Learning Mobility in Times of Climate Change

Toolbox for more sustainability in international youth work: Mobility, diet, waste and energy

Manual

JANUN Hannover e.V.

IJAB

Introduction

Greater sustainability in international youth work can be achieved in many different ways. Even if, say, a youth exchange focuses on a subject other than sustainable development, with no finger-pointing and just a little effort, it is possible to integrate sustainable action into the everyday aspects of an activity or project. Reducing energy consumption, sorting waste, a climate-sensitive diet – in most cases team leaders and organisers will not find it difficult to design a programme that is environmentally sensitive. But what if not all participants are excited about vegetarian, climate-sensitive food? Or if they are happy to sort their waste, but forget their good intentions on day 2 and go back to mixing paper and plastic?

This toolbox is a collection of brief workshop-style activities that invite participants to spend up to 30 minutes considering the connection between climate change and mobility, food, waste and energy. Each activity provides background information on the subject in question, responds to the lifeworlds of young people and helps them develop an awareness of sustainable action in a playful manner. This way, participants are encouraged to be more accepting of the rules that the group sets itself.

All activities are designed such that they can be prepared quickly without requiring a lot of materials. The background information is detailed enough so the organisers don't have to do any research before they run the activity. Some of the sources quoted in the footnotes are in German, since this made it easier for us to verify that the information provided was reliable. However, we are certain that you will be able to find similar sources in your respective regions or languages. The publication also contains templates for cards that can be used for the activities described here.

Enjoy experimenting with the toolbox!

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Mobility and climate change

How far can I get on half a gram of CO_2?

The participants find out how far they can travel by car, coach, long-distance train and plane if each vehicle produces the same amount of greenhouse gas emissions. They each "travel" until they have emitted a certain quantity of climate-damaging greenhouse gases. The exercise teaches participants about the greenhouse gas emissions of different modes of transport and encourages them to reflect on their own mobility behaviour.

At the end of the exercise, participants can discuss the advantages and disadvantages of the different modes of transport. If there is enough time, workshop leaders can provide more information on the subject of mobility.

Time required	20 to 30 minutes
Method	Interactive game requiring lots of space
Materials	• Four tape measures or similar (cord, etc.) 1.96m, 5.20m, 12.20m and 19.23m in length • 8 pieces of cardboard, two for each mode of transport, cord or string
Preparation	• Creation of eight cardboard signs (two planes, two cars, two trains, two coaches) which participants hang around their neck • Creation of measuring tapes or similar with the following lengths[1,2], – Plane (short-distance flight of up to 1500km): 1.96m – Car (mid-size, petrol, 1 person): 2.60m – Train: 12.20m – Coach: 19.23m

Opening

The participants start by naming the types of transport that can be used to travel from one city to another. It's a good idea to pick two cities they can travel between either by train, coach, car or plane. Once they have named the four modes of transport car, coach, train and plane, eight volunteers are selected. The workshop leader then distributes the eight signs amongst the volunteers and assigns two appropriately labelled signs to each mode of transport.

1 The distances are based on: UK Department for Business, Energy & Industrial Strategy. Greenhouse gas reporting: conversion factors 2019. Online: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019 [last accessed on 22 December 2022]

2 Emission levels for cars, coaches and planes are similar in different countries. However, depending on how trains are powered, e.g. whether by electricity − and depending on how this is generated − or whether by diesel, these levels differ from country to country. Vehicle occupancy, i.e. how many people travel in a train, plane or coach, also affects the calculation. The examples given here are based on data and average values from the UK. Nevertheless, they are a useful point of reference. The emission of greenhouse gases, so-called CO_2 equivalents, is measured. Cf. Ritchie, Hannah (2020): Which form of transport has the smallest carbon footprint? Online: https://ourworldindata.org/travel-carbon-footprint [last accessed on 22 December 2022]

Aim of the game

The aim is to find out how far a person can travel by coach, train, plane or car if they are only allowed to produce half a gram of greenhouse gases (so-called carbon dioxide equivalents, CO_2eq).

> i Carbon dioxide (CO_2) is the main greenhouse gas, but not the only one. To cover all greenhouse gases, scientists speak of "carbon dioxide equivalents" (CO_2eq). These include methane and nitrous oxide, for example, not just CO_2. For the sake of simplicity, we will refer to them here as greenhouse gases.

The participants take into account the average occupancy of the individual modes of transport, which plays a key role in determining how climate-friendly they are. When there are five people in a car, the mobility of each person is more climate-friendly than when a person travels alone in the car, as in this example.

It is important that workshop leaders explain the following:

The question is how far a single person can travel by train, plane, car or coach with their half a gram of greenhouse gases. All the other people travelling with them also have half a gram. How far does their train/car/coach/plane get before each passenger's half a gram is used up?

The average occupancy of each type of transport is factored into the calculation. For example, a coach is bigger and heavier, uses more fuel and therefore produces more greenhouse gases than a car. But, on average, more people sit in a coach than in a car. So if an average of 32 people are travelling in a coach, we want to know how far the coach can travel on 32 x 0.5 grams of greenhouse gases. All coach passengers travel further together with their half a gram than if, for example, they were travelling in pairs by car. To transport these 32 people from Paris to Berlin by car rather than coach, with an occupancy of 2 persons per car, would take 16 cars rather than one single coach.

Of course, a coach produces more greenhouse gases than a car, but 16 cars produce much more than a coach!

Process

Four persons with the plane, car, train and coach signs are asked to stand in a line, and each is given the tape measure or cord for their respective mode of transport. The other four volunteers line up opposite and take the other end of the tape measure/cord. Later, they are asked to step backwards one after the other until their respective tape measure/cord is completely unrolled.

We start with the car.

→ *One person travels in a car. How far can a car go until it emits 0.5 grams of greenhouse gases?*

The tape measure is rolled out. It stops at 2.60m.

The participants now have some idea about how far they can travel by car with a half a gram of greenhouse gases. This helps them guess how far they can get with the other three modes of transport.

Before the other three tapes are rolled out, the participants are invited to guess how far they can get by coach, train and plane compared to the car.

They start with the plane. The participants guess how far passengers on a short-haul flight can travel until each passenger has used up half a gram of greenhouse gases. They do so by sending the workshop leader to the appropriate spot. They tell the leader to "keep going" until the majority eventually shouts "stop".

Younger participants might need to be reminded of the following:

→ *If the plane gets further than the car, it's more climate-friendly than the car. If it's more harmful for the climate, you should shout stop before it reaches the car.*

After the group has agreed on a distance and told the workshop leader to stop, the volunteer with the plane sign walks backwards with the tape measure until it is completely unrolled. Participants can then see whether the group has estimated correctly. They stop at 1.96m. Many might think: "This isn't actually that much worse than the car."

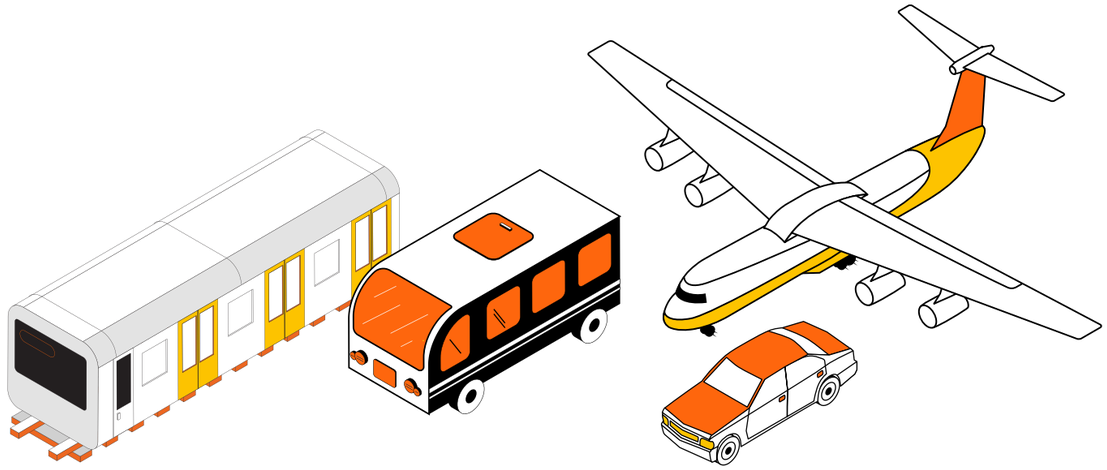
But a more detailed explanation is needed here:

The greenhouse gases emitted by the plane have an even more harmful effect on the climate at a high altitude than they have on the ground. A plane also produces other harmful emissions, such as nitrogen oxides, soot particles and water vapour (the white stripes in the sky). These have to be factored into the carbon footprint of air travel. Their impact equates to at least twice the amount of pure greenhouse gas emissions.[3] So our passenger has to go back to 0.96m. The distance travelled per 0.5 grams is at least halved.

