

# DILEMMA: IS NUCLEAR ENERGY THE RIGHT OPTION TO BEAT CLIMATE CHANGE?

## THE DILEMMA



Despite the lockdowns caused by the COVID-19 pandemic, 2020 was not a good year for slowing down climate change. Data from the USA suggests it may well have been Earth's warmest year ever.

The first nine months of last year saw record amounts of three greenhouse gases – CO<sub>2</sub>, methane and nitrous oxide – recorded in the atmosphere. Surface temperatures on Earth have warmed by 0.9°C since the year 1970. World leaders agree the time for action to prevent the devastating effects of climate change is now.

In November this year, the UK hosts the United Nations (UN) Climate Change Conference, known as COP26. The event brings together countries from all around the world, with the aim of discussing how to achieve the goals of the Paris Agreement and the UN Framework Convention on Climate Change.

Those agreements aim to tackle climate change by making sure the average global temperature doesn't rise by more than 1.5°C, compared to pre-industrial levels. The type of energy we use is a major contributing factor to climate change. Fossil fuels, such as oil and coal contribute heavily to global warming. Therefore some governments, including the UK, consider nuclear energy to be a better, greener alternative.

The British Government has, in fact, recently re-started talks about opening a brand new nuclear power plant called Sizewell C in Suffolk. The site would be built by French energy company EDF, in association with the Chinese government-owned nuclear power group, CGN. The project will cost



around £20 billion and create thousands of jobs in the local community. It could generate 3.2 gigawatts of electricity, enough to provide 7% of the UK's energy demands. It would be the first new nuclear plant in the UK since 1995.

The UK opened the world's first commercial nuclear energy plant in the 1950s, and it has remained an important source of our power ever since. It can be expensive and there are safety risks, but it can also be very efficient and less damaging for the environment than fossil fuels. But in the age of green energy – using the sun, wind and sea to generate electricity – should we still be relying on nuclear?

Is nuclear energy a good way of fighting climate change, or should we be moving urgently to 100% renewable sources?

## HOW ENERGY WORKS

For the past 100 years or so, electric energy has powered most of the world. Without it, we wouldn't function, because we need energy for virtually everything. From lights to communications to food production to construction, electric energy makes things happen in our homes, schools, factories, hospitals and offices. Electricity is powered by energy supplies, and in the past 50 years or so global energy has come from one or more of these sources:



## FOSSIL FUELS

Oil, gas and coal are all fossil fuels. These are the worst for the environment, as they directly contribute to global warming, which in turn causes climate change. We rely on oil from the Middle East and other parts of the world, and gas from Norway and Russia. We are using less coal than ever before here, but the first new deep coal mine in the UK

for decades will be opened in Cumbria in the next few years. It will provide energy only for steel and chemical factories, and not for power stations.



## NUCLEAR

It's expensive and efficient, but potentially very dangerous if it leaks or there's an accident. Nuclear energy is also much better for the environment than



fossil fuel sources. However, the dangerous waste that is produced in the manufacture of nuclear energy is very expensive to store safely. Some of this waste stays radioactive (containing harmful nuclear substances) for hundreds of thousands of years, too.

Until the news about Sizewell C in Suffolk, nuclear energy in the UK had suffered setbacks in recent years. Late last year, it was announced the 45-year-old Hinkley Point B nuclear plant was to be closed within the next two years, earlier than planned. In 2019, Japanese company, Hitachi, cancelled its plans to build a nuclear power station in Wales. And in 2018, another Japanese company, Toshiba, scrapped plans to build a new nuclear power station in Cumbria.



## SHALE



Shale gas is methane (natural gas) that is stuck in shale rock, deep underground. Just like oil, natural gas and coal, shale is a fossil fuel. The shale rock is impermeable, which means it is both watertight and airtight. Conventional gas is in permeable rocks, like

sandstone, so it can be captured by drilling a well. Shale gas doesn't seep out of its rock. This means the shale rock must be cracked to free the gas, which is where fracking comes in. The fracking process involves drilling down into the earth in order to extract shale gas from shale rock.



## RENEWABLES



Wind turbines off the coast of Wallasey

These are the best for the environment, as they can be constantly 'renewed' (ie, they don't run out, like fossil fuels) and they don't give off harmful emissions into our atmosphere.

