Collection of Teaching Materials

Activities and Exercises

How much warmer is one degree? Sensitise and empower low-level educated citizens, refugees and migrants in tackling climate change and global warming

2021-1-IT02-KA220-ADU-000033403

Co-funded by the Erasmus+ Programme of the European Union

Foreword

The Collection of Teaching Materials refers to the e-Learning Course of the OneDegree project (https://www.howmuchwarmerisonedegree.com) which is primary addressed to teachers and vocational education trainers, refugee workers and migrant counsellors. This course guides educators through methodologies and contents related to teaching adults about the connections between climate, weather, atmosphere, energy, traffic, housing, food etc. It represents the main instrument aimed to help educators to spark interest and curiosity of users with low educational background.

This Collection of Teaching Materials provides suggestions for primary and secondary school teachers and for trainers in vocational or adult education institutions how they can introduce climate subjects horizontally into their regular teaching activities.

Altogether, this collection comprises 60 activities, ranging from short and simple exercises to longer and more elaborate projects. It also covers a relatively large number of teaching subjects, because we believe that Climate Literacy should not be restricted to natural science subjects, since it also includes social, psychologic and cultural aspects.

Above all, these activities should encourage teachers and trainers to become creative and to introduce environmental aspects, and especially aspects concerning the possibilities that we citizens have to mitigate the effects of climate change, into their daily teaching. After all, we have only this one planet Earth. We need to educate climate literate people who take matters into their own hands.

Würnitz, autumn 2023

Wolfgang Eisenreich
WIN Science Initiative Lower Austria

Introduction

We have grouped the activities by their type, i.e.

- discussion
- exercise
- experiment
- project
- other

Because of the variety of teaching subjects which is due to different school systems in the countries of the partnership, the following tables are restricted to the most widely taught subjects, i.e.

- SOC social sciences
- GEO geography
- LAN foreign languages (especially English)
- HIS history
- PSY psychologiy
- MAT mathematics
- ECO economy
- BIO biology
- CHE chemistry
- PHY physics
- ART art education

The description of the activities contains also indication about the suggested duration:

- short (< 15 minutes)
- medium (15 – 45 minutes)
- long (> 45 minutes)
- spread over a longer period

Also, the suggested group size is indicated:

- individual
- small group
- large group

After the description of the activity, the materials needed are indicated. If applicable, we give also tips for teachers.

Activity type: Discussion

Activity title	Module	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Page
Planet management	1	SOC	GEO			PSY			BIO				6
How to reduce population growth	2	SOC	GEO	LAN	HIS								7
Overshoot Day	2	SOC	GEO			PSY			BIO				9
Globetrotter	3	SOC	GEO										10
Our house	4	SOC									PHY		11
Stand by	5						MAT						12
Poster making session	6			LAN									13
Waste of food	6						MAT		BIO				14
Reduce your ecological footprint	7	SOC											15
Climate wars	8	SOC	GEO		HIS								17

Activity type: Exercise

Activity title	Module	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Page
Find the meaning	1			LAN									18
Energy and the world population	1						MAT						19
Find your ecological footprint	2			LAN									20
Your footprint	2	SOC	GEO	LAN									21
Renewable energy	2						MAT						22
A crossword for the crossroad	3			LAN									23
Driving produces CO2	3						MAT						24
The blueprint of sustainabilty	4			LAN									26
Sustainable mobility	4						MAT						27
CO2 emission in the household	4						MAT						28
Solar collector	4										PHY		29
Energy efficiency	5						MAT						30
Food waste prevention and education	6								BIO				32
Write a petition	8			LAN									33

Activity type: Other

Activity title	Module	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Page
Running tap (case study)	4	SOC											34
Passive house quiz (quiz)	4										PHY		36
Electricity pub quiz (quiz)	5			LAN									38
How can I spend less (role play)	7	SOC		LAN									39

Activity type: Experiment

Activity title	Module	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Page
Melting ice	1									CHE	PHY		41
Greenhouse effect model	1										PHY		43
Acid oceans	2									CHE			44
How is drinking water produced	2								BIO	CHE			46
Solar barbeques	3										PHY		48
Carbon dioxide during combustion	3									CHE			50
Pindapower	4								BIO				52
Measured and felt temperature	4										PHY		54
Light bulbs and heat	5										PHY		55
Efficiency of light bulbs	5						MAT				PHY		57
Less energy for boiling water	5						MAT				PHY		60
Albedo	6										PHY		61
Bio-ethanol	7									CHE			63
Sorting before recycling	7									CHE			65

Activity type: Project

Activity title	Module	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Subj.	Page
Find answers	1	SOC	GEO	LAN									67
Developing green mobility solutions	1	SOC		LAN				ECO					68
What will climate change bring	1	Soc	GEO	LAN									69
Observed effects of climate change	1		GEO	LAN	HIS								71
Ecological footprint estimation	2			LAN			MAT						73
Cycling in the village	3	SOC	GEO	LAN									75
Motivate parents to a sustainable house	4	SOC		LAN		PSY	MAT						77
Energy consumption	4			LAN			MAT						79
School newpaper and radio	5			LAN								ART	81
Zero waste school	6	SOC							BIO				82
Benefits of local products	6	SOC					MAT		BIO				83
The journey of fruit and vegetables	6		GEO				MAT		BIO				84
A visit to the local supermarket	7			LAN									86
Shopping habits	7	SOC											87
More shopping	7	SOC				PSY		ECO					88
Clean air	8	SOC	GEO										89
School board for climate change	8	Soc	GEO	LAN	HIS	PSY	MAT	ECO	BIO	CHE	PHY	ART	90
School campaign	8	SOC					MAT						92

Planet management

Module: 1 (Climate questions)

Type of activity
- ◯ experiment
- ◯ exercise
- ◯ case study
- ◯ role play
- ◯ project
- ✓ discussion
- ◯ other: _____

Group size and duration
- ◯ individual
- ✓ small group
- ◯ large group

- ✓ short (< 15 minutes)
- ◯ medium (15 – 45 minutes)
- ◯ long (> 45 minutes)
- ◯ spread over a longer period

Teaching subjects:
Biology
Social science
Psychology
Geography
Natural science

Description:

Finish the first module of Climate Literacy. Divide the group into pairs of two. Discus the origin of climate change and what features of our society that are based on oil and other activities that result in increasing levels of climate gases in the atmosphere. What would the planet look like today if we never started to base our energy system on fossil fuel? How do you think that would have effected economics and living standards on the planet? What if we had started to decrease the importance of oil in the energy system in the 1960's, when the discussion on climate gases was new?

Human beings are not the only creatures living on this planet. Animals, plants and microscopic organisms has been living here longer than we have. Do the humans have any rights to change the settings of our planets future, for us and all the other living species? What is the arguments for or against?

Why should we try to stop global warming? Can we just adapt to the new circumstances instead?

Write down your thoughts and discuss the results in the whole group.

Materials needed: Paper and pencils.

Tips for teachers:
Let the students fill the whiteboard with their thoughts of this issue to visualize the complexity.

Reduce population growth?

Module: 2 (Ecological footprint)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ◯ project → discussion ◯ other:	Group size and duration → individual ◯ small group → large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) → long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s). Sociology Geography History Language

Description:

Pre-activity: Pro contra discussion preparation

Students listen to the presentation about ecological footprint and consequences that are expected because of climate changes.

Part 1: The task for students is to form a view against or for this proposed solution. The class is divided into two groups. The first group consists of students who support the idea. Their task is to prepare arguments, why this idea is the best possible solution and concrete proposals how countries can manage this goal. The other group consists of students who disagree with idea. Their task is to prepare arguments where this idea has deficiencies and to propose better alternatives.

Part 2: Each group gets questions which will be part of the discussion and has 15-20 minutes for preparation. The first task of each group is to distribute their roles and tasks. Half of the members will look for data and information on which their arguments will be formed. The other half will be speakers and present the arguments in confrontation. If the students cannot find a consensus, roles are distributed on the basis of the draw or by the trainer/teacherwho knows what kind of task will be appropriate for some of the students.

Main part: Pro-contra discussion

The trainer/teacher has the role of the facilitator of debate. In the introduction he/she presents the topic and highlights areas that will be a matter of debate. Then he/she announces the speakers on both sides and formulates the questions. Groups can be seated separately. Speakers can stand between their speech or have a frontal presentation behind the rhetorical table. Every speaker has a time limit for presentation of group's arguments. Discussion should last from 20 to 30 minutes.

Last part: Forming of conclusions and evaluation of experience

Part 1: The final question is focus on conclusions. One possible way is to limit the time for speakers, for example one minute. The facilitator of the debate makes a general conclusion with a brief summary of the whole debate.

Part 2: The trainer/teacher distributes an evaluation questionnaire about how student assess their new learning experience.

Key activities:

- learn how to use various browsers filters
- learn how to look for a credible information
- preparation of arguments and opposite arguments
- preparation of replics
- public speaking skills

Materials needed :
Computers, mobile phone, Wi-fi, projector, list, markers, evaluation questionnaires

Tips for teachers:
It is good to substantiate your explanation in the pre-activity part with use of graphs, table and examples from the Module or from other sources.
If students cannot find a consensus, roles are distributed on the basis of the draw. It is allowed that one group has more members than the other. If it happens that one of group is without members, teacher/trainer can try to invites students, who have not yet made a choice into this group. If nobody wants to take a part in a group, teacher/trainer represents the opposite pole.
The facilitator of the debate needs to use questions that allow the presentation of various views and arguments. It is important that he/she warns speakers when they exceed their time, when they become too rude or discriminate or when they try to divert the topic.
Evaluation questionnaires are required because some of students are going to identified with their positions and roles more strongly and they will need deviation from this experience. The evaluation could also help students to avoid conflicts after debate.

Overshoot Day

Module: 2 (Ecological footprint)

Type of activity
- ◯ experiment
- ◯ exercise
- ◯ case study
- ◯ role play
- ◯ project
- ✓ discussion
- ◯ other: _____

Group size and duration
- ◯ individual
- ✓ small group
- ◯ large group

- ◯ short (< 15 minutes)
- ✓ medium (15 – 45 minutes)
- ◯ long (> 45 minutes)
- ◯ spread over a longer period

Teaching subjects:
Social science
Natural science
Biology
Geography

Description:

Divide the group into smaller groups of 3-4 students. Discuss the politics of climate change, which countries are most discussed in the media? Why?

World Overshoot Day is a way to communicate that we currently are taking out more resources from the earth than it could regenerate. Each year the Overshoot Day comes earlier, due to increasing use of resources. For how long do you think this is going to be possible?

How can we explain Overshoot day to our parents, neighbours etc. in a way that actually leads to action? Look at the maps on unit 3, page 8. Do you notice any correlation between ecological footprint and ecological reserve? What do you think this correlation comes from?

Write down 5-10 immediate actions that needs to be taken to regain a balance between usage of matter produced on the planet and the regeneration of renewable resources.

Materials needed: Paper and pencils.

Tips for teachers:
Let the students involve their family and friends in the immediate actions to balance the outtake of resources.

Globetrotter

Module: 3 (Mobility)

Type of activity
- ◯ experiment
- ◯ exercise
- ◯ case study
- ◯ role play
- ◯ project
- ✓ discussion
- ◯ other: _____

Group size and duration
- ◯ individual
- ◯ small group
- ✓ large group

- ◯ short (< 15 minutes)
- ◯ medium (15 – 45 minutes)
- ✓ long (> 45 minutes)
- ◯ spread over a longer period

Teaching subjects:
Social science
Geography
Tourism

Description:

Travelling, exploring new places and meet people from other cultures is a popular way to spend both time and money for many people. But is this hobby, travelling for the purpose of joy a sustainable choice of life? What choices can we make to decrease the environmental impact when we travel? Means of Mobilityations, destination, duration, can we make a difference by planning our trip from another view?

Is it possible to try to convince people to stop travel or only to travel around the area where they live, to reduce the amount of climate gases from Mobilityation? Is it a good thing to encourage ecotourism that still leads to more travelling?

Is there risk that defeating poverty leads to a higher rate of travelling and use of fossil fuels for Mobilitying? Can we do anything to avoid that?

When we travel, wo often change our habits of living and dining. Do we forget our good manners on for example waste recycling when we are on vacation? How do we address that?

Make up plans for one weekend trip and for one longer summer vacation that has a low impact on the environment, but that you still find interesting and affordable.

Materials needed: Paper and pencils.

Tips for teachers:
Use magazines from local travel agencies and folders on local tourist attractions to inspire sustainable travelling.

Our house

Module: 4 (Housing)

Type of activity	Group size and duration	Teaching subjects:
◯ experiment ◯ exercise ◯ case study ◯ role play ◯ project ✓ discussion ◯ other: _____	◯ individual ✓ small group ◯ large group ✓ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Social science Physics

Description:

Modern houses often have better insulation and heating systems than older houses. Old houses can be renovated with new insulation and the heating system can be upgraded to a modern one which doesn't run on fossil fuels. Still, the production of new building material craves material and energy. When is it better to renovate an old house than to remove it and build a new one?

Make a list of the dividends for upgrading to a modern energy source which doesn't run on fossil fuels. What reasons do you think will weigh highest when it comes to upgrading older houses?

Do you think legislative action could be a drive for more energy efficient renovations? If so, write down a simple law with the principles you find most important. Are there any exceptions for buildings that needs a great amount of energy?

Materials needed: Paper and pencils.

Tips for teachers:
If possible, let the student walk around the school building and guess the age of the school. Maybe the building has many different parts of various age. Discuss which parts that could get renovated for a better energy efficiency of the building.