The same procedure is repeated with the train and finally with the coach. If time runs out, the workshop leader can leave out the coach and merely mention its carbon footprint. It becomes clear that travelling by coach or train is much more climate-friendly than travelling by plane or car.

Possible questions at the end of the exercise

→ *Are you surprised by the result?*
→ *Why are driving and flying so harmful for the climate?*
→ *How can you yourself travel in a more climate-friendly way?*
→ *What should policy-makers do?*



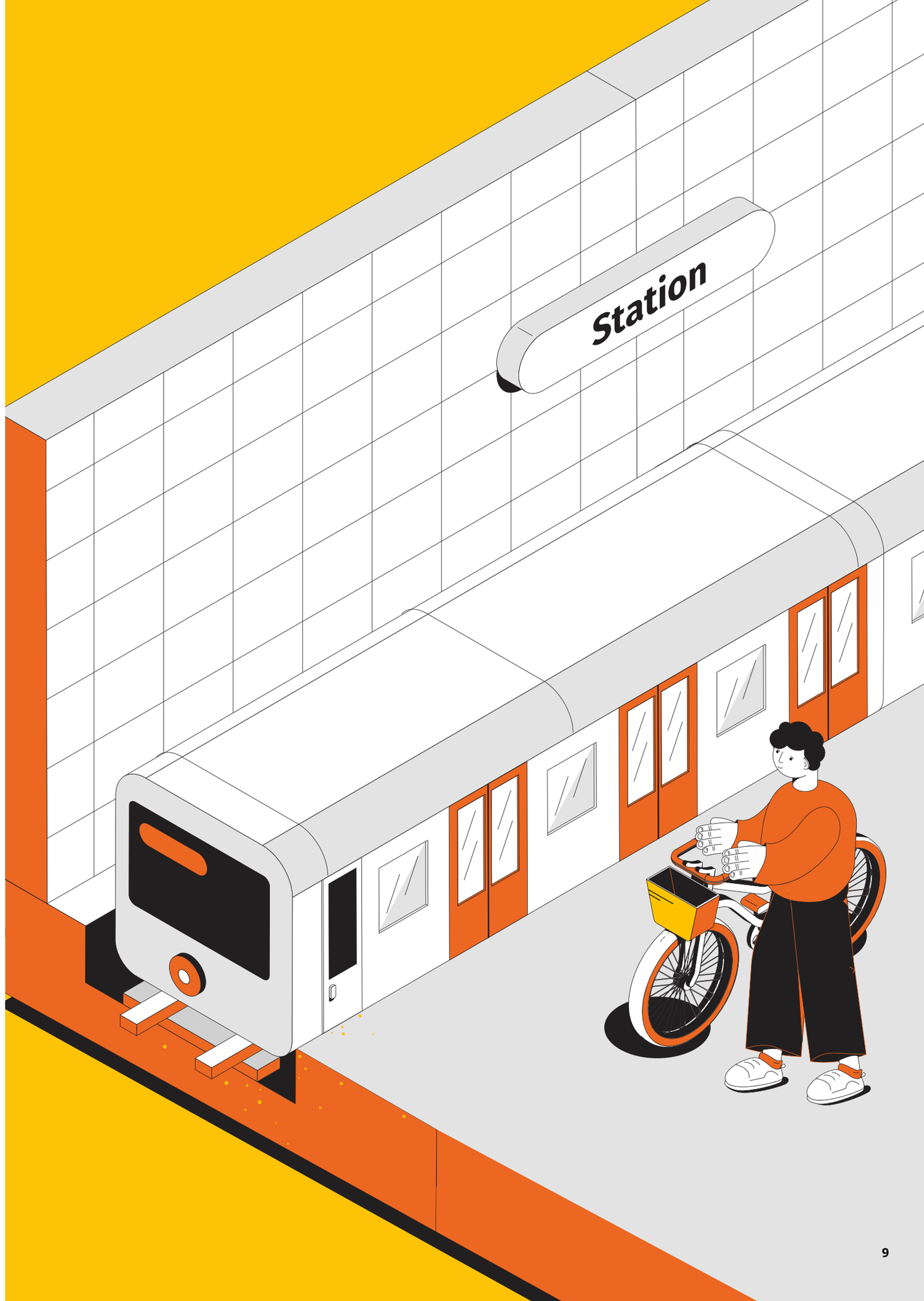
3 https://bevarjordforbindelsen.dk/non-co2-related-climate-effects-from-flight-cant-we-just-walk-quietly-through-the-doors/ [last accessed on 20 December 2022]

Want to know more?

Here are a few more facts which workshop leaders can use for a more in-depth discussion on mobility:

- These countries have the following number of motor vehicles (car, bus and lorry) per 1,000 inhabitants: Finland: 70, Poland: 771, Germany: 628, Belgium: 482, Bangladesh: 27, Malawi: 13 and North Korea: 1. If your country wasn't included, take a look at the following article https://en.wikipedia.org/wiki/List_of_countries_by_vehicles_per_capita
- A study by the RAC Foundation revealed, for example, that the average car in the UK is stationary for about 162 hours a week and is driven for only about six hours. This equates to a "parking ratio" of around 96 percent![1]
- The average speed of a car during rush hour in a major German city like Hamburg is around 20km/h. This means a car is not much faster than a bike.[2]
- 2.25 billion people around the world flew on a plane in 2009; in 2019, 4.56 billion people travelled by plane, which means the number doubled in 10 years.[3]
- Less than 20% of the world's population has ever flown on a plane.[4] (Participants' estimates are usually much higher.)
- The enormous weight of an aircraft (an Airbus 380 weighs 560 tons) has to be brought to an altitude of about 10,000 metres. This takes a huge amount of jet fuel. Greenhouse gases emitted at this altitude are also more harmful for the climate than at ground level.
- The flightradar24.com app shows how many planes are in the air worldwide at any one time. It illustrates the scale of air traffic.
- Each person has an annual budget of 1.5 tons of CO_2, which must not be exceeded if global warming is to be limited to a maximum of 1.5 degrees.[5] For example, a flight from Copenhagen to Madrid and back uses up almost exactly half this annual budget, which also covers emissions for accommodation, food, etc.[6]
- The average amount of greenhouse gas emissions per capita in different countries is presented here: https://en.wikipedia.org/wiki/List_of_countries_by_carbon_dioxide_emissions_per_capita
- Cars weigh an average of almost 2 tons and are often used only for the purpose of transporting a 25-kg child to kindergarten. This is ineffective and uses a lot of fuel. For example, the average occupancy rate of a car in Germany is only 1.4 persons.

1 https://www.racfoundation.org/research/mobility/spaced-out-perspectives-on-parking [last accessed on 21 December 2022]
2 https://de.statista.com/statistik/daten/studie/1079302/umfrage/durchschnittliche-fahrgeschwindigkeit-zur-hauptverkehrszeit-in-deutschen-grossstaedten/ [last accessed on 22 December 2022] (in German)
3 https://data.worldbank.org/indicator/IS.AIR.PSGR?end=2020&start=1970&view=chart [last accessed on 22 December 2022]
4 https://www.sciencedirect.com/science/article/pii/S0959378020307779 [last accessed on 22 December 2022]
5 https://www.atmosfair.de/en/green_travel/annual_climate_budget/ [last accessed on 22 December 2022]
6 Cf. https://co2.myclimate.org/en/flight_calculators/new



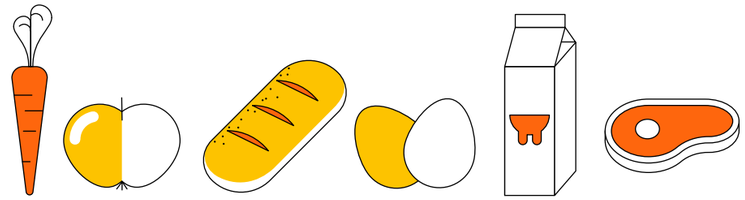
2

Diet and climate change

Enjoy your meal! The climate is at the table.

During this workshop, participants deal with issues around diet. Specifically, they compare different foods and the greenhouse gas (GHG) emissions they incur.

Participants learn that the production of different kinds of foods releases varying levels of GHGs into the atmosphere. They're asked to match up the foods to the respective emissions they incur, and are invited to discuss, guess and explore the emission levels the products cause and why. As a by-product, they learn how they can adopt a climate-friendly diet.