**SOLAR** – energy from sunlight is caught in solar panels and converted into electricity.

**TIDAL** – dams or barrages are constructed to force water through gaps, where the turbines harness the tidal energy. As the sea tides move, turbines convert their energy into power. But the dams can also damage the marine environment.

**WIND** – large wind turbines, both on land and

in the sea, can turn wind energy into electricity.

**WAVE** – devices in the sea capture the energy of the waves, rather than relying on areas of sea closed off by a dam like tidal power.

## HOW NUCLEAR ENERGY WORKS



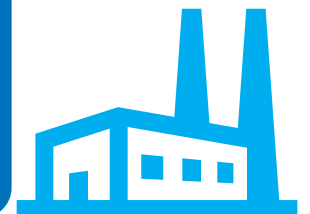
- 1 A nuclear reactor creates heat, which is used to make steam.
- 2 This steam turns a turbine connected to an electromagnet called a generator.
- 3 This generator produces electricity. Whereas fossil fuel power stations produce heat by burning oil, gas or coal, nuclear plants create heat by splitting atoms of a radioactive chemical element called uranium. Atoms are the smallest parts of an element that contains all the chemical properties of that element. Uranium is mined in 20 countries around the world, most of it coming from Kazakhstan, Canada and Australia.

The splitting of an atom's centre – its nucleus – is called fission. Uranium's atoms are split in a device called a nuclear reactor. The heat created by the atom split is what begins the process of creating energy.

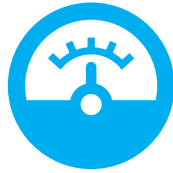
Nuclear energy is far less damaging to the environment than fossil fuel energy derived from gas, coal and oil. Though the waste it produces may be far more dangerous – more on that later.

### DID YOU KNOW?

The share of nuclear energy in the world's overall power generation is a little over 10%.



## NUCLEAR UK: A TIMELINE



There are currently eight nuclear power stations in the UK. Here's a brief history of nuclear power in Britain.



The control room at Calder Hall

**1956** The Queen opens the first nuclear reactor in the UK at Calder Hall in Cumberland. Britain becomes the first country to produce electricity from nuclear energy on a full industrial scale. The town of Workington, 24km up the Cumberland coast from Calder Hall, becomes the first town in the world to receive light, heat and power from nuclear energy. Within four hours, the first nuclear-powered electricity reaches London.

**1957** Just a year later, the world's first nuclear power accident takes place at one of the plants opened in 1956. Radioactivity leaks out of the station following a fire in the reactor. The full facts of the emergency are not made public until the late 1980s.

**1959** The second nuclear power station in the UK opens at Chapelcross in southwest Scotland.

**1962** A new nuclear power station opens in Gloucestershire. Between 1956 and 1966, a total of ten stations are built.

**1992** The build-up of large stocks of nuclear waste at plants is described as "a major... security risk" by the International Atomic Agency.

**1995** Sizewell B opens – the last new nuclear power plant to open (for now).



A worker at Sizewell B

**2003** Calder Hall closes.

**2009** A secret report by the Government's chief nuclear inspector reveals more than 1,750 leaks, breakdowns or other events at UK nuclear plants over the past seven years.

**2015** During a trip to China, the Government announces plans to build a new nuclear power station at Hinkley Point in Somerset. The Chinese commit to paying around £6 billion towards the costs. French company EDF will contribute the rest. The agreement also sets up a UK partnership with China to develop two other new nuclear power stations in the future.

**2016** The Hinkley Point C nuclear power plant is approved by the UK Government.

**2018** Construction work on Hinkley Point C begins, and the first reactor is expected to be operational by 2025, according to majority owner EDF.



Construction work at Hinkley Point C

**TODAY** - Construction is underway for the new plant at Hinkley Point C. It is the only nuclear power plant under construction in the UK, and is expected to cost around £20 billion.

## A TERRIBLE WASTE



A container carrying nuclear waste

As well as being a very expensive process, nuclear energy also produces dangerous radioactive waste. This takes the form of solids, gases and liquids. If radioactive materials leak or come into contact with humans and animals, the results can be very, very dangerous.

Nuclear waste is produced throughout the entire process of producing nuclear energy, from mining the uranium to the reactor operation and re-processing spent nuclear fuel. The waste is buried underground in special sites throughout the UK. The majority of it is at one site called Sellafield in Cumbria. It is thought that this waste will remain hazardous for hundreds of thousands of years. Greenpeace UK says it is unclear whether the storage containers, the store itself, or the surrounding rocks will offer enough protection to stop radioactivity from escaping into the environment in the future.

