# Worksheets

Engineering Net Zero

There are 6 worksheets in this pack

| | |
|---|---|
| - Carbon Footprint & Net Zero | ~20 mins (need to ask a parent for some info) |
| - Energy Demand | ~20 mins a day for a few days |
| - Energy Supply | ~20 mins (need to ask a parent for some info) |
| - Energy Sources | ~40 mins |
| - Energy Security | ~40 mins – 1 hour |
| - Achieving Net Zero | ~ 1 hour |

Lots of supporting information is found in the 'schools' information and lesson pack' on the website.

Engineering Net Zero

# Carbon Footprint & Net Zero

WORKSHEET

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## WHAT IS A CARBON FOOTPRINT?

The amount of carbon dioxide ($CO_2$) and other greenhouse gases. released into the atmosphere because of one's own energy needs. To find out more about carbon dioxide visit:

https://www.bbc.co.uk/bitesize/topics/z3fv4wx/articles/zndkxyc

## WHAT IS NET-ZERO?

A net zero carbon target means that any carbon that is produced would be captured and stored.

The UK is aiming to be net zero by 2050. To reach this goal, everyone needs to help by reducing their own carbon footprint.

## DID YOU KNOW?

**An average yearly carbon footprint for a person in the UK is between 8 and 10 tonnes of carbon. That's the same weight as 10 baby humpbacked whales!**

Activity:

## WHAT IS YOUR CARBON FOOTPRINT?

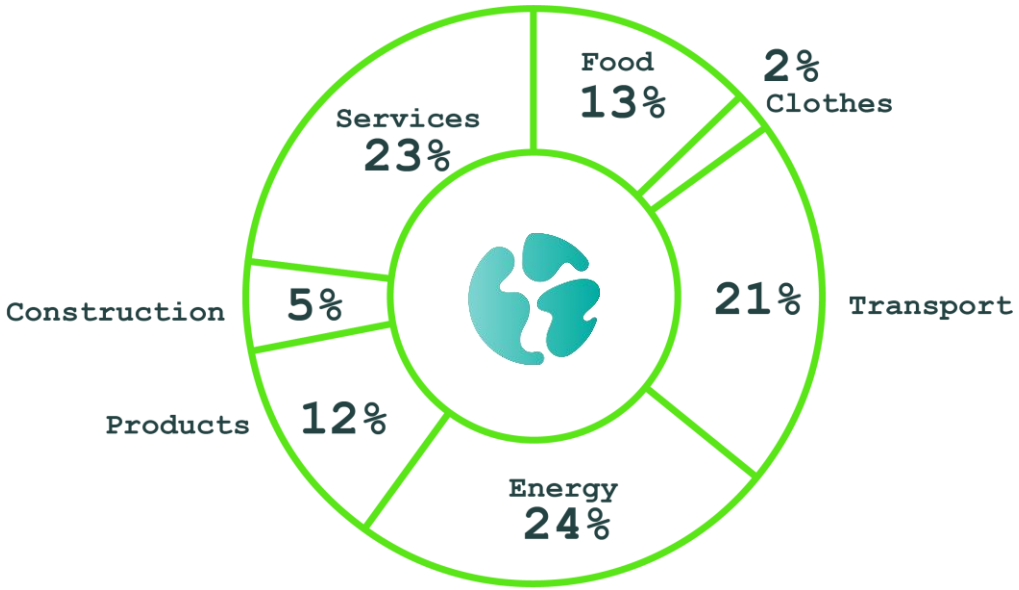
Complete this questionnaire with a parent/guardian to work out your pre-COVID carbon footprint:

https://footprint.wwf.org.uk/#/questionnaire

Was your carbon footprint bigger or smaller than the average person's? _____

What made up the biggest part of your carbon footprint? _____

What could you do to reduce your carbon footprint? _____




WHAT MAKES UP THE UK'S CARBON FOOTPRINT

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# Energy Demand

WORKSHEET

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## WHAT IS ENERGY DEMAND?