Time required	20 to 30 minutes
Method	Interactive game
Materials	• Foam (or cardboard or similar) cubes with the following side lengths[1]: – Fresh vegetables: 0.53 cm – Fresh fruit: 1.05 cm – Wheat and rye: 1.57 cm – Milk: 3.15 cm – Eggs: 4.67 cm – Beef: 99.48 cm • Suitable symbols for: fresh vegetables, fresh fruit, bread or wheat/rye, eggs, milk and beef 
Preparation	• Production of the cubes using, e.g., cardboard • Procurement of suitable replica food items or printouts of images. Using real food items is also possible, provided they do not go to waste (e.g., they can be cooked afterwards)

1 The distances are based on Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. Science, 360(6392), 987-992. Online https://science.sciencemag.org/content/360/6392/987 [last accessed on 12 December 2022]; see also https://ourworldindata.org/explorers/food-footprints [last accessed on 12 December 2022

Opening

Workshop leaders can use the following ice-breaker questions to introduce the participants to the topic of the workshop:

For younger participants:

→ *The farming sector is responsible for producing the food we eat. What kind of foods did you eat yesterday?*

The responses will provide an initial overview of different food items.

For older participants:

→ *What kind of foods do you think are better for the climate? Which are worse?*

This helps to produce some initial ideas about how our diet impacts on climate change. A follow-up question is:

→ *Can you imagine why or how the foods you just mentioned create greenhouse gas emissions?*

This helps create an awareness that several factors are at play here, such as crop production, animal husbandry, processing, packaging, transportation, animal feed, etc.

Having exchanged these thoughts, the workshop becomes more interactive.

Aim of the game

Participants are invited to estimate the amount of harmful GHG emissions that results from the production of one kilogram of the following foods: vegetables, fruit, bread, milk, eggs, beef.

Note: The values associated with the foods are global averages. The calculation of GHG emissions is based on a number of aspects including

- changes in land use (e.g. soybean farming on cleared rainforest areas),
- fertiliser use or emissions caused by liquid manure,
- production of animal feed,
- transportation (this means transportation from farms to food retailers, not include transportation from food retailers to consumers' homes),
- packaging,
- food retail (energy consumption in e.g. supermarkets, for instance for refrigeration).[2]

Process

The six cubes that represent the GHG emissions are arranged in a row according to size. The food symbols (or replica food items) are then handed out to some members of the group so they can match up each one to one of the cubes. The others can advise them on doing so. Once all matches have been done, their chosen order is checked. If errors were made, the workshop leaders can provide some hints. For instance, they could say "You've matched up four foods correctly; two are incorrectly matched. Why not take another look?" The participants then re-match all items until they have arrived at the right solution. If things take too long, the leaders can intervene and match the items correctly themselves.

Following this, workshop leaders can ask the following questions.

Any answers can be supplemented as required.

→ *Why has the beef been matched up with the largest cube?*

- Cows are ruminants and hence produce large amounts of methane emissions when they belch and break wind. Their manure also produces nitrogen. Besides CO_2, they produce other GHGs that contribute towards climate change, such as methane and nitrous oxide. Grazing land is fertilised, which is another factor. A cow that lives and hence produces methane for one year is as damaging to the climate as one car that travels around 18,000 km. Methane is 21 times more harmful to the climate than CO_2. Also, cows require large amounts of feed, which often has to be transported from the feed producer to the farm.

→ *Look at the difference between the cube with the beef and the cube with the milk. Why do you think the difference is so great?*

- This is all about how many litres of milk a dairy cow can produce each day and how long a cow needs to grow to produce one kilogram of beef. A dairy cow produces between 15 and 40 litres a day depending on performance. So if a cow produces, say, 24 litres of milk every day, it will emit one hour's worth of methane per litre as it belches and breaks wind. Beef "grows" much more slowly, and so a cow destined to produce beef will emit far more methane per kilogram.

→ *Why do you think vegetables are more climate-friendly than fruit?*

- This mostly depends on where the vegetables and fruit are produced. Vegetables often have a slightly smaller carbon footprint than fruit because they are more often produced regionally, so the distances over which it is transported tend to be smaller. Some fruits don't grow in Europe (e.g., exotic fruits like pineapple, mango and banana) so they have to be imported and hence travel longer distances. There are also major differences in carbon footprint among vegetables depending on how they are grown. For instance, sun-ripened tomatoes grown outside of a greenhouse have a far smaller carbon footprint than tomatoes that are grown indoors in heated greenhouses.

→ *Why do animal products generally have a larger carbon footprint than plant-based foods? For instance, why are soy cutlets better in this regard than a steak?*

- The term "soy" often makes us think of the destruction of the rainforest. However, it is often forgotten that most of the soy that is farmed there is used for animal feed. The soy used to produce soy cutlets is often produced regionally. Generally speaking, plant-based products are better for the environment than meat because their production is less resource-intensive. Soy and other plants could help feed far more people if they were not used as animal feed, but instead were used directly in the production of food for human consumption. Farmed animals require the energy they get from feed for all kinds of metabolic processes. Only around 10 to 35% of the calories contained in feed goes into producing meat, milk or eggs.[3,4]

→ *What is bread made of? And why does bread production impact on the climate?*

- Provided the grain for the bread is produced regionally, the climate impact of bread production is attributable to the baking. Most types of bread are baked at temperatures ranging from 200 to 270 degrees C for up to around 50 minutes. Baking requires a great deal of energy, usually electricity. Electricity generation can cause major GHG emissions.

→ *Where do the emissions in chicken farming come from?*

- Chicken-rearing in batteries, which are large barns with up to 30,000 chickens, is highly energy-intensive. In addition, chicken manure releases large amounts of methane. Battery-farmed chickens are fed on soy, corn and grain that is often imported from halfway across the world. For instance, the soy that goes into chicken feed may be produced on fields that used to be rainforest. Eggs produced by free-range chickens are better for the climate. The same goes for eggs that are laid by chickens kept by neighbours and fed on kitchen scraps.

2 Cf. Hannah Ritchie (2022): FAQs on the Environmental Impacts of Food. Online: https://ourworldindata.org/faqs-environmental-impacts-food [last accessed on 12 December 2022]

3 Cf. https://albert-schweitzer-stiftung.de/aktuell/warum-sojawurst-nicht-dem-regenwald-schadet [last accessed on 12 December 2022] (in German)

4 https://www.researchgate.net/publication/263192492_Embodied_crop_calories_in_animal_products [last accessed on 12 December 2022]

Finally, the participants should summarise what they think should be considered if one wants to adopt a climate-friendly diet.

When it comes to the carbon footprint of individual foods, it should become clear that

- it makes a major difference where and how these are farmed and/or produced,
- regional and seasonal products have a smaller impact on the climate (→ shorter distances to cover, no artificial heat sources),
- fresh products are better for the climate than frozen foods (→ refrigeration is energy-intensive),
- highly processed foods have a larger carbon footprint (e.g. French fries vs. potatoes).

Provided interest in the subject has not waned, workshop leaders are invited to contribute additional aspects to the discussion:

- The climate-related benefits of regional foods are mostly eliminated if consumers use their cars to get to the nearest supermarket.
- Today, our food is transported over ever increasing distances.
- The production of regional outdoor tomatoes generates around 85 grams (conventional) or 35 grams (organic) of CO_2 per kg. By comparison, if tomatoes are grown out of season in heated greenhouses, they incur 100 times as much CO_2 (organic: 9.2 kg vs. conventional: 9.3 kg)[5].
- Butter has a far greater climate impact than margarine.
- In Germany, 70% of food-related GHG emissions are incurred by animal products although they only account for 10% of the food consumed.[6]

Suggested final statement

More than a quarter of all man-made GHG emissions are attributed to food production.[7] If you want to help curb climate change, you don't have to eat less – but you could consider adapting your eating habits.

Want to know more?

Here's a good video clip that explains whether meat really is that bad for the climate:
Is Meat Really that Bad?

5 https://www.nachhaltigkeitsrat.de/aktuelles/bio-ist-nicht-immer-besser-rat-fuer-nachhaltige-entwicklung-empfiehlt-regionale-und-saisonale-ernaehrung/?cn-reloaded=1 [last accessed on 22 December 2022] (in German)
6 https://www.nachhaltigkeitsrat.de/aktuelles/bio-ist-nicht-immer-besser-rat-fuer-nachhaltige-entwicklung-empfiehlt-regionale-und-saisonale-ernaehrung/?cn-reloaded=1 [last accessed on 22 December 2022] (in German)
7 Cf. Hannah Ritchie and Max Roser (2022): Environmental Impacts of Food Production. Published online at OurWorldInData.org. Retrieved from: https://ourworldindata.org/environmental-impacts-of-food [Online Resource] [last accessed on 12 December 2022]

3

Waste and climate change

Less is more

In this workshop, participants look at the subject of waste and compare the different decomposition times of individual materials.

They discuss how waste can be avoided and important things to consider when waste is recycled. They are sensitised to the connection between waste and climate protection, and they learn how waste affects the environment.

Time required	Approx. 30 minutes
Method	Interactive game
Materials	One set of cards depicting waste and time cards per team • Paper tissue: approx. 3 months • Apple core: 2 weeks • Orange peel: up to 2 years • Newspaper: 1-3 years • Cigarette: 1-5 years • Chewing gum: 5 years • Tin can: 10-100 years • Crisp packet: 80 years • Plastic bottle: 500 years • Glass bottle: up to 1 million years[1]
Preparation	A set of picture and time cards is laid out for each team.