Stand-by

Module: 5 (Energy)

Type of activity
- ◯ experiment
- ✓ exercise
- ◯ case study
- ◯ role play
- ◯ project
- ◯ discussion
- ◯ other: _____

Group size and duration
- ✓ individual
- ◯ small group
- ◯ large group

- ◯ short (< 15 minutes)
- ✓ medium (15 – 45 minutes)
- ◯ long (> 45 minutes)
- ◯ spread over a longer period

Teaching subject:
Mathematics

Description:

Find five products in your home that is possible to put in stand-by mode. What is the difference in energy consumption when it is on and when it is in stand-by mode? This information can often be found on the product or in the user manual.

How much energy is wasted on stand-by mode on these products under a whole year? How can you present the number of kWh in another form? Hours to light up a 10 W LED lightbulb? Miles with an electric car? Any other way?

Materials needed: Paper and pencils, calculator, five items with user manuals.

Tips for teachers:
If possible, use an energy meter to measure the energy consumption

Poster-making session

Module: 6 Food waste		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ◯ project ✓ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ✓ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Languages

Description:

This exercise invites the trainer to make use of the topic of Food waste as a subject and engage into a language activity with the trainees.

Trainees are arranged in teams. Each team is provided with a picture showing a food-waste practice (e.g. a restaurant table with half-full plates left). They are by the trainer to discuss these pictures in each team, in the language which is being taught. Then they are asked to come up with ideas on how to minimise this food waste technique. They are asked to make a poster with these ideas. The poster will be intended to be put up in the relevant place where the food-waste takes place (e.g. restaurants, kitchens etc). The poster of each team, written in the language which is being taught, is presented to the plenary.

Materials needed :

- Pictures of food waste practices
- A1 or A2 papers for the posters
- Glue
- Magazines for scrap-booking
- Scissors
- Colour pens and markers

Tips for teachers:

It is important for the trainer to have a grasp of food-waste and its impact before the training takes place.

Waste of food

Module: 6 (Food and waste)

Type of activity
- ◯ experiment
- ◯ exercise
- ◯ case study
- ◯ role play
- ✓ project
- ◯ discussion
- ◯ other: _____

Group size and duration
- ◯ individual
- ✓ small group
- ◯ large group

- ◯ short (< 15 minutes)
- ◯ medium (15 – 45 minutes)
- ◯ long (> 45 minutes)
- ✓ spread over a longer period

Teaching subjects:
Biology
Natural science
Mathematics

Description:

Find out what happens to the food waste in the school cafeteria or dining area. Is the food waste separated from other waste? Is it recycled in any way?

Measure the amount of food wasted every day in a week by weighing the waste bags. Communicate the issue of food waste and inform your fellow students on not to serve more food than needed. If there is a capacity in the cafeteria to change to smaller plates in the dining area this will increase your results. Measure the difference in food waste before and after the campaign by weighing the food waste under another week.

Approximately how much CO2 emissions did you save by this exercise? If you would continue this campaign how much would you have saved within one year? How can you present the number of CO2 emissions in another way? Miles with a car driven by diesel? Minutes in the shower? Miles with an airplane?

Materials needed: Paper and pencils, cafeteria or restaurant, waste bags, scale.

Tips for teachers:
Talk to the personnel of the cafeteria and choose two weeks of measuring where the menu is somewhat likewise.

Reduce your ecological footprint

Module: 7 (Shopping)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ◯ project ✓ discussion ◯ other: _____	Group size and duration ✓ individual ✓ small group ◯ large group ✓ short (< 15 minutes) ◯ medium (15 – 45 minutes) ✓ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Social sciences

Description:

Trainees are asked to identify in a word-search puzzle 12 terms related to the main positive and negative consequences related to the production levels derived from the social consumerism model and discuss about actions that can be carried out aimed at caring and cleaning earth.

D	H	D	J	L	I	F	V	A	V	C	U	V	A	D	N	V	R	C	S
S	C	S	J	N	G	R	E	E	N	E	C	O	N	O	M	Y	C	A	C
A	S	W	P	S	C	J	N	E	C	X	A	E	J	V	V	A	W	J	B
V	U	A	C	I	D	I	F	I	C	A	T	I	O	N	C	A	U	F	V
F	V	T	F	V	S	W	X	E	V	J	R	V	A	J	R	V	A	D	B
C	R	E	N	E	W	A	B	L	E	E	N	E	R	G	Y	C	E	S	Y
E	E	R	D	S	R	S	D	H	O	L	P	G	H	S	M	A	U	B	E
O	C	P	C	S	A	T	F	I	I	M	G	C	D	R	O	U	G	H	T
P	A	O	B	C	P	E	V	D	D	F	D	A	H	D	N	S	F	B	R
K	X	L	U	N	P	D	L	A	N	D	U	S	E	C	O	P	J	F	D
H	V	L	E	R	I	C	D	H	C	V	A	S	Y	D	C	P	A	V	N
M	J	U	D	F	N	A	D	E	S	N	V	S	Y	K	E	S	V	S	I
E	B	T	C	S	G	C	D	I	K	F	V	M	D	S	R	V	T	J	B
G	O	I	S	H	D	E	Y	V	S	Y	R	J	S	C	A	E	H	B	X
I	C	O	N	S	U	M	E	R	I	S	M	D	H	R	L	C	C	W	D
O	V	N	F	D	V	J	T	C	Y	J	V	D	I	F	U	I	R	S	C
O	R	D	V	D	H	S	D	V	S	H	E	V	S	D	C	S	F	A	V
N	N	O	P	W	T	U	I	D	R	O	T	H	J	S	R	L	M	Z	T
M	R	T	I	K	G	L	O	B	A	L	W	A	R	M	I	N	G	K	U
P	Q	S	U	L	O	B	S	O	L	E	S	C	E	N	C	E	P	O	N

Once the word-search puzzle is solved (15-20 minutes) it is advice to make groups of 2-3 students and assigned one word to every group. They will be asked to search information about these terms and explain to the rest of the classmates how they are related to sustainable/non-sustainable consumption in current society.

Materials needed :

- Pens
- Papers

- Computers to do online search

Tips for teachers:
It is advisable to enhance discussion in the last part of the exercise posing questions to the students that make them react and provoking their reaction to reinforce the lessons learnt. This will require that teachers prepare in advance information in real cases related to the terms include in the quiz.

Climate wars

Module: 8 (Promoting climate literacy)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ◯ project ✓ discussion ◯ other: _____	Group size and duration ◯ individual ◯ small group ✓ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject: History Sociology Geography

Climate has affected human life and civilization from the emergence of hominins to the present day. These historical impacts of climate change can improve human life and cause societies to flourish, or can be instrumental in civilization's societal collapse

Climate change has been associated with the historical collapse of civilizations, cities and dynasties. Notable examples of this include the Maya culture Ancient Egypt. Other, smaller communities such as the Viking settlement of Greenland have also suffered collapse with climate change being a suggested contributory factor.
Through deforestation and agriculture, some scientists have proposed a human component in some historical climatic changes. Human-started fires have been implicated in the transformation of much of Australia from grassland to desert.
The group discusses other evident impacts of human activities that have led to changes in landscape and climate, e.g. the deforestation of Northern Africa by the Romans. Recent examples could be the acid rain on the 1980s or the draught that was one major cause for the Syrian civil war.

Materials needed :

Tips for teachers:

Finding the meaning

Module: 1 (Climate questions)		
Type of activity ◯ experiment ✓ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Languages

This exercise invites the trainer to make use of the topic of Climate Change as a subject and engage into a language activity with the trainees.

The exercise entails the collection of articles about Climate Change by the trainer, in the language which is being taught in the classroom. These articles can be derived from newspapers, magazines, online sources, as long as they provide credible information. The cut-outs must be found and prepared before the activity commences, by the trainer. The titles of the stories must be cut-out by the trainer, so that the trainee does not know which title belongs to which article. Trainees in the classroom are given an article each (or in groups) and are asked to read the story. Then they are asked to match the story with the correct headline. When all trainees choose their headline, they present the article to the classroom and the selected headline, and point out the words in the headline that they found most helpful to much it with the article.

In the next activity, trainees are given headlines (these could be headlines not belonging to an actual article) in the language which is being taught in the classroom. Then they are asked to write a short story to go with the headline. They can use information they can find in the articles which were used in the previous activity. The articles are then read in class and a discussion can take place on the subject (in the language which is being taught).

Materials needed :

- Newspaper or magazine cut-outs of articles talking about Climate Change, with their titles cut-out separately (found and cut-out before the activity by the trainer). The number of stories depends on the number of trainees.
- A set of headlines referring to Climate Change (these can be made up, not belonging to an actual article) prepared by the trainer to give out to trainees. The number of headlines depends on the number of trainees.
- Pens, Papers

Tips for teachers:

It is important that teachers are prepared by actually reading the articles they find for this activity, in order to have a background idea of what the articles are talking about. This will assist teachers in better facilitating the activity and the discussion. Sources of these articles can be scientific magazines (e.g. New Scientist, National Geographic), local or international newspapers, online sources of information on climate change (e.g. IPCC) etc.

Energy and the world population

Module: 1 (Introduction to Climate Literacy)

Type of activity
◯ experiment
X exercise
◯ case study
◯ role play
◯ project
◯ discussion
◯ other: quiz_____

Group size and duration
◯ individual
X small group
X large group

◯ short (< 15 minutes)
X medium (15 – 45 minutes)
◯ long (> 45 minutes)
◯ spread over a longer period

Teaching subject(s)
Mathematics

1. Calculate the percentage of the world's population living in the region. Enter the proportion in the table.
2. Suppose your class is symbolic to the entire world population. Calculate how many students in your class represent the respective population of the individual regions. Enter the numbers in the "Persons" column.
3. Divide the class into groups representing the various regions.
4. Suppose the chairs in your class symbolize global energy consumption. calculate the percentage of the total world energy consumption attributable to the regions. How many chairs correspond to these proportions. Enter the numbers in the table.
5. Distribute the chairs according to the results of the calculation in groups in the class.
6. All the representatives of the respective regions of the earth go to the chairs that are attributed to their group. Can everybody sit dow?
7. Evaluate the result: Does energy consumption correspond to the population?

Region	Population in millions	% of global population	students in your classroom	Energy consumption in billion coal units	chairs in your classroom
Europe incl. Russia	742			4,18	
North and Central Anerica	362			3,89	
Latin America and Caribbean	610			0,95	
Middle East incl. Iran	313			1,09	
Afrika	1084			0,58	
Asia and Pacific	3979			7,13	
	7080			17,82	

Materials needed :

Tips for teachers:

Find your ecological footprint

Module: 2 (Ecological footprint)		
Type of activity ◯ experiment ✓ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ✓ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Languages

Description:

This exercise invites the trainer to make use of the ecological footprint "questionnaire" as a subject and engage into a language activity with the trainees.

Trainees are given a number of questions written in the language which is being taught in the classroom. These questions, in the form of a multiple choice questionnaire, ask trainees about their daily habits and activities. These questions can be edited to be appropriate for the class group they are responding. Questions can include inquires about water use, eating habits, Mobilityation, shelter and other relevant categories.

By answering the questionnaire, trainees will be able to calculate their ecological footprint in the language in which they are being trained. Following the calculation of the results, the classroom can be ranked according to their ecological footprint (e.g. from Climate Superhero, to Climate Hero, Climate Rascal, and Climate Villain) and trainees can be divided into pairs, with one partner having a low and the other having a high ecological footprint. These pairs can engage into a discussion about habits and lifestyle, and how these may be adapted to take Climate Change and the effects of our activities into concern. Conclusions may be presented to the classroom (in the language which is being taught).

Materials needed :

- An Ecological Footprint quiz, translated in the language which is being taught in the classroom (copies depending on the number of trainees.
- Pens

Tips for teachers:

It is important that teachers are prepared by actually knowing the questions, and realizing what the ecological footprint is, in order to have a background idea of the topic when discussing it with trainees. It is also beneficial if the teacher takes the test themselves so that they have an idea of their own ecological footprint before asking the trainees to calculate theirs.

Your footprint

Module: 3 (Ecological footprint)		
Type of activity ◯ experiment ✓ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) ✓ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Social science Geography Language

Description:

In the present exercise the trainees are asked to prepare a questionnaire in small groups made up with 8 questions related to the Ecological Footprint calculation for different categories and levels (product, activity, individually, geographic region and earth): fishing grounds, crop land, grazing land, forest land, built-up land (infrastructure) and carbon (CO_2 capture).

These questionnaires should be exchanged and answered with the other groups.

The duration of the questionnaire preparation should be around 30 minutes but the answering can be extended depending on the discussions opened while solving it. Nevertheless, every group should present 2 of the questions included in the questionnaire answered aloud to the classmates and explain which they think the correct answer is and why, starting an open discussion when necessary and appropriate leaded by the teacher.

It is recommended that the teacher divides the group of students into small groups of (3 to 5) and assigns them different climatic regions of Europe.