Energy demand is how much energy a person uses in their day to day lives, this includes electricity and the amount of fuel they use for transport and heating.

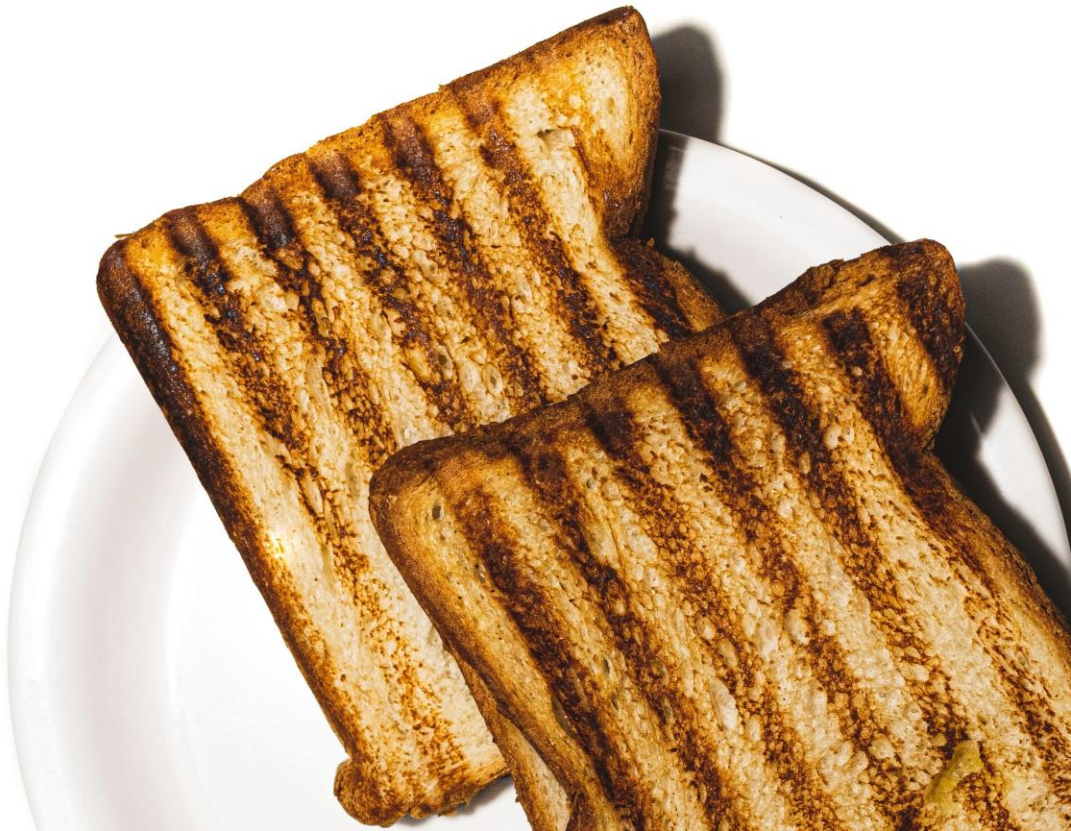
## WHAT IS NET-ZERO?

A net zero carbon target means that any carbon that is produced into the atmosphere would be captured and stored.

The UK is aiming to be net zero by 2050.

## DID YOU KNOW?

**The average person consumes 5,130 kWh of energy per year, that's enough to toast more than 450,000 slices of bread!**



KS2 Activity:

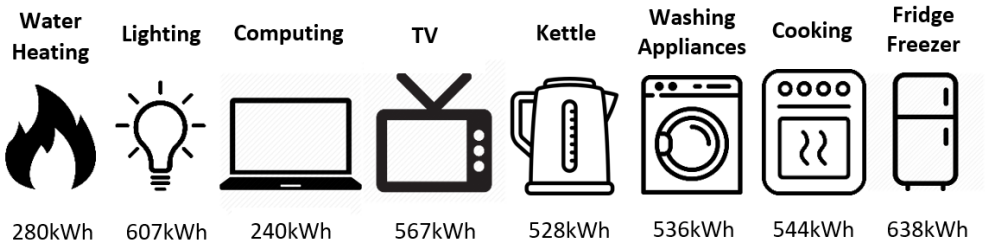
## WHAT IS YOUR ENERGY DEMAND?