Opening

The workshop leader can introduce the game with the following questions. Differences between regions or countries are a particularly interesting part of the discussion.

→ *Is waste separated in your city / region (e.g. glass, paper, metal, food waste)?*
→ *Are people cooperative and do they separate their waste?*
→ *Do you try to avoid waste? If so, what examples can you give?*

The participants can then discuss the negative effects of waste.

1 https://umweltschutz.online/folgen-von-muell/verrottungsdauer/ [last accessed on 12 December 2022] (in German)

Here are a few facts to help them:

- Waste that is not disposed of properly significantly contributes to global climate change. Large quantities of hazardous methane gas escape from open landfills or illegal waste dumps. Illegally incinerated waste produces soot which is damaging not only for the climate but also for our health. According to the Intergovernmental Panel on Climate Change (IPCC), landfills and sewage plants are responsible for about 5% of global greenhouse gas emissions.[2]
- Another problem is plastic waste in our oceans. Every year, an estimated 14 million tons of plastic end up in the sea. Marine animals such as seabirds, whales, fish and turtles often mistake plastic waste for prey and ingest it. Many ultimately starve to death because their stomachs are filled with plastic debris. They also suffer from lacerations, infections, reduced ability to swim and internal injuries.
- Plastics – so synthetic materials – are made from petroleum, among other things. Over 300 million tons of plastic is produced every year, half of which is used to make single-use items such as shopping bags, cups and straws. This means half of all products are used only once and then discarded.[3] Fortunately, more and more laws are being introduced to ban single-use items.

But incorrect waste disposal is not the only cause of greenhouse gases. The items that eventually end up in landfills have to be produced in the first place, and these production processes also cause greenhouse gases.

Process

The participants divide into teams of 4 to 6 people. Each team is given a set of picture cards depicting 10 different objects and time cards representing decomposition times.

Each team now assigns the objects to the decomposition times. They have 5 minutes to do this.

The time it takes for materials to decompose depends on many different factors, such as exposure to the sun, temperature, humidity, size of the waste pieces and the microorganisms involved. The exact composition of the material is another important factor. Paper, for example, is often coated with varnishes or plastics, which means it takes much longer to break down than if it were only made of cellulose.

All the teams present their results (guesses) before the correct answers are revealed.

In the next step, the workshop leaders discusses the following questions with the participants:

- *How important is recycling, and what do we have to consider when we separate waste? Can we recycle everything? Is recycling alone the solution?*

Recycling is the process of saving used materials and natural resources from landfills and putting them to new use, i.e. making something new out of them. This saves not only resources but also energy. Recycling an aluminium beverage can requires 95% less energy than producing a new one from raw materials. However, recycling aluminium is a complex process because aluminium is rarely used on its own but is mixed with other metals (producing what is known as alloys), which are difficult to separate. During the recycling process, some of the aluminium is lost. This means we cannot just make a new can from an old can. In fact, less than a quarter of the world's aluminium is made from recycled material. Incidentally, an average smartphone is made from about 60 different raw materials, including about 30 different types of metal[4]

Recycling plastics (synthetics) poses similar problems. Plastics are made from different materials (made up of molecular chains, or polymers) such as carbon, hydrogen, nitrogen, sulphur, chlorine or phosphorus. There are many different types of plastics, each with different properties (flexible, rigid, fire-resistant). When different plastics are combined, as is often the case, for example, with cheese packaging, recycling becomes difficult.

2 https://www.bmz.de/de/themen/abfallwirtschaft/klimawandel-18518 [last accessed on 12 December 2022] (in German)
3 Cf. https://www.iucn.org/resources/issues-brief/marine-plastic-pollution [last accessed on 12 December 2022]
4 https://www.quarks.de/umwelt/muell/darum-ist-aluminium-nicht-gut-fuer-die-umwelt/ [last accessed on 14 December 2022] (in German)

If the different plastics cannot be separated, the packaging cannot be recycled. Often, the packaging then has to be incinerated.[5] An average of only 48% of waste produced in Europe was recycled in 2020, in other words barely half.[6] So it's always better to ensure we generate as little waste as possible even when we do our shopping.

Possible questions at the end of the exercise

- *What can we do during our visit to avoid waste?*
- *What happens to the waste we do produce?*
- *Is the waste collected and disposed of/recycled separately here on site? If so, how can we ensure our waste is properly separated and disposed of?*

Want to know more?

Anyone interested in doing more on the subject can organise a film evening and show the video **"Story of Stuff"**.

5 https://www.nabu.de/umwelt-und-ressourcen/abfall-und-recycling/recycling/27543.html [last accessed on 14 December 2022] (in German)
6 https://www.eea.europa.eu/publications/reaching-2030s-residual-municipal-waste/reaching-2030s-residual-municipal-waste [last accessed on 14 December 2022]

4

Energy and climate change

All about energy

In this unit, participants are invited to look at energy consumption and different ways to generate electricity.

Participants are sensitised to the connection between energy consumption and climate change, and they discuss ways to save energy.

Time required	Approx. 30 minutes
Method	Interactive game
Materials	• Poster or flipchart and pen • For each team: – Cards depicting everyday situations – Cards with details about energy consumption
Preparation	It's best to find a suitable outdoor area, but the game can also be played in a large room. The workshop leader draws a baseline on the ground and from there one lane for each team. The participants use the "power consumption" cards to mark out the kWh usage for everyday activities on each lane. 0.1 kWh corresponds to one metre[1]. – 10cm: charging a smartphone (0.01 kWh) – 70cm: working on a laptop for one hour (0.07 kWh) – 1.5m: playing on a game console for one hour (0.15 kWh)[2] – 2m: blow-drying hair for 10 minutes (0.2 kWh) – 2.5m: cooking half a kilo of potatoes with the lid on the pan (electric cooker) (0.25 kWh) – 5m: cooking half a kilo of potatoes without the lid on the pan (electric cooker) (0.5 kWh) – 6m: baking a frozen pizza in the oven (0.6 kWh)

Opening

→ *How is energy generated/produced? Which examples do you know from your countries / region?*

When we speak of energy, we are not only speaking about electricity, but also about the energy needed for heating and transportation.

The participants name the different sources of energy, e.g. on a poster, if necessary, with the help of the workshop leader. The main sources of energy are

- nuclear energy
- biomass (e.g. wood, plants)
- natural gas
- geothermal energy

1 Unless specified otherwise, all details are based on average values determined according to the average estimated electrical output (watts) of current reference devices.
2 Cf. https://www.klimaaktiv.at/energiesparen/effiziente_geraete/neue-Konsolen-Stromverbrauch.html [last accessed on 12 December 2022] (in German)

- coal
- oil
- solar energy
- hydropower and
- wind power

→ *Which of these sources of energy are globally the most common?*

- The main sources of energy (as of 2021) are coal, oil and gas, which together cover about 84% of the world's energy requirements.[3] These energy sources together, however, emit especially large amounts of carbon dioxide, so significantly contribute to climate change. Of the 37.12 billion tons of CO_2 that were emitted globally in 2021, 34.74 billion tons were produced by coal, oil and gas. In concrete terms, this means coal accounts for 14.98 billion tons, oil for 11.84 billion tons and gas for 7.92 billion tons of CO_2.[4]

If there is enough time, the workshop leader and participants can discuss other sources of energy and the extent to which they can be considered environmentally friendly.

- **Nuclear energy:** While coal, oil and gas are problematic because of resource depletion and, above all, emissions, the two main problems with nuclear energy are the safe storage of highly radioactive waste and the risk of a core meltdown with catastrophic consequences for humans and the environment (as was the case in Fukushima/Japan in March 2011).[5]
- **Renewable sources of energy such as wind power, solar energy, hydropower, biomass and geothermal energy:** This energy is generated from natural resources that are inexhaustible (e.g. wind and sun) or come from replenishable material (wood, plants). These sources of energy play an important role in reducing greenhouse gas emissions. But even some of these clean energies sometimes have drawbacks. With hydropower, for example, large-scale dams can disrupt freshwater ecosystems or force populations to relocate to make way for reservoirs. Wind turbines on wind farms can pose a threat to birds and bats. Engineers are working on ways to make wind power stations safer for birds. Biomass includes ethanol and biodiesel, wood and wood waste, but also biogas from landfills. Biofuels from plants, however, are controversial because biofuel production can compete with food production, as is the case with corn.[6] So we have to consider these energies carefully. But renewables are still far better than coal, oil and gas.