Materials and conditions needed:

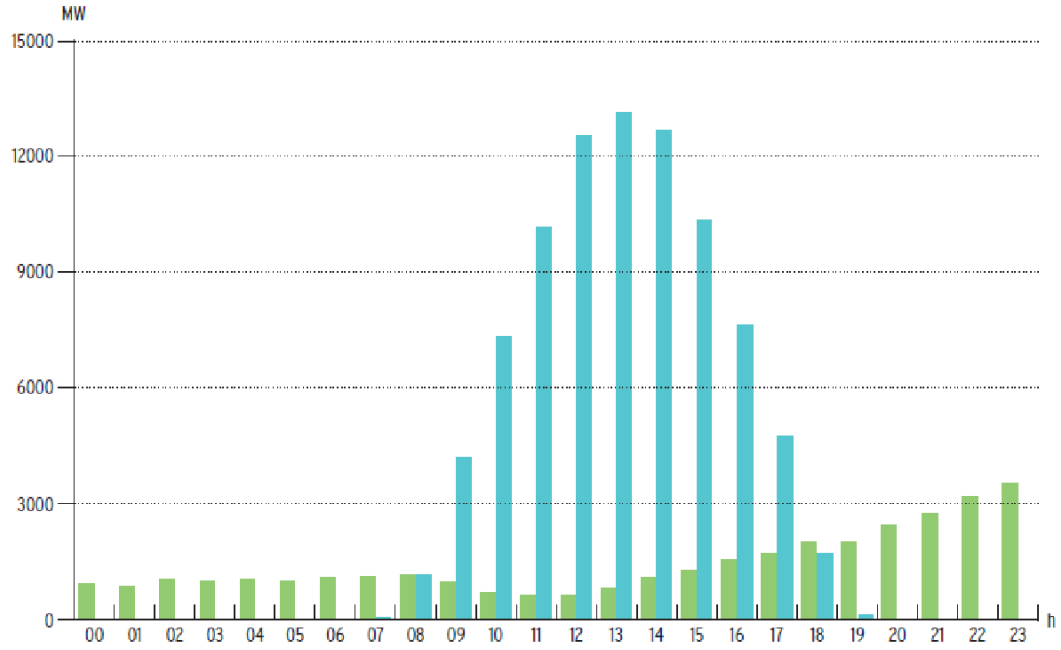
- Computers to do online search of information
- Homework time

Tips for teachers: A previous deeper insight into what carbon footprint is and with what purposes is used should be introduced to the trainees in order to set the basis for this activity.

Renewable energy

Module: 2 (Ecological Footprint)		
Type of activity ◯ experiment X exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: quiz_____	Group size and duration ◯ individual X small group X large group ◯ short (< 15 minutes) X medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Mathematics

The graph shows the production of energy on 23 September 2023 in Germany. The green columns represent wind energy, the blue columns energy from photovoltaic sources. Formulate an explanation for the values shown.
2. Collect ideas for what energy is needed in our society
3. On the basis of your results on task 2, consider how the total energy demand develops on a typical working day over 24 hours. Prepare a graphic based on Figure 11. Plot the development of the energy requirement into the graph.
4. Write down what renewable energy sources you know. Record whether or not their performance is variable. Justify why.



Materials needed :

Tips for teachers:

A Crossword for the Crossroad

Module: 3 Mobility		
Type of activity ◯ experiment ✓ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ✓ individual ✓ small group ✓ large group ✓ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Languages

Description:

This exercise invites the trainer to make use of the topic of transportation as a subject and engage into a language activity with the trainees.

Trainees are asked to complete a crossword which will be prepared before the activity by the trainer. The crossword will bear questions regarding mobility and more specifically about sustainable and unsustainable mobility (for example a question can be: Which means of transportation contributes the most to greenhouse gas emissions? And the answer will be “Airplane”). The trainees will have to use their language skills but also their knowledge about transportation and its contribution to climate change to complete this task.

This exercise can take the form of a competition if the trainer wishes so, with the first trainee to correctly complete the crossword winning something. Alternatively, the trainees may be given a time during which they will have to complete the crossword (e.g. 10 minutes), by which time they will stop completing it and the trainee who holds the most correct answers wins. If a competition is not the preferred method used by the trainer, then a discussion can follow the completion of the crosswords (in the language which is being taught).

Materials needed :

- A crossword puzzle about Sustainable transportation, prepared by the trainer. The number of copies of the crossword puzzle depends on the number of trainees.
- Pens

Tips for teachers:

While the teacher will be developing the crossword, they will get a better understanding on transportation and sustainable and unsustainable practices.

Driving produces CO2

Module: 3 (Mobility)		
Type of activity ◯ experiment X exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual X small group X large group ◯ short (< 15 minutes) X medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject: Mathematics

Description:

Students ask their parents and other members in their family how many kilometres their car has driven last year and how much gasoline or diesel it consumes on 100 kilometres. They write the values into the table (see below). They note whether the car has a petrol or a diesel engine, as well as the corresponding emission value:
Diesel: 2,63 kg CO2/l
Petrol: 2,32 kg CO2/l

Car model	km per year	consumption l/100 km	Petrol / Diesel	CO2 emission per litre	CO2 emission per year in kg	CO2 emission per km in kg
VW Golf	*11000*	*8,2*	*Petrol*	*2,32*	*2347,84*	*0,213*

Tasks:
Calculate the annual CO2 emissions of the car in your household and add the results if there are more than one car.
Calculate the CO2 emissions per km for each car.
What would have been the CO2 emissions if your family had travelled the same distance in the year by bus or train?
Calculate the CO2 emissions on your last flight trip!

Means of transport	CO2 emission per passenger
Bus, train	6 kg/100 km
Aeroplan short distance (< 400 km)	29 kg/100 km
Aeroplan medium disstance (400 - 1000 km)	22 kg/100 km
Aeroplan long distance (> 1000 km)	15 kg/100 km

Materials needed :

Tips for teachers:

The blueprint of sustainability

Module: 4 (Housing)		
Type of activity ◯ experiment ✓ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ✓ large group ✓ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Languages

Description:

In line with the fourth module "Housing" developed by the Climate Literacy Project, this exercise invites the trainer to make use of the topic of Housing as a subject and engage into a language activity with the trainees.

The exercise proposed involves understanding oral speech and depicting it in a piece of paper. Trainees are given a description of a passive house by the trainer. The trainer slowly reads, in the language that is being taught, a very detailed description of this house (with its solar panels, ventilation systems, insulation etc.). While trainees are being given the description they are asked to be drawing a blueprint of the house at the same time.

When the description of the passive house is completed by the trainer, each trainee will have a blueprint of the house they have drawn. These blueprints will be hang on the wall and a discussion will commence between trainees on how they visualized this house, and what each of the different components of the passive house do and how they contribute to the house being a sustainable construction. In this way they are learning about passive houses and proving their language understanding skills.

Materials needed :

- A text description of a passive house.
- A3 papers (one for each trainee)
- Coloured pencils
- Pencil sharpeners
- Rulers
- Erasers

Tips for teachers:

The trainer should use clear instructions and prepositions in order to make the design of the house as clear as possible for the trainees. The trainer should also speak very slowly to the trainees.

Sustainable mobility

Module: 3 (Mobility)

Type of activity
◯ experiment
✓ exercise
◯ case study
◯ role play
◯ project
◯ discussion
◯ other: _____

Group size and duration
✓ individual
◯ small group
◯ large group

◯ short (< 15 minutes)
✓ medium (15 – 45 minutes)
◯ long (> 45 minutes)
◯ spread over a longer period

Teaching subject(s):
Mathematics

Description:

Trainees are asked to complete some math calculations in examples of carbon footprint in the different means of Mobility.
This activity can be integrated easily into a general class about carbon footprint. Each trainee will receive the problem data and will perform the calculations of carbon footprint of each means of Mobilityation.
The teacher will give the basic data and encourage the students to perform the calculations for a given path and a given load.
Finally, he will choose a volunteer who will explain the calculations so as to highlight the differences between the different carbon footprints of the different modes of Mobility and the impact they have on the global climate.
An example
Calculate the different carbon footprint in each mean of Mobility to carry a 100 ton of products from Barcelona(Spain) to London (UK) :

- 3000 km by ship (a carry vessel has a relative rate emission of 20 grams of CO2 per ton and km)
- 1500 km by truck (a heavy truck has a relative rate emission of 50 grams of CO2 per ton and km)
- 1200 km by plane (a plane has a relative rate emission of 540 grams of CO2 per ton and km)

Materials needed :

- Pens
- Papers
- The problem and data.

Tips for teachers:
The teacher must have prepared and solved the problem before the class.
An example is given about cargo Mobility, but data on relative ratios of different means of Mobility can be easily located in the sources of information and the problem can be adapted easily to the Mobility of passengers.

CO_2 emission in the household

Module: 4 (Housing)		
Type of activity ◯ experiment X exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual X small group X large group ◯ short (< 15 minutes) X medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s) Mathematics

Description:

Heating is one of the largest energy consumers in the household. In order to calculate the emissions, the consumption values are multiplied by the average emission value. However, the different fuels are calculated in different units - fuel oil in litres, gas in cubic meters (m^3) and distant heating in kilowatt hours (kWh). The values for heat consumption can be found in the billing statement of the suppliers.

The emission values for the various fuels are as follows:
Oil heating: 2.7 kg CO2 / l
Gas heating: 2.0 kg CO2 / m^3
Distance heating: 0.225 kg CO2 / kWh (average value, depending on local conditions)

Carbon dioxide emissions per capita and year

Inquire about the heat consumption at your home last year. Calculate figure the CO2 emissions caused by this in kilograms!
Add the number of people who live in your household and calculate the carbon dioxide emissions per capita and year!
Complete the appropriate formula!

Materials needed :

Tips for teachers:

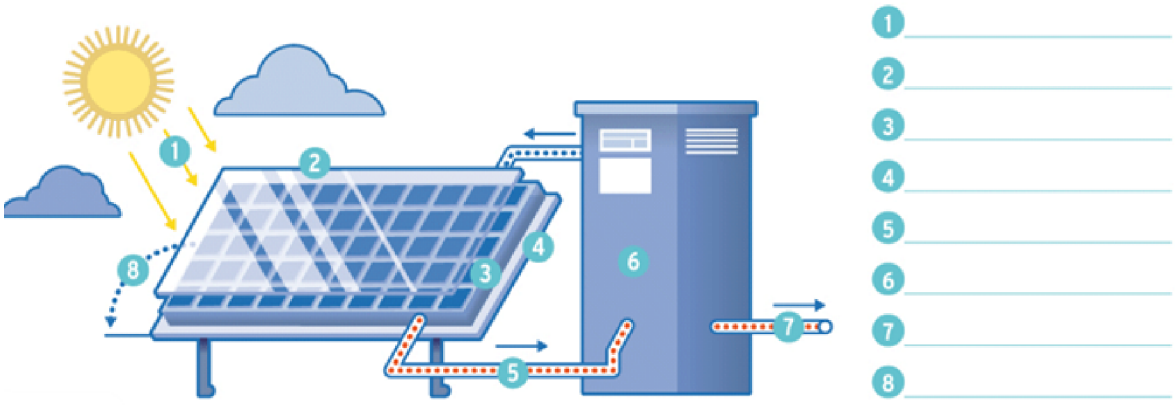
Ask the students shy wood is not mentioned in this list?

Heating with wood produces only small amounts of carbon dioxide. The low CO2 emissions of a wood heating system are also a reason for many to buy a wood heating system. The carbon dioxide is absorbed by the tree during growth and released it during the combustion of the wood. It is then bound again by trees so that a cycle arises and the emission does not burden the environment.

Solar collector

Module: 4 (Housing)		
Type of activity ◯ experiment X exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: quiz_____	Group size and duration ◯ individual X small group ◯ large group ◯ short (< 15 minutes) X medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s) Physics

Description:
Solar collectors can convert solar radiation into heat to heat water for daily use or heating. The sun warms an absorber, which is a surface that absorbs as much of the radiation energy as possible. A heat transfer medium, usually water, flows through the absorber. On the shadow-facing side of the collector, there is insulation to reduce heat losses. To the sun, the collector is covered with a glass disc which also reduces the radiation loss
In order to absorb as much energy as possible, the inclination angle and orientation of the collector are selected in such a way that the sun is as perpendicular as possible to the absorber. The heated water flows through well insulated pipes into a buffer tank. There, it can be further heated by means of a conventional heating system, for example in winter, when only lower temperatures are reached due to the lower sun and more frequent cloudiness. The heated water is then used in the house.



1. Label the drawing using the information from the text.
2. Explain to a partner which properties and components of a solar collector contribute to achieving the highest possible water temperature.
3. Evaluate this use of solar energy, the solar thermal energy. Write down advantages and disadvantages.

Materials needed :

Tips for teachers:

Energy efficiency

Module: 5 (Energy)		
Type of activity ◯ experiment ✓ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ✓ individual ◯ small group ◯ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject: Mathematics

Description:
Trainees are asked to complete with calculations mathematically the main ideas about energy efficiency. At the same time we explain the different levels to measure the efficiency of a building or house

First of all, the teachers have to explain the different levels and good practices that exist about this topic and the way that energy could be saved. Some mathematical explanations about the electricity have to be done or supposed.

Once the teacher had exposed the theory about the topic, the trainees are asked to solve some exercises with some mathematical calculations about this and discuss the result.

Exercise 1
In our house, we have about 12 incandescent lamps with a consumption of 60W/lamp. Each lamp is connected about 3 hours/day.
We are thinking about changing all the lamps with LED ones, which consumption is about 5W/lamp. Each LED lamp costs 5 €
If the cost of the energy (variable cost) is about 0,14€/kWh, ¿how many time has to last, at least this LEDs to be an economically positive inversion?