Get your parent/guardian to show you your home's electricity meter. Record what it reads at the start and at the end of the day.

**Start of the day:** _____

**End of the day:**

**How much energy did you use in a day?** _____




Now record your electricity meter readings for another day but this time try and reduce the amount of electricity you use. Use the image above to help you, it shows how much energy different household appliances use in a year.

**Start of the day:** _____

**End of the day:**

**Did you manage to reduce the amount of energy you used?**

KS3 Activity:

## WHAT IS YOUR ENERGY DEMAND?

Get your parent/guardian to show you your home's electricity meter. Record what it reads at the start and at the end of the day.

**Start of the day:** _____

**End of the day:**

**How much energy did you use in a day?** _____

The average coal power station produces **3.5 billion kWh** of electricity every year and a large wind turbine produces **4.4 million kWh**.

If every home used as much electricity as yours:

**How many homes could 1 coal power station power in a year?** _____

**How many homes could 1 wind turbine power in a year?** _____

**There are 3.28 million homes in London, how many coal power stations would it take to power them all for a year?** _____

**How many wind turbines would it take to power London's 3.28 million homes?** _____

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# Energy Supply

WORKSHEET

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## WHAT IS ENERGY SUPPLY?

The energy supply is the amount of energy resources available to be used by a country.

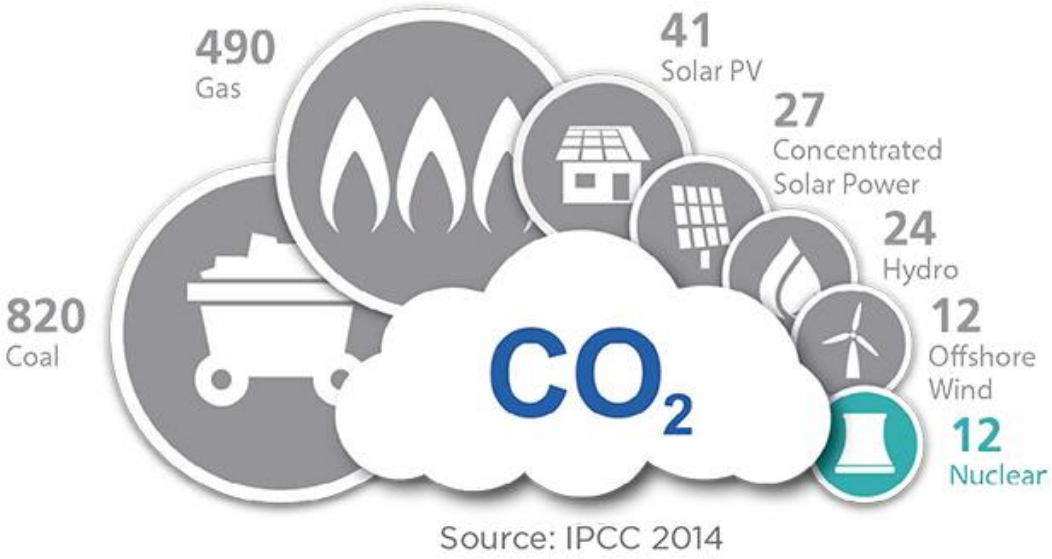
## WHAT IS NET-ZERO?

A net zero carbon target means that any carbon that is produced would be captured and stored.

The UK is aiming to be net zero by 2050. To reach this goal, the UK government needs to think about the environment when deciding what makes up our energy supply.

## DID YOU KNOW?

**A gas power plant produces 40 times more $CO_2$ than a nuclear power plant for the same amount of electricity!**




Source: IPCC 2014

# Energy Supply

Activity:

## WHERE DOES YOUR ENERGY COME FROM?

Find out who supplies the electricity to your home.