3 Cf. Our World in Data based on BP Statistical Review of World Energy. Online: https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html [last accessed on 12 December 2022]; vgl. auch https://ourworldindata.org/grapher/primary-sub-energy-source [last accessed on 12 December 2022]
4 Cf. Hannah Ritchie, Max Roser and Pablo Rosado (2020): CO2 and Greenhouse Gas Emissions. Published online at OurWorldInData.org. Retrieved from: https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions [Online Resource] [last accessed on 12 December 2022]. Data based on the Global Carbon Project (2022).
5 https://www.bpb.de/shop/zeitschriften/izpb/169476/energiequellen-und-kraftwerke/ [last accessed on 15 December 2022] (in German)
6 https://www.nationalgeographic.com/environment/article/renewable-energy [last accessed on 16 December 2022]

Process

Now it's time for participants to examine their own energy consumption behaviour. They ask themselves how much energy they use in their everyday lives. Teams of 6 to 8 participants are formed. The teams line up at the baseline and are each given a set of cards depicting everyday situations. They are asked to guess how much energy is needed in each situation. They place the picture cards in the appropriate place on their lane. The more energy that is needed, the further away they place the picture card. They have a maximum of 5 minutes to do this.

→ The consumption of electricity is measured in kilowatt-hours (kWh). A kilowatt-hour measures the energy a device uses in kilowatts (= 1,000 watts) per hour. A 50-watt light bulb uses 50 watt-hours in one hour, which equals 0.05 kilowatt-hours. In 2021, average energy consumption per person globally was 20,939 kWh; in EU countries, this figure was almost twice as high at 37,497 kWh per person.

The individual teams all line up at the baseline. The workshop leader explains the game:

→ *Ask yourselves how much electricity the described situations need. Place the picture cards in the right place on the timeline.*

The participants discuss the estimates of all the groups, then the workshop leader reveals the correct answers and can add such comments as:

It makes a big difference whether you cook something with or without a lid on the pot.

Smartphones as devices (i.e. just the running of the phone) have little energy impact, and the power consumption of laptops is also insignificant. What does use up a lot of energy, however, is the internet. Every search request you send, every video you stream, every email you send – everything runs through large computing centres, with servers that need electricity. Servers also produce a lot of heat and have to be cooled. Calculating the exact energy consumption is a complex process, but we can assume that one hour of video streaming in full HD quality uses between 0.22 and 0.37 kWh.[7] The way we use smartphones means they consume a lot of energy every day, far more than is needed just for the charging process.

Some appliances consume energy even when we aren't using them or have switched them off, e.g. printers, Wi-Fi routers, washing machines or monitors. We can sometimes see a small light burning or we notice the appliance is warm; sometimes, we can't even see whether the standby mode is switched on. The answer here is to disconnect the power supply. Unplug the device or use a power strip with a switch.

Workshop leaders can conclude the exercise by asking

→ *What electronic device could I easily do without? Which one could I definitely not do without?*

Participants then suggest ways to save energy during the specific activity.

Energy-saving tips may include

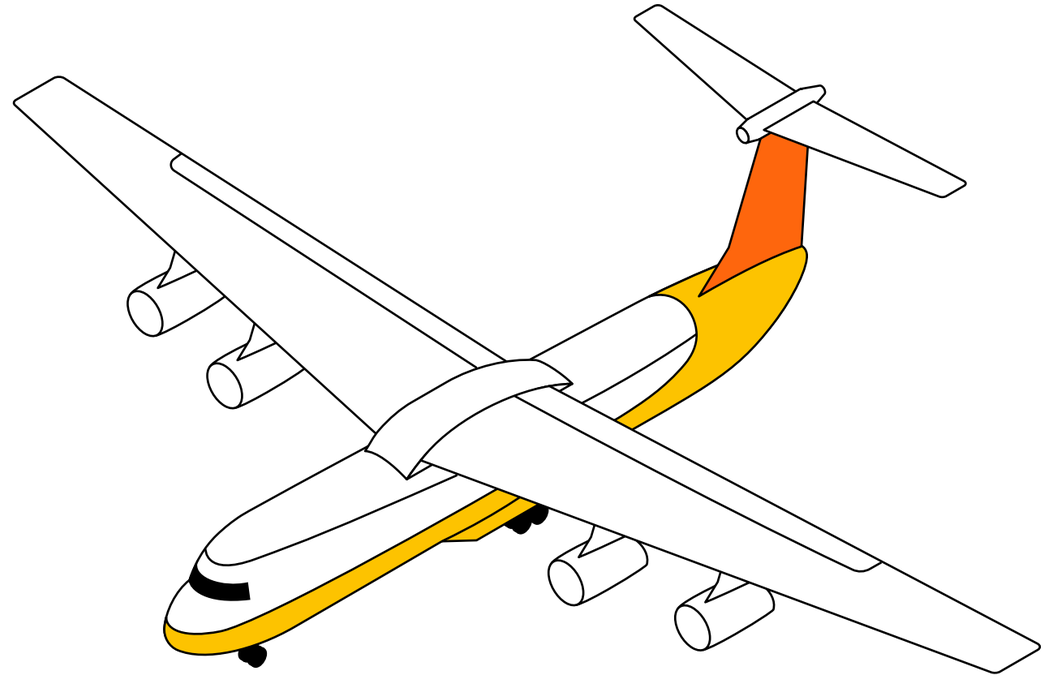
- **turning down the heating**, especially when no-one is using the room for a longer period. Heating has an important energy-saving potential.
- **airing rooms only briefly**; open all windows for 3-5 minutes and turn down the heating during this time.
- **switching off lights** if you are the last to leave a room.
- **taking shorter showers**.

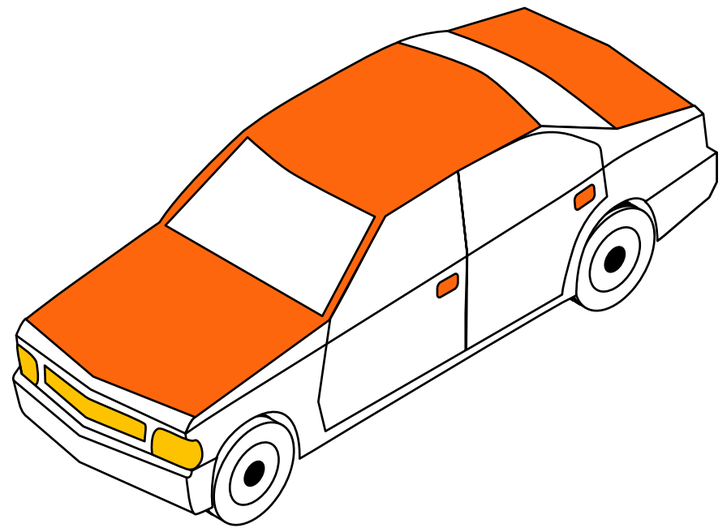
7 Cf. https://www.deutschlandfunkkultur.de/stromfresser-internet-wie-viel-energie-verbrauchen-google-100.html (in German)

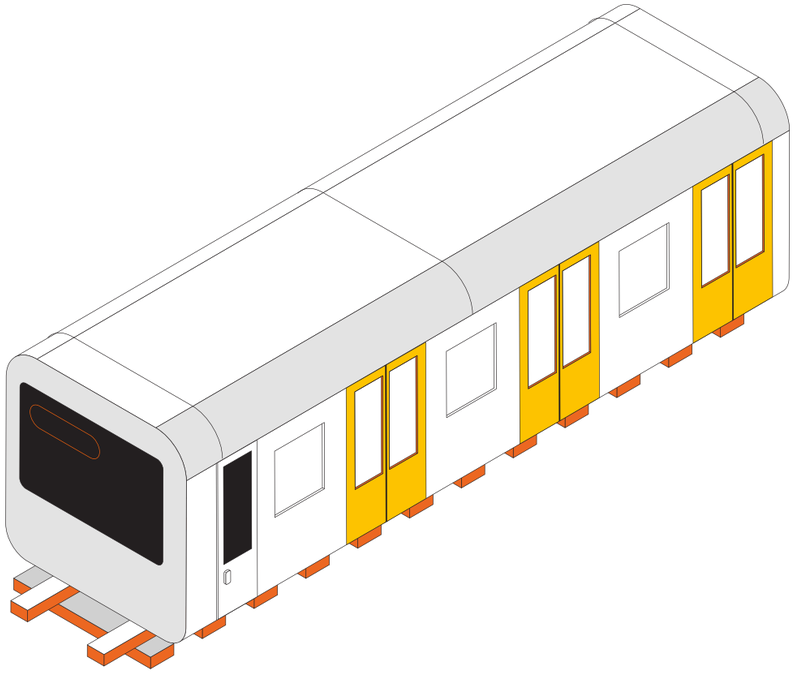
- **switching off standby mode** on devices or disconnecting appliances from the power supply.
- always **closing the fridge door quickly** and making sure the temperature is set correctly (+7 degrees is sufficient; perishable food should be kept at the bottom of the fridge, where it is coldest).
- **cooking with lids** on pots (saves 50% electricity) and not preheating the oven.