Solution
Consumption of the incandescent lamps: 12 lamps*60W*3h/day*365d/year=788.400 Wh=788,4 kWh
Consumption of the LED lamps: 12 lamps*5W*3h/day*365d/year=65.700 Wh=65,7 kWh
Energy saved per year: 788,4-65,7 = 722,7 kWh
Cost of the energy saved: 722,7*0,14 = 101,18€/year
Cost of the LED lamps: 12*5€= 60€
The LED lamps have to last, at least= 60/101,18= 0,6 years = 7,2 months
So, the change is very recommendable economically and environmentally

Exercise 2
We are going to buy a new refrigerator.
We have seen two different models: refrigerator 1 and refrigerator 2. The first ones is A++ class, has a consumtion about 195 kWh/year and costs 600€. The other is class A, has a consumption of 360kWh/year and costs 400 €.
If we consider that the refrigerator will have a life of 10 years, what option is the best? (cost of energy 0,14€/kW)

Solution
Consumption of the A++ refrigerator: 10 years *195kWh/y=1950 kWh

Consumption of the A refrigerator: 10 years *360kWh/y=3600 kWh
Energy saved with the A++ option: 3600-1950 = 1650 kWh
Cost of the energy saved: 1650*0,14 = 231€
The extra cost of the A++ refrigerator is recommendable

Materials needed :

- Pens
- Papers
- Calculator (if needed)

Tips for teachers:

It is important that teachers had prepared this activity reading sources of information about the topic and have some mathematical and theoretical skills about energy consumption calculation. This will help teachers to facilitate the achievement of the objectives of the exercise. Sources of information can be found easily online related to *energy efficiency of household appliances*.

transportation

transportation

Food waste prevention and reduction

Module: 6 (Food and waste)		
Type of activity ◯ experiment ✓ exercise ◯ case study ◯ role play ◯ project ✓ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ✓ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Biology

Description:

In this exercise the trainees are asked to identify good practices about food waste reduction.

The good practices to identify are in this scales:

- 3 good practices in food-waste and waste at individual scale (home and work),
- 3 good practices at local scale (city or town)
- 3 good practices at global scale.

Once the trainees have identified these practices, they are asked to identify other three cost-efficient good practices at each level.
It is advisable for the teacher to divide the trainees into small groups (3-4) and encourage the internal discussion to enrich and diversify the results.
Finally, the trainees can write and expose their contributions to the other groups, generating discussion on the topic.

Materials needed :

- Pens
- Papers

Tips for teachers:

It is important that teachers prepare this activity by reading about food waste reduction and prevention in order to have a background idea of what the exercise and trainees can reach. This will help teachers to facilitate the achievement of the objectives of the exercise and will give examples to students in case they fail to identify good practices by themselves. Sources of information can be found easily online related to *food waste reduction*.

Write a Petition

Module: 8 (Promoting Climate Literacy)		
Type of activity ◯ experiment ✓ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Languages

Description:

This exercise invites the trainer to make use of the topic of taking action as a subject and engage into a language activity with the trainees.

This activity can be integrated into an essay-writing activity planned as part of the language class. Each trainee will be given 3 articles on climate change. They will be asked to read them carefully. While reading them they will be invited to note down some ideas and keywords about what can be done about it. They will then be asked to write a petition to their local or national government, addressing them and asking for change. The articles and the petition-essay will be in the language which is being taught.

Materials needed :

- 3 articles on climate change in the language which is being taught
- Pens
- Papers
- A petition template

Tips for teachers:

It is important that teachers are prepared by actually reading the articles they find for this activity, in order to have a background idea of what the articles are talking about. This will assist teachers in better facilitating the activity and the discussion. Sources of these articles can be scientific magazines (e.g. New Scientist, National Geographic), local or international newspapers, online sources of information on climate change (e.g. IPCC) etc. It is also useful that the trainer has some idea of what a petition text includes in order to provide the necessary guidance to the trainees. The template can be constructed following the fields that are required to be completed by someone setting up a petition online (visit petition websites such as Avaaz for ideas).

Running tap

Module: 4 (Housing)		
Type of activity ◯ experiment ◯ exercise ✓ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ◯ small group ✓ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s); Environmental science Social sciences

The presentation of an experiment on citizens lack of interest on water loss, water wasting

The case study:

How many people would walk past a running tap in the street without turning it off? And how much water would be wasted until someone responsible enough to turn the tap off walks past?

Those are the questions that were investigated using a drinking fountain installed for a few hours during the Budapest 2016 World Water Summit at one of Budapest's busiest intersections, Nyugati Square. At an event based on the running tap installation, the organisers attempted to assess people's consciousness of their everyday water consumption.

In an experiment lasting five hours, over a thousand people walked past a continuously running tap in Budapest's Nyugati Square.

- 43 of them stopped to turn it off, i.e. one in twenty-four people actually noted the waste.
- Many people stopped and looked back, unable to decide whether they should turn the water off, but then they walked on.
- Some even drank from it and then left it running.
- The experiment showed that older people are more water-conscious than the young: 60% of those that turned the water off were over the age of 60.
- But there were also tourists, pregnant ladies, students and businessmen who could not just stand by and watch the water running.

The organisers rewarded the environmentally minded passers by with small gifts, while on the screen installed over the tap, a tree turned green to show when someone protected the environment by stopping to turn the tap off.

Design, tasks, solution to be performed:

Trainer:

1. Explain the course of the conversation
2. Download and project the original text and video
3. Moderate the discussion on the need of the preservation of water resources, the importance of support drinking water for the following generations

Participant teams:

1. Read the story of the case study, watch video
2. Discuss the apathy, inattention, indifference, lack of interest of people on water
3. Would you act, have turn off the tap?
4. Discuss the importance of access of safe drinking water, importance of reservation of water reservoirs

Materials needed :

- PC, projector

Passive house quiz

Module: 4 (Housing)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ◯ project ◯ discussion X other: quiz_____	Group size and duration ◯ individual X small group X large group X short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s) Physics

Description:
Although most answers are easy and obvious, you can ask students to explain their answer in more detail.

1. Why is the "Passive House" called Passive House?
◯ Because you can sleep so well.
◯ Because one can play "passively" football.
◯ Because of its construction and arrangement, it uses passive solar energy.
◯ Because it does not move.

2. What is the difference between a low-energy house and a passive house?
◯ The low-energy house is lower than the passive house.
◯ No one.
◯ The passive house needs less energy for heating than the low-energy house.
◯ The Passive House fits into every low-energy house.

3. How much energy does a passive house need for heating?
◯ 200 kilowatt hours per square meter per year.
◯ 100 kilowatt hours per square meter per year.
◯ 50 kilowatt hours per square meter per year.
◯ Not more than 15 kilowatt hours per square meter per year.

4. Why is a passive house with a ventilating system ventilated?
◯ Because the house therefore does not need any other heating and always fresh air is there.
◯ Because it stinks inside and no one can stand it.
◯ Because this is much more fun than opening the windows.
◯ Passive houses are not ventilated at all.

5. How much money has to be spent on heating in a passive house per year?
◯ About 100 euros.
◯ 500 euro.
◯ 1,200 euros.
◯ 5,000 euros.

6. Which houses can be built as a passive house?
◯ Only schools and kindergartens.
◯ Factory halls and offices only.
◯ Only residential buildings.

◯ All: from the house to schools and kindergartens to economic buildings

Materials needed :

Tips for teachers:

Correct answer for question 3: 15 €
Correct answer for question 5: 100 €

Ask the students shy wood is not mentioned in this list?

Heating with wood produces only small amounts of carbon dioxide. The low CO2 emissions of a wood heating system are also a reason for many to buy a wood heating system. The carbon dioxide is absorbed by the tree during growth and released it during the combustion of the wood. It is then bound again by trees so that a cycle arises and the emission does not burden the environment.

Electricity pub quiz

Module: 5 (Energy)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ◯ project ◯ discussion ✓ other: quiz_____	Group size and duration ◯ individual ✓ small group ✓ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Languages

Description:

This exercise invites the trainer to make use of the topic of Energy as a subject and engage into a language activity with the trainees.

Trainees receive either individually or in teams (depending on the group size) and each trainee or each team are provided with answer sheets. Then, a number of questions are being asked in the form of a pub quiz, but focused on the topic of Energy and relevant sustainable practices (e.g. Which is the least energy consuming type of lamp? LED, halogen or compact fluorescent?). The questions being read out and the answer sheet should be in the language which is being taught.

In the end the answer sheets of each individual or team are passed to the quiz-reader, and they are marked. The team with the most correct answers wins.

Materials needed :

- Pub quiz questions prepared by the trainer
- Answer sheets prepared by the trainer
- Pens

Tips for teachers:

The preparation of the pub quiz will require some background research of the subject by the trainer.

How can I spend less?

Module: 7 (Shopping)		
Type of activity ◯ experiment ◯ exercise ◯ case study → role play ◯ project ◯ discussion ◯ other: activities	Group size and duration ◯ individual → small group ◯ large group ◯ short (< 15 minutes) → medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subjects: Sociology Language

Description:

Pre-activity: Discussion about background and dimensions of our overconsumption. The trainer/teacher should challenge students/pupils with provocative personal and other questions to start thinking more widely:

1) What do you really know for example about the shirt you are wearing today? Who made it? Where and how long needed a person to work on it and under which circumstances?
2) What was added that your shirt could travel from India to Europe? In how many hands and places was this shirt before it came into your hand?
3) How much drinking water is wasted to fill one New Yorker (or Zara...) store?
4) Imagine how much waste you produce in one week. Multiply it by the number of residents in your town/village. Calculate how much area will be needed for a landfill? What could be there instead of the garbage? And how could all these quantities be re-used?

Part 1: Role-play situations

1. **Need or want:** Two students are needed and they are going to switch their roles in two different situations. In the first, one student is going to play how it is if you buying because you want and not because you need something. In the second situation the other student presents how it is look like if you buy something because you really need it. The other students identify reasons and comment which acts or behaviour helped them to discovered an answer.

1. **How can I spend less: The** role situation needs to reflect that our need to buy is connected with feelings of being unloved, sad, lonely. However, there are free of charge therapies: sport or art activities, nature, talk and touch, animals, volunteering, … ***This part in open and can be played by actor's***

2. **How can I spend lees:** One student is needed and he/she is presenting reasonable ways of buying: think ahead, stick to the shopping list, pay only with cash, know one's consumers' rights, avoid high additional costs.
   In this role situations the student is faced with unknown situations. Different classmates coming in the role of promoters who want to encourage them to purchase more with discounts, savings, bonus games, loyalty cards, coupons,.

3. **How can I spend less**: Two to five students are needed. They are going to demonstrate re-use opportunities: the first will re-design something old, the second will re-use different types of garbage, the third one will demonstrate second-hand exchange, the fourth one will use leftovers for another meal, the fifth person will demonstrate how to set our own vegetable or herb garden

Other students can share their own experience and comment different alternatives.

Part 2: Self-reflection

Students/pupils get a self-reflection questionnaire. The teacher/Trainer encourages them to share their answers. For example: who finds himself too often shopping? What are the reasons?

Students/pupils can retain their questionnaires. Their task is to monitor whether their shopping habits changed with new choices or not. Teachers can monitor individually students/learners from time to time.

Self-reflection questions should be:

1) For what I do spend money?
2) Whom am I supporting with my money when I am buying these products?
3) Why do I have the need to have all the time something new?
4) What will happen if I won't have all that? Which things that are for free can fulfil me?
5) What needs to be done to change some of my bad habits: do I need to become one of those workers who are exploited? Or lose a good relationship, a house or health?
6) In what kind of society I would like to live?
7) In what kind of industry, market and services do I need to invest, if I want to have such society?
8) What will really motivate me to change my bad habits?

Key activities:

- learn more about background and dimensions of our overconsumption
- thinking about reasons for overconsumptions and the impact of which we have
- reflect our own habits, beliefs and responsibility
- become familiar with the various alternatives to consumerism, which can be practiced alone
- identify one's own bad spending habits and make a plan for changing them

Materials needed : projector, computer, printer, Wi-fi access, notebooks, pens, chairs, table

Tips for teachers:

In the pre-activity part, the trainer/teacher should share some background based examples, which could be presented as videos, or the trainer's/teacher's experience, or touching personal stories from media. It is important that in this part student will become emotionally involved and get more information what is behind. Some of the questions in the debate also need to be asked more personally, that students/pupils get a feeling how they are involved and that they also have a power to change that.

In part 1 are involved all students/pupils. The majority as audience who observes the situation through objective view and tries to influence the actor's decisions in different roles. This type of roles are called half-prescripted learning situations. They can be selected by the teacher or they have opportunity to choose between different ones. The role of actors is to move away from their own values, beliefs and assume someone else's identity to act persuasively enough.

The aim of the self-reflection part is that students/pupils become aware of their reasons, beliefs and habits.

Land and sea ice

Module: 1(Climate questions)		
Type of activity ✓ experiment ◯ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ✓ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Chemistry Physics

Introduction

Since the peak of the industrial revolution, during the second half of the 19th century, the average temperature on our planet has risen by 0,85°C. This is called "global warming" and it is not slowing down, on the contrary: scientists predict that the average temperature will rise by more than 4°C by 2100 if humanity does not change its lifestyle. And that has major consequences. With this experiment you discover the effect of melting ice and snow yourself.

To work!

Put four ice cubes in the first glass.
Place the remaining ice cubes in the sieve and place the sieve on the second glass.
Now fill both glasses with water, such that the water level in both glasses is equal.
Put the glasses next to each other and wait a little. If you want to speed up the melting process, you can use a hairdryer to warm up the ice cubes.

What is happening?

The ice cubes in the first glass represent sea-ice: ice that floats around in big floes on the Arctic Ocean. The ice cubes in the sieve on the second glass represent land ice: the ice caps in Greenland and Antarctica, for example.

When all ice cubes have melted, you can see that the water level in the second glass (water + melted land ice) has risen. The melting water of the land ice has been added to the "sea water". The water level in the first glass, however (water + melted sea ice), has remained equal. After all, the sea ice in this glass in the glass was in the sea water already, no water was added to the glass.