Find out how that company generates electricity.

**Where does most of your energy come from?**

**Is it an environmentally friendly source?**

**Do you think your energy supplier generates electricity more or less sustainably than the UK as a whole? Include your reasoning.**

To find out how the UK generates its energy supply visit https://gridwatch.co.uk/ . Take a snaphot of the UK electricity mix at this current point in time to help answer the question above.

British Gas EDF npower ovo energy e·on bulb

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# Energy Sources

WORKSHEET

# Energy Sources

Energy can be generated from many different sources. Each energy generation method has advantages and disadvantages, and none of them are good at everything. We need to use a combination of energy sources to supply the energy we use in a sustainable way.

## FUN FACT!

**From January to March 2020, 47% of UK's energy generation was from renewable sources.**

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**Activity:**

## WHERE DOES YOUR ENERGY COME FROM?

**Create a poster or leaflet about one energy generation method.**

Choose from the below options:

- Nuclear Power
- Gas Power Stations
- Hydroelectric Power
- Biomass Power Stations
- Coal Power Stations
- Wind Farms
- Tidal Turbines
- Solar Power
  (can choose Photovoltaics, Solar Thermal, or both)

For the method you choose, you need to include:

1. Description of how it works.
2. Is it renewable or non-renewable?
3. At least one advantage and disadvantage.
4. The cost, security of supply and environmental impact.

**Remember**, the cost is whether it is a cheap/expensive generation method. You could find a cost per kWh to quantify this.

Security of supply is whether the method can be controlled so energy is generated when we need it.

For environmental impact, mainly consider the greenhouse gas emission, but you might also want to consider other factors such as land usage and effect on wildlife.

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# Energy Security

WORKSHEET

# Energy Security

Energy supply is not just about how much energy we use and how long for, it's also about when we want to use it. Imagine if when you turned on your computer it didn't switch on. Or if your lights turned off in the evening.

One of the big problems with only using renewable energy is we can't control when they produce energy. Solar panels only produce power during the day and wind turbines when the wind is blowing.

How do we ensure we have enough electricity at the times when we need it?