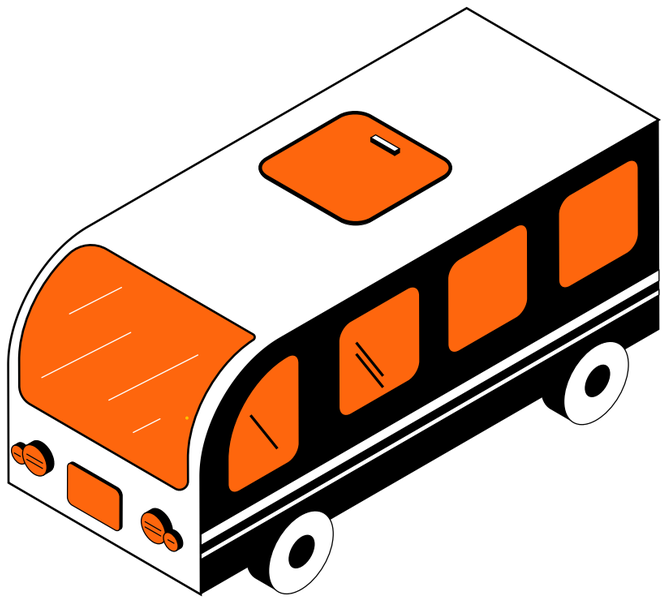
Want to know more?

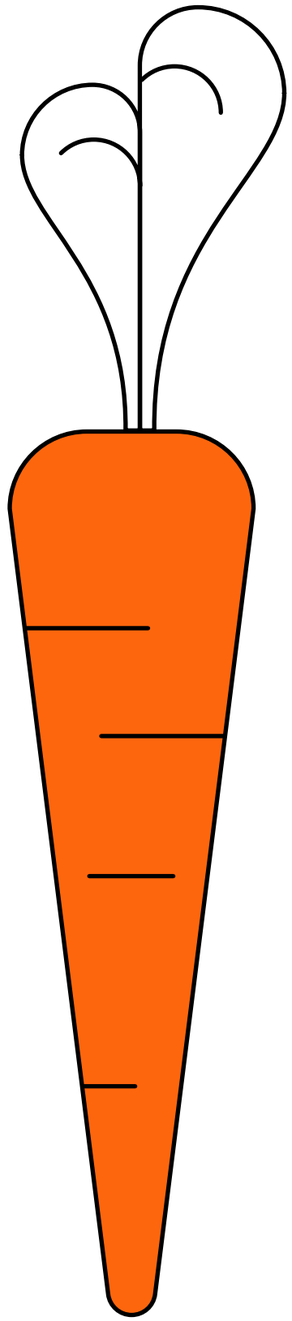
Those who want to find out more about renewable energies can watch this video: **Can 100% renewable energy power the world?**