The rise of the sea level due to global warming, is a consequence of the melting of land ice. Scientists use the term "land ice" to refer not just to land ice in the polar regions, but also from glaciers in higher areas.

Materials needed:

- two wide glasses
- water
- a sieve
- 8 ice cubes

Tips for teachers:

For advanced groups or classes with a scientific background, you can extend the materials and discuss other factors that should be taken into account:

- Fresh water vs. salt water
  The (mostly) fresh floes float on salt water at the North Pole, and not on fresh water as is the case in our glass. If this fresher (less salty) ice melts, it forms water that is fresher than the surrounding salt water, is less dense, and thus takes more volume. This increase in volume, however, is negligible compared to the effect described above: worldwide it corresponds to a rise in sea level of about 49 µm per year, or the thickness of a hair.
- Expansion of sea water
  When the temperature of the sea water rises, it expands. When the ocean is several kilometers deep, a 1°C rise in temperature can cause the sea level to rise over a meter.
- The rise of the planet's surface
  Because large masses of ice melt, the continents become less heavy and rise up, effectively lowering sea level.
- Power of ice caps
  Because ice caps have such great mass, they attract sea water. When the ice caps melt, this attractive power decreases. This means the rise in sea level caused by the melting water is LOWER the CLOSER you are to the ice cap. In Europe, for example, the sea level rise will be below average because the ice in Greenland melts away. This means that the sea level could actually decrease in Greenland and West-Antarctica, contrarily to other parts of the world.

Greenhouse effect model

Module: 1 (Climate questions)		
Type of activity ✓ experiment ◯ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject: Physics

SCHEDULE:

Place the first thermometer in the bottle then replace the top.
Place the second thermometer on the table.
Read the temperature shown by both thermometers: they should indicate the same temperature.
Place a bulb above each of the thermometers and switch them on. Wait between 5 to 10 minutes then read the temperatures: the thermometer placed in the bottled indicates that the temperature in higher than the one left in the open air.

EXPLANATION:

Brief reminder of the greenhouse effect. The Earth's surface exposed to the sun absorbs the heat from the sun rays. When the Earth becomes dark, it sends the accumulated heat back towards space (heat always travels from a warm environment to a less warm one). The greenhouse gases present in the atmosphere absorb a portion of this heat, the remainder being sent into space. Greenhouse gases then "release" this heat into the atmosphere, causing a rise in temperature.
The name "greenhouse effect" is therefore not entirely correct because the role of a greenhouse is to form a physical barrier to trap this heat, which is not the case for greenhouse gases in the atmosphere.
In our experiment, the plastic bottle plays the role of the atmosphere and 'traps' the heat provided by the bulb, just like a greenhouse. The thermometer in the bottle shows a rise in temperature.
This model is sufficient enough to visualise a result (rise in temperature) caused by an element (greenhouse gases in the atmosphere) which prevents the heat from completely returning to space. However, this model is not correct in terms of the phenomenon causing a rise in temperature. In this experiment, the bottle serves as a greenhouse, but does not enable the "greenhouse effect" to be highlighted in the climatological sense (absorption + emission).

Materials needed :

- 1 transparent, plastic bottle
- 2 thermometers
- 2 bulbs (halogen bulb, NOT a LED bulb)

Tips for teachers:

- This experiment can be a good introduction for discussing about the role of the Sun in Earth's climate.
- You can use different types of bottles (more or less opaque) to observe the influence of atmosphere's transparency on climate

Acid oceans?

Module: 2 (Ecological footprint)		
Type of activity ✓ experiment ◯ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ✓ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject: Chemistry

Introduction

CO_2 has a negative effect on our atmosphere and on the temperature on our planet in particular. But did you know it also harms our oceans?

To work!

Take a glass of water and add a few drops of phenolphthalein.
Now use the pipet to add the ammonia little by little, until the turning point where the water turns a light pink.
Take a deep breath, and hold it. Now blow through the straw INTO the glass of water.
CAREFUL! Do not suck up the water into your mouth!

What is happening?

After blowing for a little, the pink color disappears. This is because phenolphthalein is an acid-base-indicator. At a pH higher than 8,2 (light basic), phenolphthalein turns pink. Below a pH of 8,2, phenolphthalein is colorless.

The air that we breathe in contains 21% oxygen (O_2) and 0,04% carbon dioxide (CO_2). The air that we breathe out contains less oxygen (±17%) and more carbon dioxide (±4%). The longer you hold your breath, the more oxygen is taken up by your lungs and the more carbon dioxide is released. The CO_2 in your breath makes the water more acid, causing the phenolphthalein to lose its color.

Apart from contributing to global warming, the CO_2 that is emitted by our intensive way of life has also other malignant effects. Because the CO_2 particles dissolve in the sea water, the sea acidifies. And not even a little: around half of the CO_2 humanity sends up in the air by burning fossil fuels, ends up in the oceans. This is very damaging for life in the oceans. Just as the sink or coffee machine is descaled with acid vinegar, on the long term dissolved CO_2 dissolves mineral deposits in the oceans. This of course has consequences for coral reefs and other living creatures in our seas and oceans (sea slugs, mussels, oysters, …).

Since the start of the industrial revolution, the pH of our oceans has gone down around 0,1. That may not sound like much, but pH is a logarithmic scale. This means that lowering of the acidity with 0,1 corresponds to around 29% more H^+-ions in the water (the more H^+-ions in the water, the more acidic the solution).

Materials needed :

- glass
- water
- phenolphthalein
- ammonia
- pipet
- straw

Tips for teachers:

Attention: CO_2 by itself is NOT an acid. However, when carbon dioxide dissolves in water, carbonic acid (H_2CO_3) is formed and the following reaction equilibrium is set:

$$CO_2 + H_2O \leftrightarrow H_2CO_3$$

Carbonic acid, a weak acid, then divides up into:

$$H_2CO_3 \leftrightarrow 2H^+ + CO_3^-$$

It is these H^+-ions that are responsible for the acidification of water.

How is drinking water produced?

Module: 2 (Ecological Footprint)		
Type of activity ✓ experiment ◯ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) ✓ long (> 45 minutes) ◯ spread over a longer period	Teaching subject: Chemistry Biology

EXPERIMENT SCHEDULE AND EXPLANATIONS:

In industrialised countries, when water isn't bought in bottles, access to water is simple: we turn on the tap and water runs out from it.
Where does this water come from? Mainly from rivers and natural reservoirs. However, it is not fit for drinking (potable). It must therefore be treated to become fit for consumption.
Information: the different stages below describe a **simplified** treatment process which enables experiments to be carried out in small groups and with little material. It enables clean and clear water to be obtained **but not water which is fit for drinking**.

Preparing water
In a deep tray filled with water, add a little soil, a few leaves and twigs, then mix this together. A model of water which can be found in a river is obtained.

1. Screening

Water is pumped from a water source (e.g. a river) and passes through screens which hold back the biggest objects.
In this experiment, participants use small sieves to simulate screens.

2. Settling

After screening, water enters a settling tank where its stays for several days. Under the effect of gravity, the heaviest particles fall to the bottom of the tank.
In our experiment, we can quickly see that the bottom becomes covered with earth, whereas other, lighter particles remain suspended in the water.
After 5 to 10 minutes participants fill a glass with **surface water** from the container.

☐ The water is clear.

3. Filtration

Settled water is filtered by passing it through a thick layer of sand. This layer holds back a large portion of the particles which remain suspended in the water. These remain trapped in between the grains of sand.
In our experiment, filters must be prepared (during settling) according to the diagram.
This operation should be repeated so that water is filtered 2 or 3 times in succession.

☐ The water is clean.

4. Oxidation

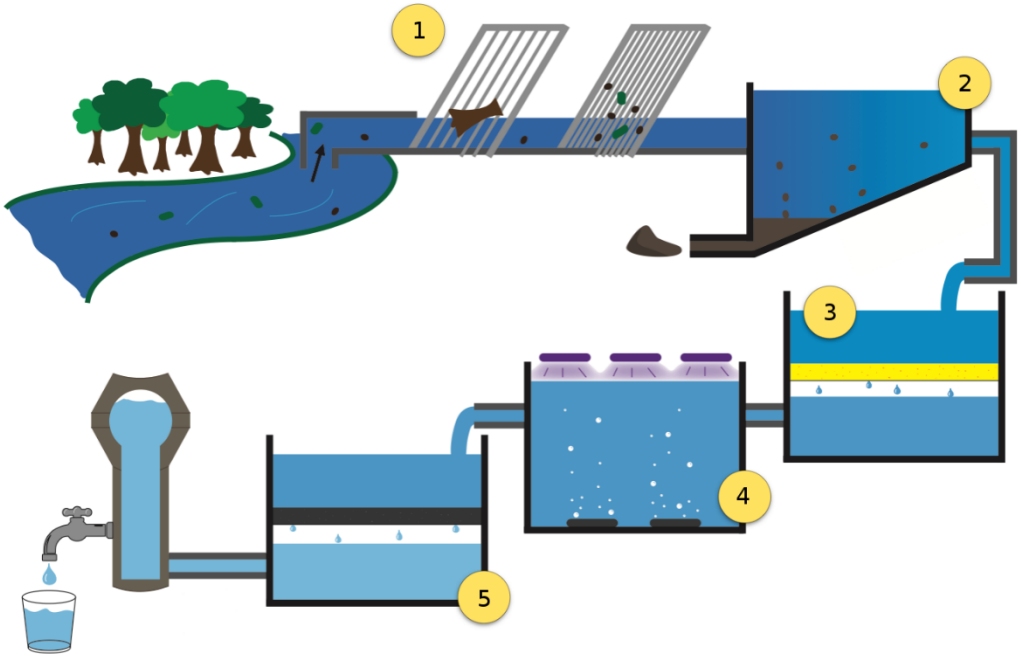
Once settled and filtered, water may still contain bacteria, germs or viruses which need to be removed in order to prevent them from proliferating. Chlorine or ozone is used for this. As the use of the chemicals is subject to very stringent safety rules, this experiment is not carried out here.

☐ The water is clean.

5. Microfiltration

In order to make it drinkable once and for all, the last microparticles and certain organic compounds, in particular responsible for odours and unpleasant tasting water, need to be removed.
Activated carbon filtration is used for this. Every grain of this very fine, black powder has a large surface area onto which the residues stick or become trapped.
In our experiment, after having cleaned the contents of the filter, put a coffee filter into it and add 2 or 3 spoons of activated carbon. We then filter the water (see step 4).

☐ The water is now clean, healthy and odourless.



Materials needed :
Groups of 2 or 3 students

- 1 transparent, plastic container filled with water
- Soil, dead leaves, twigs
- 1 small sieve/strainer
- 2 transparent, plastic cups
- 1 plastic bottle, at least 1L
- Hydrophilic cotton wool
- Sand
- 1 coffee filter
- Activated carbon

Tips for teachers:

- It can be a dirty activity, so choose the right place to do it
- You can enlarge the subject including drinking water production into the natural cycle of water
- Some protocols in drinking water production may be different between several factories (especially in 5th and 6th steps)

	# Solar barbecue

Module: 3 (Mobility)		
Type of activity ✓ experiment ◯ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Physics

Introduction

Have you ever thought about using solar energy directly to heat up food? In this experiment you discover that it isn't even all that hard!

To work!

Stick the piece of tin foil on the cardboard such that the most shiny side is outside.

In the middle of both sides of the shoebox, draw an arched line using the arc-template below. Make sure the lines are neatly opposite each other.
Use a cutter knife to cut open both arched slots. In the focal point of each arch, make a little hole through the shoebox using the needle.

Slide the piece of cardboard through the slots with the shiny side up.
Puncture the barbecue stick through holes you made, put a marshmallow on it with some chocolate sprinkles.
Place the solar barbecue in the sun or under a halogen lamp and wait till you have a wonderfully warm marshmallow with a coat of molten chocolate.

What is happening?

The energy of the sun consists of light and heat. At noon, the strength of the radiation can reach up to 1000 Watt per square meter. That is twenty times more than an ordinary 50 Watt light bulb. By using a bent mirror, all this energy is reflected to the center of the mirror, causing a strong increase in temperature. The marshmallow with chocolate becomes hot and melts.

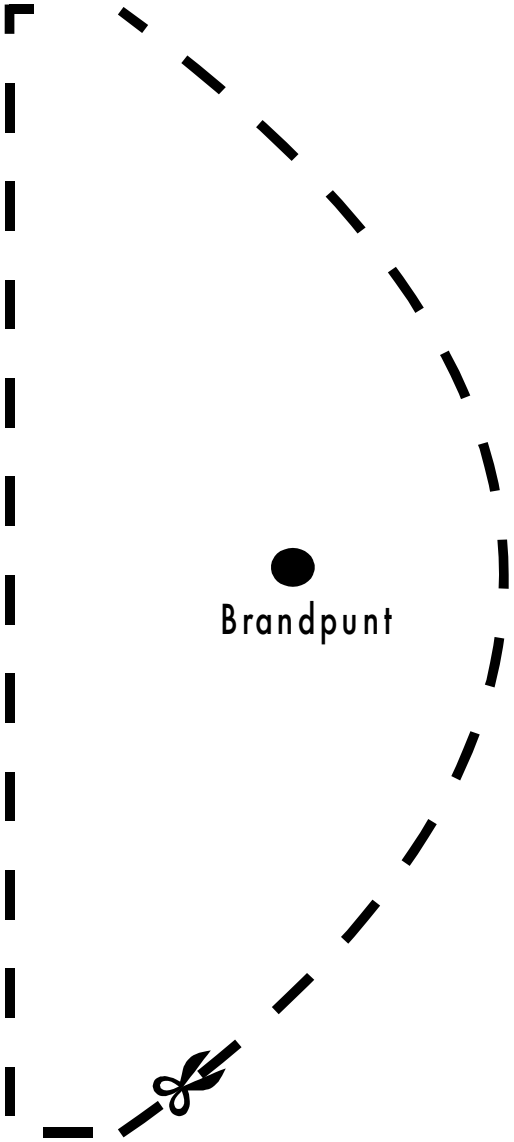
Today the solar barbecue is used in developing countries to replace other energy sources such as wood and butane. The French foreign legion used similar devices to prepare food as early as 1870.