## THE COST PROBLEM

Nuclear energy is expensive. Constructing a large nuclear reactor involves thousands of workers, tens of billions of pounds, and a lot of expensive components and materials. The estimated cost of the new nuclear plant in Suffolk is £20 billion. Then there's the cost of the waste storage facilities, which can also run into the billions. Gas and coal-fired power stations are far worse for the environment, but much cheaper to build – around £1 billion.



Fossil fuel power plants are worse for the environment – but cheaper than nuclear

## THE SAFETY PROBLEM

In 1986, one of the four nuclear reactors at the Chernobyl power station in Ukraine exploded. The disaster released at least 100 times more radiation than the nuclear bombs dropped on Japan during World War II. Most of this spread around Russia, Belarus and Ukraine, but the wind carried radiation around lots of countries in Europe, including the UK. Around 350,000 people had to move away from

the area around Chernobyl. Greenpeace estimates that the radiation leak will cause more than 90,000 deaths from cancer and a total of 200,000 deaths from all radiation-related illnesses. About 4,000 cases of thyroid cancer have already been recorded, most of them in people who were children or teenagers at the time of the explosion.

More recently, a disaster in Fukushima, Japan, has raised serious questions about the future of nuclear energy. In March 2011, a massive earthquake struck off the coast of Japan, causing a tsunami that flooded part of the Fukushima Daiichi nuclear plant. This led to a loss of power that caused nuclear meltdowns and explosions. Radioactive material leaked, and people in a 20 kilometre zone around the plant had to be evacuated, while water in the area was contaminated. The programme to clean up the area may take as long as 40 years to complete.

Thankfully, incidents such as those at Fukushima and Chernobyl are rare – but they highlight the possible dangers of nuclear energy.



The Chernobyl power station after the explosion

## YES, NUCLEAR ENERGY IS THE OPTION TO BEAT CLIMATE CHANGE



### 1. IT DOESN'T EMIT HARMFUL GASES –

The biggest crisis facing humans and the Earth is climate change. No energy source is perfect, but nuclear energy, at least, does not produce any polluting gases that contribute to global warming and the climate emergency.



**2. POWER STATIONS LAST DECADES –** The first power stations built in the 1950s were shut down in the early years of the 21st century. Nuclear plants provide a reliable energy source for 40+ years. If we want to beat climate change, committing to more nuclear energy allows us to plan our energy supplies for many years to come.

**3. IT'S VERY EFFICIENT –** It takes only a very small amount of nuclear fuel to generate a very large amount of electricity. Nuclear power is therefore very efficient.

## NO, NUCLEAR ENERGY IS NOT THE OPTION TO BEAT CLIMATE CHANGE



### 1. IT'S TOO RISKY –

The Chernobyl and Fukushima disasters show the potential dangers of nuclear energy. It's foolish to risk a major crisis like this happening again, when there are other, safer energy sources around us – like renewables.



### 2. IT'S SO EXPENSIVE –

According to a report last year, it takes on average ten years to build a nuclear power plant and tens of billions of pounds. The cost per megawatt hour of energy produced is much higher for nuclear (£80-130) than for solar (£26-31) or onshore wind power (£21-40). It makes no sense to spend huge sums of money on nuclear when other forms of energy are cheaper.

**3. THE WASTE IS DANGEROUS –** Nuclear energy produces waste that remains radioactive for thousands of years. This is highly risky and could be hazardous to both humans and the environment.

DISCUSS 

What are the advantages of nuclear energy?

DISCUSS 

What are the disadvantages of nuclear energy?

DISCUSS 

Why is the UK in a good position to use renewables?

DISCUSS 

What matters more: the cost of energy or its impact on climate change?

DISCUSS 

Should the UK produce more of its own energy or continue to import cheaper energy sources from other countries?

DISCUSS 

Do you think individuals like you can tackle climate change, or is it in the hands of the Government?

DISCUSS 

Do you think nuclear energy is safe?

DISCUSS 

Should countries around the world commit to phasing out fossil fuel energy soon?

DISCUSS 

Can the Government do more to promote and fund renewable energy?

DISCUSS 

Do you think this year's COP26 UN Climate Change Conference will make any difference?