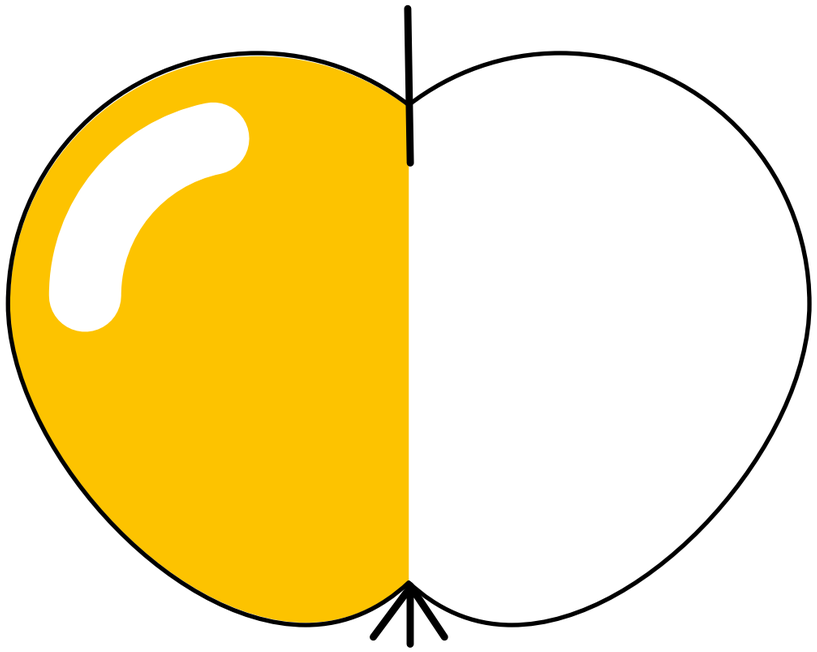




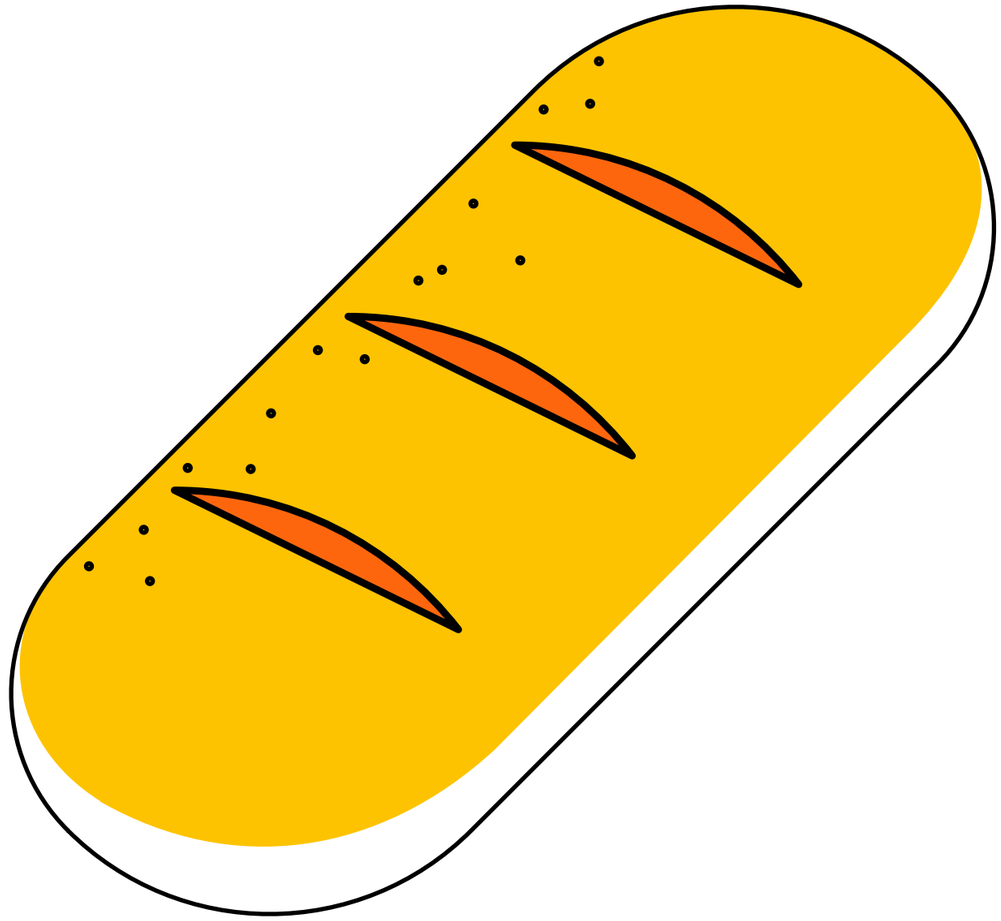


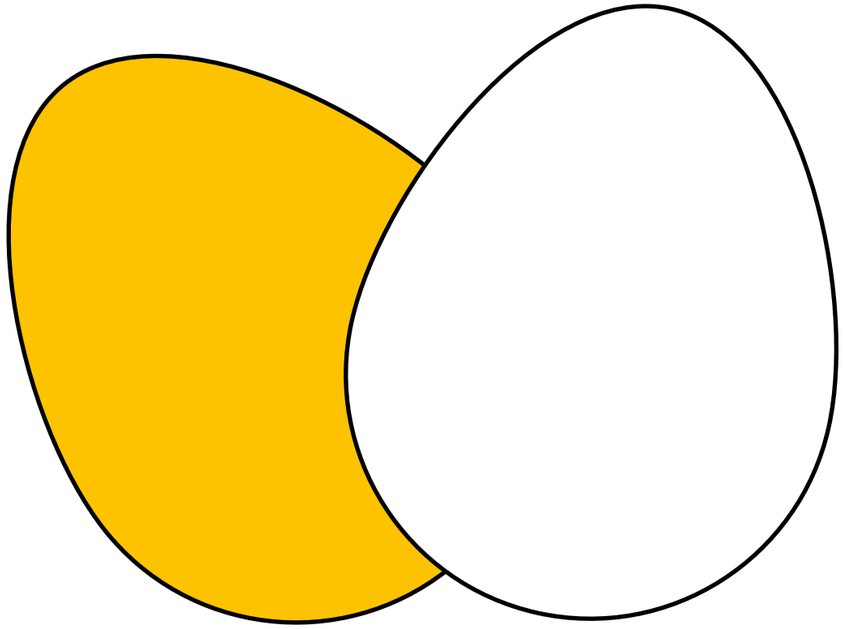


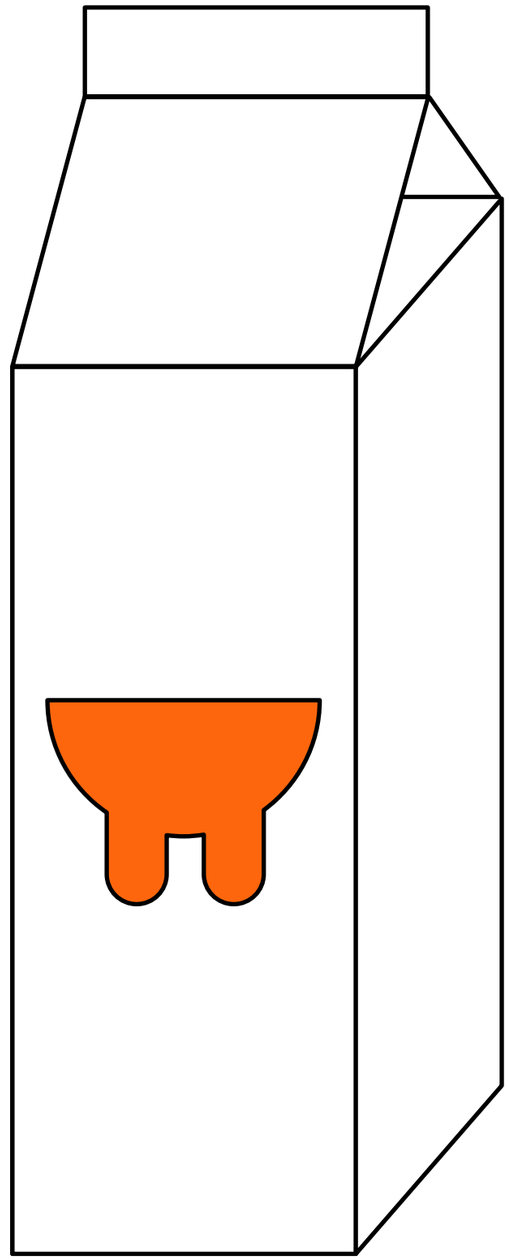


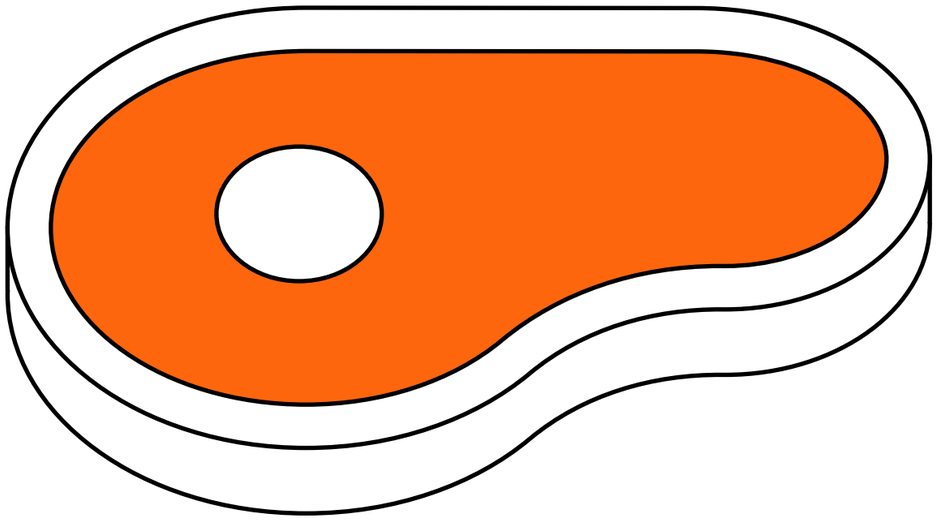


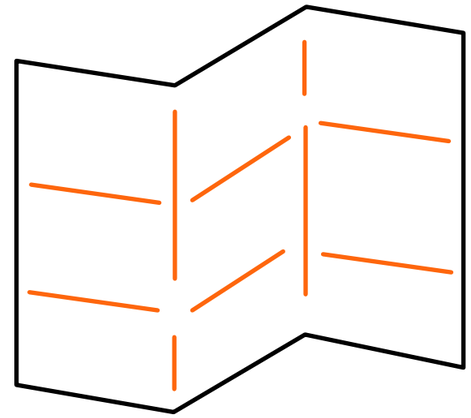
Diet and climate change

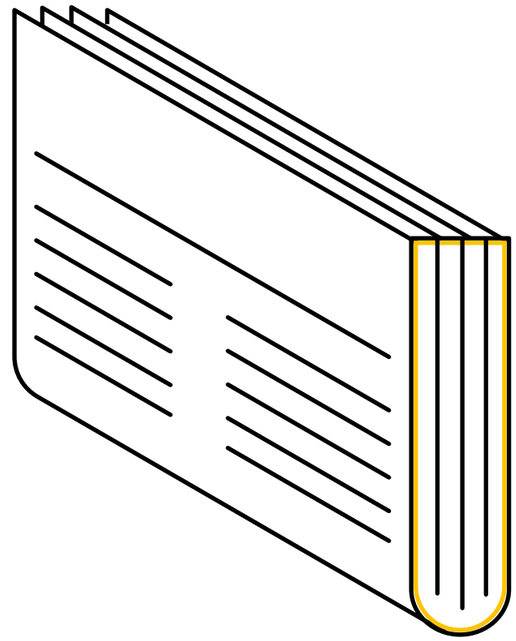


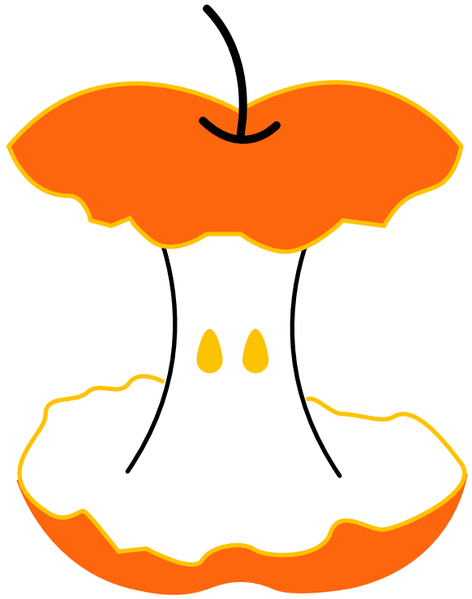


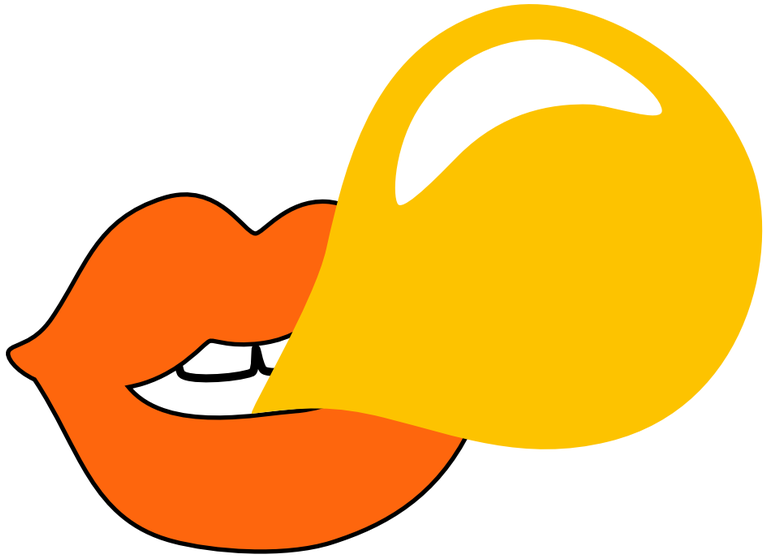


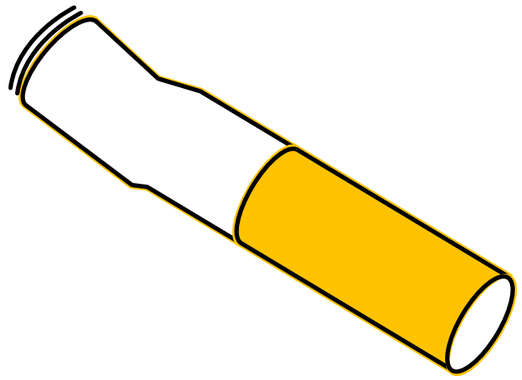