Materials needed :

- piece of cardboard (A4)
- tin foil
- shoe box
- arch-template
- cutter knife
- needle
- barbecue stick
- marshmallows and chocolate sprinkles

Tips for teachers:

- When selecting the shoebox, make sure it is not too wide. Similarly, the cardboard should not be too stiff, e.g. the back of a legal pad.
- You can let the students decide on which food they want to heat up in their solar barbecue. You can for example prepare frankfurters and make hotdogs.
- Point out the dangers of the solar barbecue to the students too. Looking directly in the reflected rays is dangerous. Therefore, ask the students to wear good sun glasses when conducting the experiment.
- You can also ask the students to measure the temperature, both next to the barbecue and at its center, and compare them. You can diversify these measurements by asking some of the students to close off the barbecue with a glass plate, or apply an isolation layer.


Brandpunt

Carbon dioxide during combustion

Module: 3 (Mobility)		
Type of activity ✓ experiment ◯ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject: Chemistry

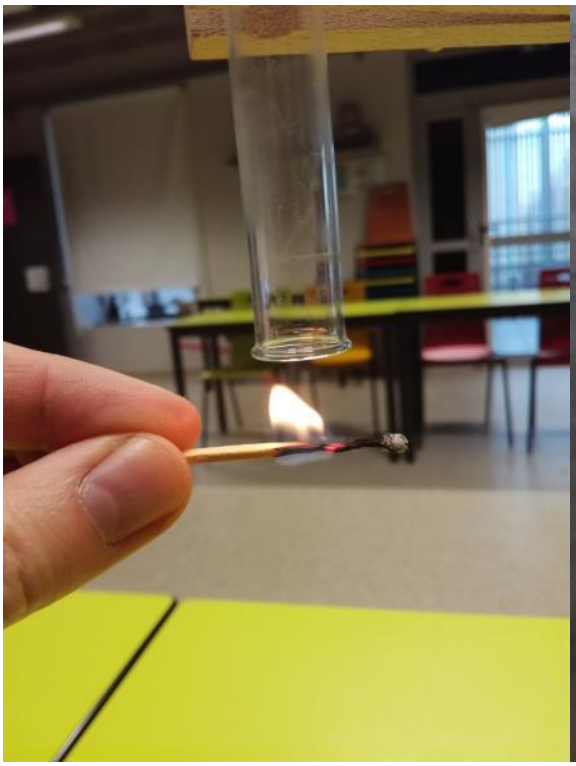
EXPERIMENT SCHEDULE:

Prepare a control test tube with limewater. Blow through the straw into the water. In a few seconds, the limewater will become cloudy. The expired air contains carbon dioxide and the limewater becomes cloudy in the presence of carbon dioxide.

Take the second test tube, hold it vertically upright with the opening facing down. Place the lighted lighter (or match) under the test tube for a few seconds. Slowly turn the test tube around, half fill it with limewater, close it with the bung and shake it.

The limewater becomes cloudy in a few seconds. Therefore the substance which is burning (gas from the lighter or wood from the match) produces carbon dioxide.

By extension, all **combustion** reactions produce carbon dioxide.



EXPLANATIONS:

Combustion is a chemical reaction which involves two reagents: a fuel and an oxidiser.

In the majority of common combustion reactions, the oxidiser is the oxygen contained in the air. The fuel, which contains carbon, may be solid (e.g. wood), liquid (e.g. petrol) or gas (e.g. natural gas).
During any combustion reaction, the reagents' atoms (fuel + oxidiser) combine to form **carbon dioxide**, **water** and sometimes other substances.
Limewater is therefore used to show that carbon dioxide is present. When the two are mixed together, a calcium carbonate precipitate (white) appears in the water.

Materials needed :

- Lighter, match
- 2 test tubes + a bung
- Limewater
- A straw

Tips for teachers:

- to demonstrate the presence of an invisible and odourless gas
- to examine the sources of carbon dioxide, in particular combustion which occurs in engines, industries, the house, etc.

Pindapower

Module: 6 (Food and waste)

Type of activity
- ✓ experiment
- ◯ exercise
- ◯ case study
- ◯ role play
- ◯ project
- ◯ discussion
- ◯ other: _____

Group size and duration
- ◯ individual
- ✓ small group
- ✓ large group

- ◯ short (< 15 minutes)
- ✓ medium (15 – 45 minutes)
- ◯ long (> 45 minutes)
- ◯ spread over a longer period

Teaching subject:
Biology

Introduction

Just like people, plants need energy to grow. This energy is provided to them by the sun. This experiment will show you how you can release this energy again.

To work!

Carefully put the tip of the needle into a peanut and the eye in the cork.

Remove both sides of the large can and make a few holes in the bottom. Be careful around the sharp edges of the can!

Make two holes in the small can, put a long spike through it, and hang the small can in the large can. Put a little bit of water in the small can and measure the temperature.

Now light the candle and hold the peanut in the flame until it catches fire.
Start the clock and place the burning peanut under the small can with water. Measure the temperature again when the peanut has burned up.

What is happening?

Plants need energy to grow. This energy is mostly derived from the sun. You can see this because most plants do not grow well on shadowy places.

During photosynthesis the plant cells take up the solar energy. Thanks to this energy a series of complicated chemical reactions takes place, allowing the plant to grow.

In nature there is a general rule that says that energy is never lost. That means that the solar energy is stored in the plant. You can release that energy again if you literally use the plant as fuel. The energy is then converted into light and heat. The same happens when you eat the plant: your body uses the energy that is released to grow and to keep its temperature.

Peanuts contain an enormous amount of energy because they contain a lot of oil. Fats contain twice as much energy than sugar. That is why it is better not to eat too much fat. Your body will store the excess energy in fat layers. In other words: you become fat…

Materials needed:

- one bag of unsalted peanuts
- two empty cans: a big one and a small one
- can opener
- pin
- thermometer
- chronometer
- long spike
- cup of water
- needle
- cork
- a small candle
- matches

Tips for teachers:

- You can choose to divide the class up into groups and let the students experiment with different types of nuts and peanuts. Afterwards, results can be compared.
- Let the students conduct the experiment in a well-ventilated space. The peanuts burn heavily and may give rise to strong odors and fumes.
- You can let the students calculate exactly how much heat the water has taken up: measure the mass m of the water and the temperature change $\Delta°t$ during the experiment. The amount of heat taken up then equals Q, with

$$Q = 4186 \frac{J}{kg.°C}.m.\ \Delta°t$$

- This amount of energy more or less corresponds to the amount of energy of the peanut. This is of course not an exact value. Most likely, the peanut did not completely burn up, and some heat was lost. Exact results would require better experimental conditions (e.g. using a calorimeter).
- Discuss with the students how the only thing left after burning is carbon. This is the end product of the chemical reaction.

Measured and felt temperature

Module: 4 (Housing)		
Type of activity ✓ experiment ◯ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subjects: Physics

EXPERIMENT SCHEDULE:

All materials must be left in the open air for 10 minutes or so.
Touch the different materials, some will feel hot and others cold. Try to rank these.
Then check the surface temperature of each material with an infra-red thermometer. This will indicate (more or less) the same temperature for each one.

EXPLANATION:

Why were the materials left in the open air for a given amount of time?
So that they all reach the same temperature. The heat exchange, and therefore the variations in temperature, always occurs from the warmest object to the least warm object. If these objects are placed in a given environment, heat will be exchanged until both objects are at the same temperature.
Why do we feel a difference in temperature?
Here, the warmest object is the experimenter's hand (around 30°C on the surface). Heat will therefore be transferred from the hand to the different materials.
These materials are **thermal insulators**, i.e. they prevent heat from passing through them (wood, plastic). The hand's heat therefore remains "blocked" between the hand and the object. The heat that we can feel is therefore from our own hand.
These materials are **thermal conductors**, i.e. they allow heat to easily pass through them (metals). The hand's heat escapes through the insulator. If heat is taken away from surface of our own hand, it feels cold.
Lastly, other materials have high **thermal inertia.** This means that they cool down or heat up very slowly. When we touch a cold stone, the heat from our hand is absorbed by the stone, which becomes slightly warm. Just as we do for metal, it feels cold to the touch. If the stone remains in the sun, it will soak up the heat and then release it.
How is an insulator characterised?
The best thermal insulator is immobile air. A good insulator imprisons minuscule air bubbles such as foam, fibreglass and polystyrene.

Materials needed :

- Different materials (wood, plastic, material, metals, stones, etc.), ideally having a flat surface
- Infra-red thermometer

Tips for teachers:

- to examine the concepts of insulators, conductors and thermal inertia.
- to ask questions about materials used for insulation (clothes, buildings)
- to examine the difference between heat and temperature.

Light bulbs and heat

Module: 5 (Energy)		
Type of activity ✓ experiment ◯ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ◯ small group ✓ large group ✓ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject: Physics

Introduction

In our daily life we describe "light" as that which we can detect through our eyes. But the light we "see" is only a small part of what a physicist understands as light. In other words, there is "visible light" and "invisible light". To our eyes, infrared light is invisible. We can, however, detect it as heat. This has consequences for the energy usage of lamps.

To work!

Turn the three lamps on, and place an upside down, translucent bucket over them. Tell the students what is under the buckets: an incandescent lamp of 15W (Watt), an incandescent lamp of 60W, and a CFL lamp of 15W. The students now have to figure out where the CFL lamp is.

What is happening?

The CFL lamp emits most light (comparable to the incandescent lamp of 60W), but radiates much less heat.

The incandescent lamp of 15W emits much less light than the other two lamps, so it is easily recognizable. The incandescent lamp of 60W emits about the same amount of light as the CFL lamp of 15W. This is because an incandescent lamp converts about 90% of the energy into heat rather than light. Therefore, if you replace an incandescent lamp of 60W with a CFL lamp of the same luminous flux, you will use a lot less energy for the same amount of light.

A classic incandescent lamp emits light when you send electricity through the filament. This causes the filament to heat up, and emit light. To avoid the filament to burn, all oxygen is removed from incandescent lamps. Early incandescent lamps had a vacuum atmosphere, but modern lamps are filled with an inert gas.

You could compare a CFL lamp with a TL lamp that is folded to fit in a normal lamp holder. The tube of the CFL lamp is filled with mercury gas. When electricity flows through the tube, electrons and mercury atoms collide, causing the mercury atoms to emit light. The ultraviolet (UV) light that the mercury atoms emit, however, is not visible to us. That is why the side of the CFL lamp is covered with a layer of fluorescent powder, that converts the UV-rays into visible light. A CFL lamp lasts about ten times as long as an incandescent lamp.

Materials needed :

- incandescent lamp 15W
- incandescent lamp 60W
- CFL lamp 15W
- three translucent buckets

Tips for teachers:

- The students get two types of information to determine which lamp is where: illumination, and the heat each lamp radiates. Encourage them to come to the right conlusion by themselves.
- Let the students investigate at home how many incandescent lamps, CFL lamps, LED lamps, … they have.
- CFL lamps contain a minuscule amount of mercury, which is not very healthy. If you break a CFL lamp, you should open the window for fifteen minutes before you clean up. But the CO_2 you save with CFL lamps is more important to the environment than the extra mercury you might spill. Additionally, researchers are developing lamps that replace mercury by xenon, an inert gas that doesn't interact with anything and is therefore not poisonous.

Efficiency of light bulbs

Module: 5 (Energy)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ✓ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ✓ spread over a longer period	Teaching subjects: Physics Mathematics Environmental sciences

Description:

Students/participants estimate the light emission and power consumption of selected light bulbs, calculate the efficiency of them, make a ranking of the bulbs.

Objective:
Students/participants build a measuring-equipment. They measure the electric consumption and the light emission intensity of an incandescent bulb, a halogen bulb, a fluorescent bulb and a LED bulb of same socket (E14 or E27) and similar light output, and calculate the efficiency (lumen/watt). Finally, they make a diagram to illustrate the results.

Design, tasks, to be performed:

Trainer:

4. Discusses with students the benefit of reducing energy consumption for individuals, for community and for global environment.
5. Explains the project (aim, tasks, runoff, expected results)
6. Creates teams of 4-5 participants
7. Allocates tasks on team members according to their knowledge and team requests.

Participant teams:

1. Build up the measuring device according the sketch in the handout.
2. Place the various bulbs into the device
3. Measure the energy input/consumption (in watts), and the light density (in lumen) emitted
4. Notice the results in the table in the handout.
5. Calculate the efficiency of the bulbs (lumen/watt)
6. Represent the results on following diagrams:
   - nominal energy input (energy consumption marked on the bulb) versus measured energy input,
   - nominal energy input versus light emission (lumen)
   - measured energy input versus light emission (lumen) on the same diagram
   - type of bulbs versus light emission efficiency
7. Make presentation, discuss the results.

