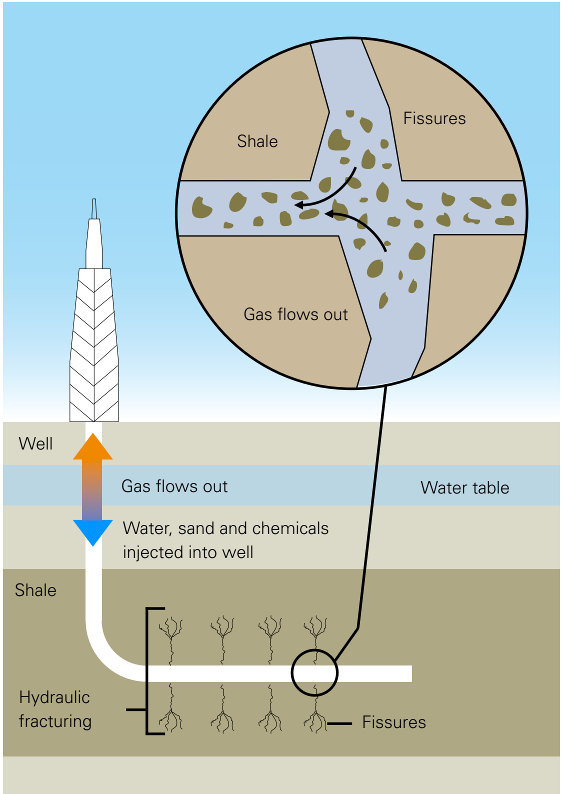
Fracking technology

Oil and gas are made from hydrocarbon molecules, chains or rings of carbon atoms with hydrogen atoms attached. When burnt in air the hydrocarbon reacts with oxygen to form carbon dioxide and water vapour. In the process a large amount of energy is released. We use this energy to power our cars, to produce electricity and to heat our homes.



Oil and gas account for over half of the energy consumed around the world.

Shale gas has been used in a small way since the 19th century. There are huge reserves across the world, yet most shale gas is trapped so tightly inside the rock that, for a long time, it was too costly to release it. George Mitchell, an American businessman, experimented with fracking technology when most believed shale gas to be a pipe dream.



Standard practice was to use high-pressure water to force open rock formations and release the natural gas. Adding sand to the mixture then kept the rock fractures open when the water pump was turned off. Mitchell's innovation was to add chemicals to the water that enabled the fluid to be pumped into the well much faster and so fracture it more effectively. This refinement made it economical to extract natural gas from shale, providing a new source of cheap and abundant energy.

Chemicals for fracking

There are many different chemicals used in fracking. Some of the important types are:

- acids to clean and initiate fissures
- alcohols and guar gum to improve viscosity
- friction reducers, such as polyacrylamide.

In the UK, the Environment Agency must approve these chemicals before they are used. There have been protests that drinking water supplies have been contaminated by these chemicals. No one has yet provided conclusive evidence that this can happen, but the residents of fracking regions remain understandably concerned.

Environmental friend or foe?

Although economically beneficial, some argue that the development of shale gas may come at too high a cost to the environment and to our health. Fracking has probably caused minor earthquakes. The tremors are too small to be a danger to humans, but the same violent process of breaking apart rock formations could let fracking chemicals and natural gas seep into groundwater aquifers, from which we take our drinking water – see Box Chemicals for fracking.

Another problem arises from the large amount of water needed to fracture shale rock. If shale gas were produced in an area suffering a drought, it could take much needed water away from the already parched environment.

But shale gas isn't all bad news for the environment: when burned, natural gas produces far less carbon dioxide than an equivalent amount of oil or coal. As a result of switching power station fuel from coal to natural gas, carbon dioxide emissions in the US have decreased to their lowest level in 20 years. In the short term, the development of shale gas could help to reduce global carbon dioxide emissions, and so reduce the risk of climate change.

Anti-fracking protesters fear that groundwater may become contaminated.

A global revolution?

Estimates of natural gas reserves have doubled because of the newly developed technologies that can extract shale gas. Some seven quadrillion (a seven with 15 zeros following it) cubic feet of shale gas is now classified as 'technically recoverable'. Vast new reserves have been found across the world, from China to Argentina to Poland. Even the UK holds shale gas reserves worth around £1.5 trillion.

Before these reserves can be developed, the environmental and safety concerns of the public will have to be allayed. But whether these reserves are developed will depend on the tough decisions societies must make about how to support our future energy needs, and what the risks and rewards of each energy source are.

Thomas Lewton is a researcher on TV science programmes.