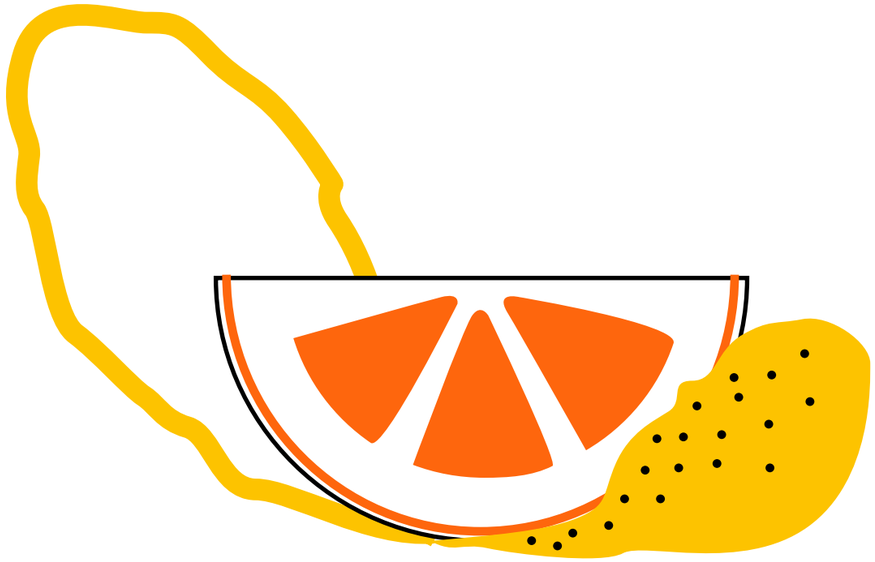


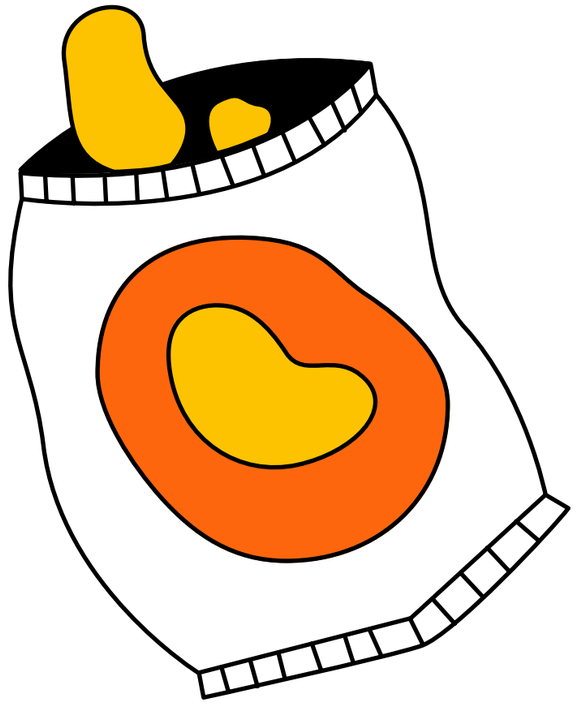


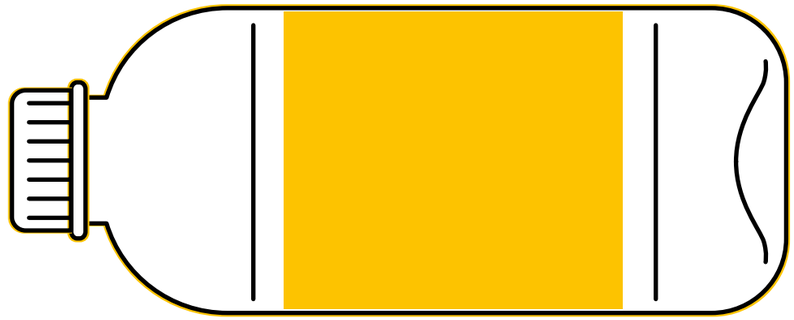


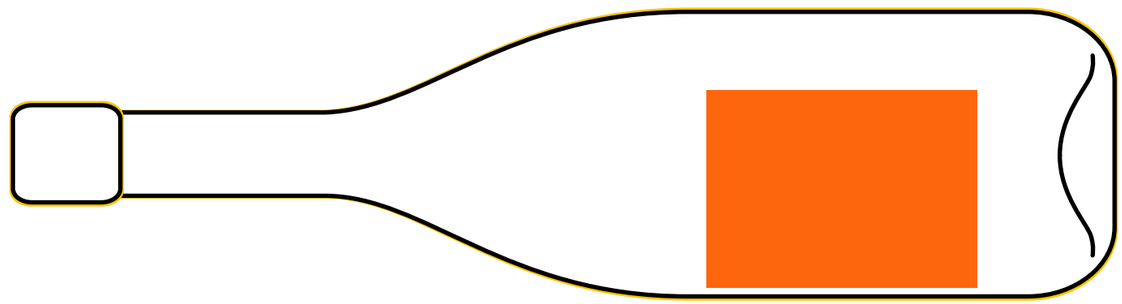


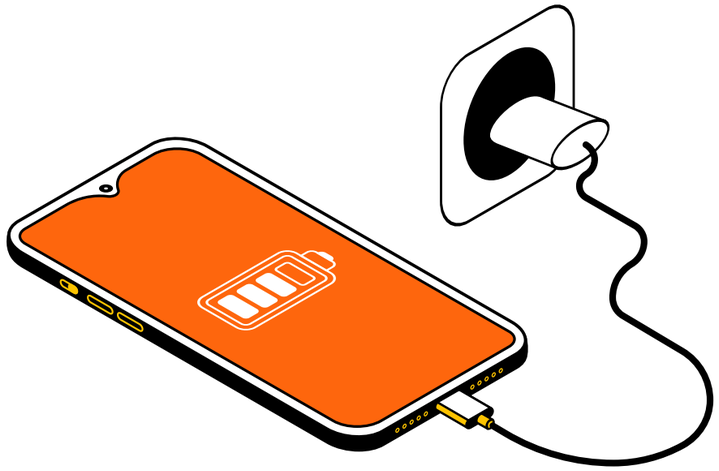










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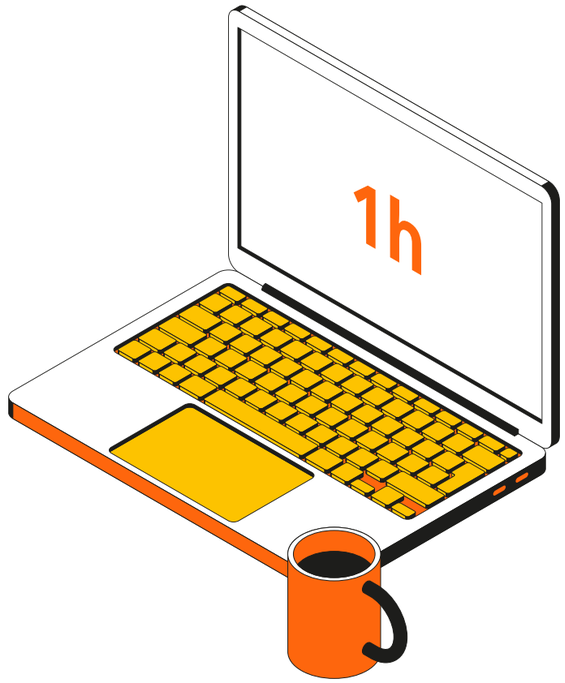
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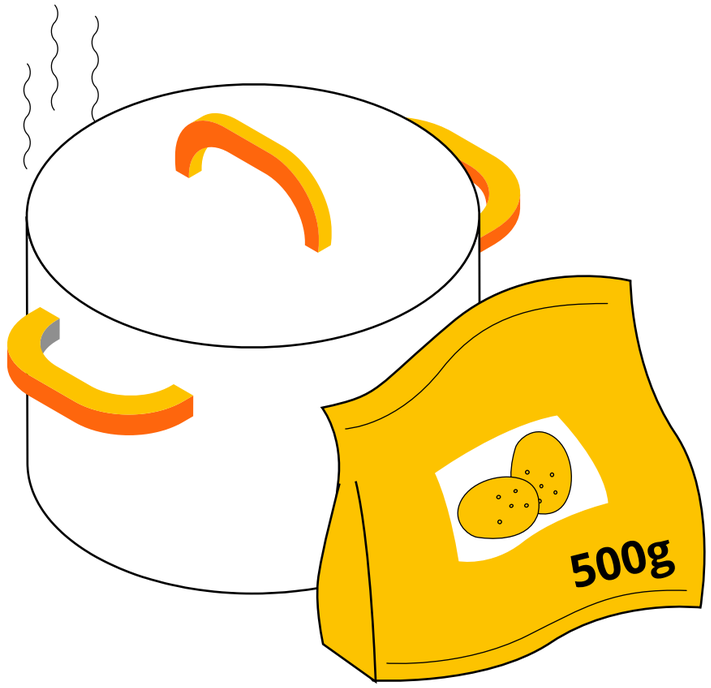
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