Expected results:

1. Participants of the team learn the benefit of an organised joint work
2. On their own results they learn how to spare energy and money, how to mitigate climate change

Materials needed :

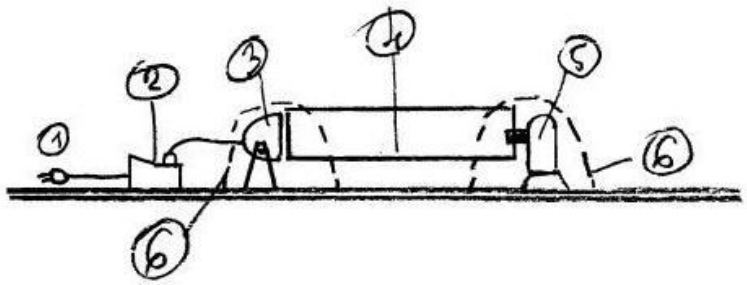
- student handout,
- PC,
- camera, mobile phone,
- reflector foot lamp
- paper box, or cylinder
- black paint
- black linen
- electric power meter
- luminance meter
- different bulbs of similar light emission (lumen) and socket

Tips for teachers:

- Lead and administer the presentation
- Let the student act free, to be innovative creative, to carry out own ideas.

Student handout

The structure of the measuring device.

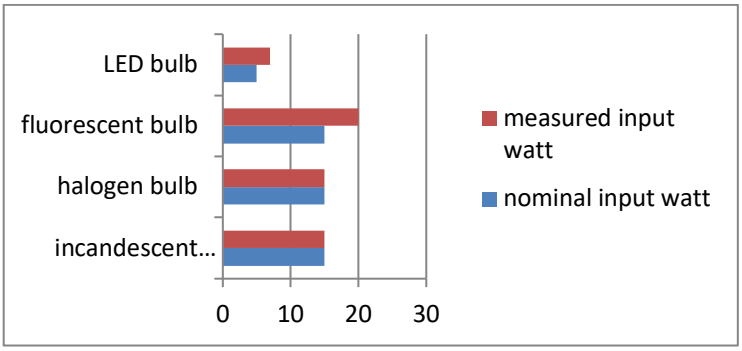


1: connection to 220 V
2: electric power meter
3: reflector foot lamp
4: cylinder interior painted black
5: luminance meter
6: black line, stray light filter

Excell table (sample copy)

Type of lighting bulb	nominal input watt	measured input watt	light emission lumen	efficiency lumen/watt nominal	efficiency lumen/watt measured
incandescent bulb	15	15	270	18	18
halogen bulb	15	15	400	27	27
fluorescent bulb	15	20	450	30	23
LED bulb	5	7	300	60	43

Diagram (sample copy)



Less energy for boiling water

Module: 5 (Energy)		
Type of activity ✓ experiment ◯ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subjects : Physics Mathematics

SCHEDULE:

The aim of that experiment is to boil 50 cl of water using as little energy as possible, using different common devices (especially electric kettle and hotplates).
Measure the time spent between the moment you start the heating device, and the moment when water starts boiling.
Each test has to be performed with the device used at full power.
To calculate the energy consumption, do the maths: consumption (Watt hour, W.h) = power (Watt, W) x time (hour, h).
The power of each device is usually written on it, or in the user manual.
Is there a difference when you cover the container ?

EXPLANATION:

To heat the contents of a container, you need a heat transfer (= energy transfer) from the source (the device) to the target (the water). But energy leaks can happen, that decrease the amount of energy transferred to the target, and increase the heating time.

- If you use a hotplate and the container is too small, the surface of the hotplate that isn't in contact with the container will transfer the heat to the ambient air. It's an energy leak.
- Metal containers are good thermal conductors. The energy can easily go through their wall. It's an energy leak.
- If the container is not covered, the water inside will release some heat in the ambient air (especially through evaporation). It's an energy leak.

The electric kettle is the most efficient method because it's an isolated system. Water and heating device are shut in an isolated compartment (plastic are good thermal insulators). All the produced heat is used to heat water, with a minimum of energy leaks.
But sometimes you have to use a metal container, so cover it! It will increase the insulation between in and out and will avoid a large part of energy leaks.
Using those methods, you can boil water using almost two times less energy.

Materials needed :

- 50 cl of water
- 1 electric kettle
- Different types of hotplates (electric, gas, induction)
- Different types of containers and covers (metal, ceramic)

Tips for teachers:

- This experiment is mainly used to understand the importance of thermal insulation in energy savings. So it's not a problem if you have only one type of hotplate to experiment with.

	# Albedo	
Module: 4 (Housing)		
Type of activity ✓ experiment ◯ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ✓ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) ✓ long (> 45 minutes) ◯ spread over a longer period	Teaching subject: Physics

Introduction

Because of the greenhouse effect, snow and ice planes disappear. The disappearance of these white surfaces causes our planet to warm up even faster. In this experiment you discover why.

To work!

Pull the opening of the balloons over the neck of the bottles. To make sure they are properly attached, you can choose to use an elastic band.

Place the two bottles close to a heat source, preferably in the sun. If the sun doesn't shine, you can also use a hot lamp or a blow dryer to heat up the bottles.

What is happening?

The balloons blow themselves up. The balloon on the black bottle grows faster and harder than the balloon on the white bottle. The black bottle absorbs energy (heat) from the sun much better than the white bottle does, while the white bottle reflects most of the solar energy that reaches her. When a bottle absorbs energy (heat), the air inside heats up. Hot air expands, and the balloon grows bigger.
The albedo of an object is measures in how far that object reflects the sunlight. In theory, a perfectly white object has an albedo of 1: it reflects all the light it receives. The darker an object, the lower its albedo. An object that absorbs all sunlight and does not reflect anything, has an albedo of 0.

Roughly two thirds of our planet consists of dark blue oceans. Just like the black surface from the experiment, they can absorb a lot of heat: they have a low albedo. Moreover there are fewer white reflecting clouds over water than over land. The large amount of energy in our oceans ensures that the climate on our planet is pleasant and moderate. The continents themselves, and especially the parts that are covered with eternal snow, reflect the sunlight a lot more.

Because of the melting of the ice caps, the reflecting surface of our planet decreases, and more solar heat is being captured. The massive deforestation also contributes to global warming. The albedo effect is even larger in the tropics than it is in the polar regions, because they receive a lot more sun. When tropic farmers chop down the dark rain forest to cultivate the even darker soil below, the temperature in that region will go up with a yearly average of 3°C. This is on top of the fact that the deforestation causes the green lungs of our planet (the tropic rainforests), that absorb the greenhouse gas CO_2 and emit oxygen into the air, to disappear.

Materials needed :

- a plastic bottle painted white
- a plastic bottle painted black
- two small balloons
- heat from the sun (or another source)

Tips for teachers:

- Inflate the balloon with air to stretch it before the experiment.

Bio-ethanol

Module: 7 (Shopping)		
Type of activity ✓ experiment ◯ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ✓ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject: Chemistry

Introduction

Not only do we emit too much CO_2, we also send other harmful substances into our atmosphere. Most often the emission of harmful substances is the result of burning.

To work!

Light both fluids and turn off the light. Hold a glass beaker above each flame and catch the "smoke". Then, place the beakers down over the candles.

What is happening?

In both dishes combustion takes place. This is a chemical reaction in which a fuel reacts with oxygen. By placing a beaker over the flame, no fresh oxygen can reach the fuel. When all oxygen has been used up, the combustion can no longer take place and the flame dies. The dish with the "normal petrol" results in a black soot against the inside of the cup.

The combustion of ethanol and oxygen is a complete combustion. This entails that the fuel binds to as much of the oxidant (in this case oxygen) as possible. That means that in all or nearly all cases all fuel molecules are completely broken down into atoms, whereby every atom binds to as many atoms of the oxidant (usually oxygen) as possible for that type of atom. The complete combustion of ethanol looks as follows (three dioxygen molecules per ethanol molecule):

$$C_2H_5OH + 3\ O_2 \rightarrow 2\ CO_2 + 3\ H_2O$$

Therefore, the only remaining product of this complete combustion is carbon dioxide (and water). The carbon dioxide is in the cup as a gas, which by definition is not visible. At most you might see a little bit of water vapor appear on the inside of the glass.

The compounds of the petrol react according to an incomplete combustion. This reaction occurs if there is not enough oxidant around but the combustion reaction still does not stop (for example due to extreme heat). During an incomplete combustion the atoms from the fuel will bind to less atoms of the oxidant (usually oxygen) than is possible for that type of atom. During an incomplete combustion, less heat is released than with complete combustion. Petrol consists of several hydrocarbon compounds with four to ten carbon atoms. A reaction of such an incomplete combustion could look as follows:

$$C_xH_y + z\ O_2 \rightarrow a\ CO_2 + b\ CO + c\ C + d\ H_2O + e\ H_2 + f\ CH_4$$

Except for carbon dioxide and water, you can recognize several other products such as methane (a stronger greenhouse gas than CO_2), carbon monoxide (a poisonous gas), carbon (visible as soot) and water vapor.

Materials needed :

- a dish with ethanol
- a dish with lighter fluid
- a lighter
- two glass beakers

Tips for teachers:

- Turn off the lights after lighting the flames. After all, ethanol burns with a barely visible flame, that is more clearly visible when the lights are out. It also increases the surprise effect of the "black beaker"!
- Discuss the advantages and disadvantages of bio-ethanol with the students:
    - Advantages of bio-ethanol
        - No emission of soot or fine dust (pollution + lower albedo)
        - Renewable energy: plants that are harvested for ethanol production, can be planted again.
        - CO_2 neutral: the CO_2 that is released when fermenting the plant material and burning the bio-ethanol, is compensated by the CO_2 that is absorbed by the plants planted for future bio-ethanol production.
    - Disadvantages of bio-ethanol
        - Keeping in mind that a significant part of the world population suffers from hunger, it is hard to defend using fields that could be used for growing food, for growing energy. For bio-fuels of the second generation (leftovers from food crops, energy crops that grow on infertile soil) and the third generation (algae), however, this argument does not hold.
        - Strictly speaking, the ethanol does not burn up completely. By-products are formed, such as carbon monoxide and aldehydes. In São Paolo, Brazil, where they use a lot of bio-ethanol, the amounts of formaldehyde and acetaldehyde in the atmosphere are two to three times higher.

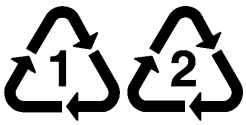
Sorting before recycling

Module: 7 (Shopping)		
Type of activity ✓ experiment ◯ exercise ◯ case study ◯ role play ◯ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject: Chemistry

EXPERIMENT SCHEDULE:

Recover plastic and metal objects: soft drink cans, food cans, shampoo bottles, water bottles, etc. These objects are manufactured from different materials according to their use, and can be sorted then collected to made new objects.

Plastic packaging normally has a symbol indicating its type.



The PET (polyethylene terephthalate) is impermeable to carbon dioxide: that is why it is used to manufacture plastic soda bottles. Plastic can be recycled to manufacture clothes made from synthetic fabrics.

The caps from these bottles are manufactured from another plastic called HDPE (High density polyethylene). This is also used for engine oil containers, shampoo or milk bottles. It is opaque and protects the contents from light.

Apart from the symbol, we can tell the difference between the plastics by immersing them in water. HDPE floats whereas PET sinks. Ensure that there are no air bubbles when filling the bottles and containers, and fill them well to check their buoyancy.

For metal cans, another type of test needs to used. Put a magnet next to the can. If it sticks to the can then the can is made of steel. It it does not, then the can is made of aluminium.
In sorting centres, these cans are separated by an electromagnet. The aluminium will be melted down in order manufacture new cans, wheel hubs or the even an aircraft bodies... but to do this you first need to collect 15 millions cans!

Materials needed :

- an aluminium can and a steel can
- HDPE and PET type plastic packaging
- a magnet
- a large container full of water

Tips for teachers:

Find answers

Module: 1 (Introduction into climate change)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play → project ◯ discussion ◯ other:	Group size and duration ◯ individual → small group ◯ large group ◯ short (< 15 minutes) → medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Sociology Geography Language

Description:

Pre-activity: each student gets a link to source/title of literature, which he/she needs to borrow where to find explanations for some expressions and phenomena.

Part 1: Activity "Who is it/what is it?"

The content of this activity is connected with pre-activity task and helps students to become familiar with some of expressions and documents which are related with climate changes in their countries. Teachers and trainers can use photos and titles form newspapers, extracts from interviews on the radio or news programmes on TV.

Students can walk from picture to title and write their answers or tell their answer in dialogue with the teacher or mark just those ones which they do not know.

Examples of questions: 1) Try to explain what climate system is?
2) Why is a national strategy needed?
3) Who is this man on the picture one?

Part 2: Find answers

Each group which consists of 4-5 members gets a list of questions (Annex 1). The Trainer/teacher gives all necessary instructions for work and enables the students' access to the Climate Literacy modules and web.
The aim of this activity is that students train how to sort and combine different interpretations of phenomena into short and easy understandable explanations.

Part 3: Presentation and evaluation

Students have the task to present their findings with time schemes, drawing pictures, computer animation or examples in real world.

In the last 5-10 minutes teacher/trainer hands out a short evaluation questionnaire to get feedback from students.

Key activities:
Learning new concepts, become acquainted with main processes and phenomena associated with climate change, obtain more information about national documents which are connected with climate changes and also with scientists, politicians and NGOs that work on this field.

Use of different sources, transferring information to graphic presentations, summarizing of descriptions.

Annex 1: Examples for questions

GROUP A: basic terminology and presentation of climate changes as natural phenomenon

1) What are the main differences between climate and weather?
2) What is: climate system, anthropogenic climate change, desertification?
3) Explain and display the greenhouse effect?
4) Why is "all a matter of energy" as is said in Module 1?
5) Use time and event schemes and explain when climate changes are natural phenomena?