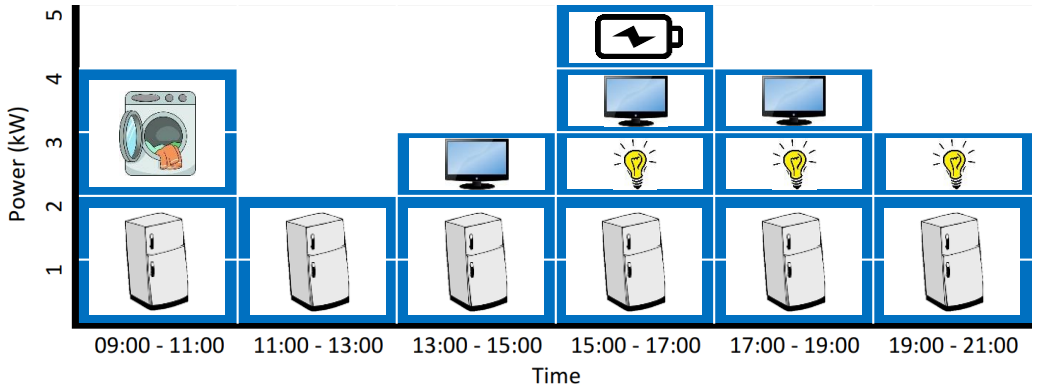
**FUN FACT!**

**It would take 130,220 Nissan Leaf cars to power Bristol for a day!**

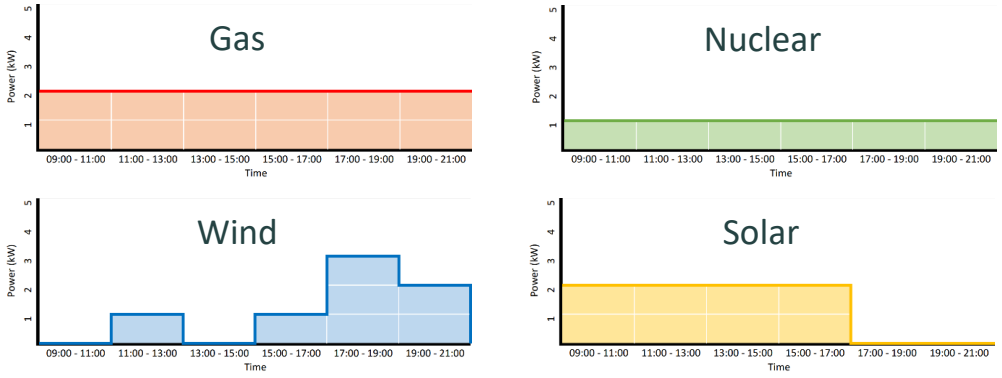
# Energy Security

## Activity:

Your house uses the energy shown below throughout a day:




Energy can be supplied by the four methods shown below:




**Answer the following questions:**

1. Explain the reason for the shape of the Solar energy profile.
2. What times of day does a combination of Gas and Solar not provide enough energy?
3. What if you can store excess energy supplied throughout the day in batteries. Does using both Gas and Solar meet your energy demand? (Hint: think about the total amount of energy for the whole day)
4. Does using a combination of Gas, Wind and Solar meet your energy needs? If it does, how much does it exceed your required demand for each time period?
5. What two things do you need to do so Nuclear, Wind and Solar would meet your energy needs? (Hint: Can you do things at a different time?)

Well done if you've managed to balance your energy demand over the day. Now try and balance it over two weeks - Summer 2020 Energy Challenge: EnergyMixer

Engineering Net Zero

# Achieving Net Zero

WORKSHEET

The amount of energy used is expected to increase as the world population grows and we use more digital devices. However, rising concern over climate change has led to a desire to reduce emissions of greenhouse gases. While carbon dioxide is perhaps the most known greenhouse gas, there are many others such as methane and even water vapor.

Net Zero is a target for any greenhouse emitted will be offset or sequestered. Carbon emitted can be compensated by projects which remove carbon, such as planting trees, or captured and stored.

## FUN FACT!

**Per gigabyte of data, it's estimated to use 600,000 times more energy to store data on the cloud than your computer.**

# Achieving Net Zero

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## Activities:

Find out more about one of the new technologies that will help us to reach Net Zero:

- Carbon Capture
- Hydrogen (fuel)
- Energy storage:
    - Batteries
    - Hydroelectric storage
    - Compressed air storage
- Small modular reactors

Look at the electricity map to find out how much carbon dioxide each country emits. The greener the colours are on the map, the lower the carbon emissions are. Think about:

1. Before opening the website: France has a high nuclear capacity; what colour do you think will it be on the map and why?
2. Which types of energy generation will be used in areas which are dark brown? Now open the website. Pick a country which is dark brown and record the top three electricity sources.
3. Germany and Spain use lots of solar and wind power. Use the wind and solar layers ( and ) to see how the countries colours change. What colour are they on a sunny and windy day? What colour are they on a still night?

Use the Mackay Energy Calculator to try and achieve your own Net Zero. Adjust the levers at the bottom of the webpage to reach –100% on the $CO_2e$ meter. You might need to think about how secure, environmentally friendly and expensive each method is. You can find out more about each lever by clicking on the icon above it.

Here are some challenges to try:

- What's the fewest "Ambition Level 4" levers you need to achieve Net Zero?
- Can you reach Net Zero without using any of the Low Carbon Electricity levers?
- Leaving all other levers at "Ambition Level 1", which three areas to improve the reduction of carbon emissions the most?

**Electricity Map:**
https://www.electricitymap.org/map

**MacKay Calculator:**
https://my2050.beis.gov.uk/?levers=111111111111111

**Fun fact source:**
https://medium.com/stanford-magazine/carbon-and-the-cloud-d6f481b79dfe