GROUP B: climate changes as global-economical issue

1) What has changed with the industrial revolution?
2) Explain with examples, which of human activities are mostly responsible for climate changes?
3) Explain and display how global warming starts and where we can already see consequences in our life?

GROUP C: Climate changes themes in media

1) Looking for news and articles about climate changes
2) Overview what media have been writing about climate changes

Materials needed :

Copies of list for literature, different newspapers, radio, TV or computer for playback extracts from interviews on the radio or news programs on TV, list with questions, short evaluation questionnaire

Tips for teachers:

Pre-activity link/title could include different literature (CD-s, videos, web sides, books, science magazines, daily newspapers) and need to be connected with the theme from Module 1. Links and titles of the sources need to be verified and available on the web and contribute to raising student's interest.

Part 2 requires the use of open type of questions to motivate students and to get a more detailed overview of how well are they informed and how much interest they show for themes. If the interest is low, then is advised that the trainer/teacher link themes more with life situations or areas, which interest students more. The trainer/teacher is in this part mostly in the role of a mentor who directs students and offers further explanation.

For part 3: The teacher/trainer can offer already designed posters with time and events schemes into which students just insert their text, graphs and pictures. Students can also use Prezi or Glogster (e-posters and scheme).

Evaluation form is feedback for teacher/trainer: what have students learned, how much are interested in knowing more (assessment scale), which was the most and the least interesting part, which of these skills/information can they use in their everyday life.

What will climate change bring?

Module: 1 (Climate questions)		
Type of activity ◯ experiment ◯ exercise ✓ case study ◯ role play ◯ project ◯ discussion ◯ other: activities	Group size and duration ✓ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) ✓ long (> 45 minutes) ◯ spread over a longer period	Teaching subjects: Sociology Geography Languages

Step 1: Discussion
The teacher/trainer uses a Power Point presentation and explains the background and the consequences which are expected in a few years. During the presentation, students can comment some of presented facts or predictions for the future. The teachers' explanation and questions should trigger students to think through different perspectives, predict the consequences and come to conclusions with deduction (from examples to general conclusions).

Step 2: Case studies
Each student chooses one of the presented cases. Then they select the corresponding research sheet with questions and introduction for investigation work. They need to have access to internet to use different sources, e.g. Google map, local and NGO's websites and literature where they can find information on which they are going to draw conclusions. They have 20-25 minutes time for these tasks.

Example of research questions:

a. Which countries are most vulnerable?
b. What have vulnerable countries already done to mitigate the consequences?
c. With what kind of problems will these countries need to deal with in the near future?
d. What can we all do to contribute to solving the problem?
e. What kind of problems can Europe expect if the problems will not be solved?
f. Which solution are you proposing for the next two years?

Step 3: Short presentation
Students present alone or in groups. Their presentations (one or two minutes) should include key findings and present a solution.

Step 4: Class exhibition
After the presentations, the teacher edits the research materials (sketches, notes, results, photos, drawings, abstracts) together with student for an exhibition.

Materials needed :
Computer or mobile phones, Wi-fi, printed literature, research sheet, colour and white paper and pens, markers, posters, newspapers

Tips for teachers:

Prepare yourself for the discussion in step 1 with studying the background and possible consequences, with open questions such as: "If this is true, what kind of problems could be expected in 5/15 years? Try to answer, what flood

fence would not be suitable for the area? Put yourself in the role of mayor. Do you have a population of 750,000, you are maritime center, you have 12 million € budget. What kind of solution will be financially and environmentally acceptable?" They will help you gain more cooperation from students and give you important overview about their level of interest and the capacity of their strategic thinking and ideological orientation.

You can provide uniform format of research sheets or different versions of it, if you prefer to associate research work also with development of specific learning goals. Introduction in research sheet for student should be short and clear and provide all necessary information, which are important for successful research work.

Research questions should link the problem of your country with short-and long-term consequences for all citizens of Europe. They should also encourage students to investigate what has already been done and which solutions are still necessary.

The class exhibition is the presentation of all students' research work. It can serve for evaluation of the results or be used by other classes.

Observed effects of climate change

Module: 1 (Climate questions)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ✓ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ✓ spread over a longer period	Teaching subjects: Geography History Language Environmental sciences

The existence, presence of climate change are denied by some experts, is assumed as a result of the periodicity of climate. The documentation and demonstration of the increasing frequency of unusual climatic events can deal as proof, indication of the jeopardy of climate change.

Students make a collection of events, occurrence, effects, and unusual weather situations caused by climate change.

The trainer/supervisor creates teams of 3-5 participants and helps to allocate tasks on teams according to the expected results and team requests. Finally, they evaluate the results and the project realisation with the teams, participants.

Tasks for the participant teams:

1. Determination of the scope of research:
    - geographical area
    - unusual climatic effects
    - time interval
    - media
2. Tasks allocation under the teams, persons
3. Research phase: collecting date, intensity, duration of observed events
4. Interview with citizens in higher age
5. Making photos on remaining, visible effects, consequences of unusual climatic events
6. Compilation of collected data in table form (temperature, rain fall)
7. Preparation of diagrams
8. Presentation of the results in classroom, on school media
9. Promoting the research results to the local community and media by illustrated article

Expected results:

1. Participants get certitude, knowledge, overview on the effects of climate change on own experience.
2. Participants get willingness to act, to work to mitigate climate change.
3. Survey on unusual climate events.
4. Demonstration, presentation of project results.

Materials needed :

- PC,
- camera, mobile phone
- access to archives

Tips for teachers:

- The archive data of national meteorological service can serve as rich source
- Let students, teams act free, to be innovative, creative, to carry out own ideas

Ecological footprint estimation

Module: 2 (Ecological footprint)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ✓ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subjects: Ecology Mathematics Informatics Languages

Team participants estimate their own ecological footprint using simple and sophisticated footprint calculators respectively, and compare the results of other team members.

Objectives:

Participants will see the importance and effect of several lifestyle habits, consumerism and Mobility behaviour on the ecological footprint. They can select activities to reduce it to get lower values, e.g. how can they contribute to a sustainable life.

Design, tasks, solution to be performed:

Trainer:

8. Holds a discussion on the ecological footprint
9. Creates teams of 5-10 participants
10. Helps to allocate tasks on teams according to expected results and team requests
11. Moderates the presentation and discussion of results

Participant teams:

1. Allocate tasks on team members according to team requests
2. Download a simple and a sophisticated footprint calculator
3. Execute calculations with own real data on both calculators, notice the result
4. By modifying the answers or by validation of the by calculators suggested measures to reduce your footprint, they estimate the elements of their life style/behaviour to be changed
5. Select the activities they plan to change with the aim to contribute to sustainability
6. Compare the footprints of team members
7. Discuss the results and planned reducing activities, compile propositions for classmates
8. Hold a presentation
9. Promote the event and results to the local community and media

Expected results:

1. Participant become familiar with the footprint phenomenon
2. Change of life style, consumer attitudes among young people

Materials needed :

- PC
- Footprint calculator with manual counting e.g.:
  www3.epa.gov/airnow/workshop_teachers/calculating_carbon_footprint.pdf
- Footprint calculator online e.g.:
  www.greencred.me/footprintcalculator/
  http://footprint.wwf.org.uk/
  http://ecologicalfootprint.com/ (simple)

Tips for teachers:

- Help in the team formation.
- Let the student act free, to be innovative creative, to carry out own ideas.

Cycling in the village

Module: 3 (Mobility)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ✓ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) ✓ long (> 45 minutes) ◯ spread over a longer period	Teaching subjects: Geography Language Environmental sciences Social sciences

Replacing motorized personal Mobility to biking serves environmental protection and climate change mitigation effect by reducing the formation of smog and green house gas emissions.

Design, tasks, solution to be performed:

Trainer:

12. Discuss with students the benefit of using a bike for personal Mobility for the individuals, for the community and for global environment.
13. Explain the project (aim, tasks, runoff, expected results).
14. Create 4-5 teams of 3-5 participants
15. Help allocate tasks on teams according to expected results and team requests.
16. Moderate the presentation and discussion of the results
17. Moderate the formulation of the proposal to Mayor and City Council in joint work of all teams

Participant teams:

Map of bicycle route:

1. Cycle along the bike route in the village/city
2. Draw the route on the city map, mark the sections of high and low grade quality, deficiencies, hazardous points
3. Create an e-map using your drawn route map

Bicycle storage sites

1. Take a systematic biking / walk in the village/city to institutions of public importance eg. railway and bus station, long distance bus stop, school, medical center, hospital, police, post, shops, shopping centre, bank, restaurant, local government offices, etc.
2. Mark the bike storage sites on the village map, notice the capacities.
3. Make a table about the address, capacity and estimated required capacity of the storage sites.
4. Make photographs

List of public institutions that can or cannot be attained on bike

1. During the designation of bike storage sites notice the institutions of public importance.

2. Make a table : list the institutions and notice the attainability by bike on bike route, safely on street, unsafely on street, attendance impossible
3. Draw existing or possible bike route on the map from city centre, railway and bus stations to the listed institutions

Formulate a proposal on development of biking possibilities addressed to the Mayor and the City Council

1. Prepare a compiled e-map based on your results
2. Prepare a table on institutions of public interest summarised your observations
3. Present the results of the project for school classmate, training participants.
4. Each team should write their proposals for developing biking possibilities on flipchart or sheet
5. Team members and school classmates, training participants jointly have to select the best and deliberate proposals.
6. Formulate a letter containing a short statement of the project, the project results and your proposals to the Mayor and city council.

Expected results:

1. a map of bicycle route in your residential area
2. checkmarks of bike storage sites on the map of your residential area
3. a survey on capacities of bike storage sites and list of assumed further needs
4. a list of public institutions that can or can't attained on bike
5. summary and presentation of project results
6. a deliberate proposal on development of biking possibilities addressed to the Mayor and the City Council

Participants get information on biking possibilities, get encouragement, willingness to use bike for personal Mobility. Understand the importance of climate change. They can conciously act against climate change.

Materials, devices needed :

1. bicycle
2. PC,
3. printed and e-city map,
4. camera or mobile phone.

Tips for teachers:

- Lead and administer the presentation and letter formulation.
- Let the student act free, to be innovative creative, to carry out own ideas.

Motivate parents to a sustainable house

Module: 4 (Housing)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play → project ◯ discussion ◯ other:	Group size and duration → individual → small group ◯ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) → long (> 45 minutes) ◯ spread over a longer period	Teaching subjects: Social science Psychology Language Mathematics

Step 1: Assembling a questionnaire

Propositions for elements of the questionnaire:

1. Categories for types of the buildings: passive house, traditional house, apartment block, other
2. District: city, suburb, rural
3. Year of construction of the building
4. Type of adaptations of building: energy, water, solar elements, heating system
5. The average amount of the monthly invoice for energy, water and heating system
6. Critical areas (open type of questions)
7. Obstacles, which demotivate parents to deal with the problem(s) more actively? (e.g.: financial, shared ownership, rented apartment, old building, other)

The trainer/teacher needs to review and discuss with students which questions are relevant for the need of the research and which should be modified or added. It should not contain too many questions, at least not more than ten. The final version is printed or sent by e-mail to learners who have two days to get answers from parents.

Step 2: Home investigation

Learners bring the questionnaire home and present to their parents the aim of this research.
If parents do not know some of the answers related to the year of construction or types of adaptations, the teacher can help learners to try to find this information on the websites of housing administration.

Learners bring/send questionnaires back to the teacher/trainer in order to process the data and presented them in one of next learning hour.
Another option is that students process these data in one of learning hours with teacher of informatics.

Step 3: Data processing and presentation

The teacher and learners make the analysis and presentation of the results.
On the basis of results, each student/pupil prepares at least three tips or suggestions which will be helpful in motivating parents to start using more sustainable solutions.

Key activities:

- understand and learn new terms
- become informed about the different research methods and elements in qualitative research ,
- identify the strengths and weaknesses of different research approaches
- gain information on how energy-efficient are their homes and where are critical areas

- formulate proposals for a more economical solution on which can have an impact all family members and are financially favourable

Materials needed : projector, linen, computer (Power point presentation, Excel documents or other programs, which allow data presentation end processing), printer, Wi-fi access, notebooks, pens

Tips for teachers:

In step 1, the teacher/trainer should review and discuss with student/pupils, which questions are relevant for the need of research in order that they understand the purpose of each question and the importance of proper form of question.

Step 2: If parents are absent, or if they do not know much about adjustments, or are not willing to cooperate, learners can make their own research.

Step 3: The teacher/trainer can also demonstrate the analysis of data, since one of goals is also to teach students how to do analysis and qualitative research.

Step 4: Student/pupils can also make demonstration videos about easy repair ideas or how to find and apply for financial subventions or inform parents about the Climate Literacy platform. The aim of this task is that they are more actively involved in this issue than family members and citizens.

Energy consumption

Module: 4 (Housing)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ✓ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ✓ spread over a longer period	Teaching subject: Mathematics Languages Environmental sciences

Students/participants make a survey on Energy consumption

Design and tasks to be performed:

Trainer:

1. Explains the project (aim, tasks, runoff, expected results).
2. Helps in the team formation of 3-5 participants
3. Allocates tasks on teams according to expected results and team requests.
4. Leads and administers the presentation.

Participant teams:

1. Collect the monthly bills of selected consumptions of their home: electricity, gas, heating, water.
2. Prepare a table on each type: energy consumption vs. the months.
3. Prepare diagrams on the different energy consumptions vs. months separately
4. Make a diagram representing all consumptions vs. moths.
5. Compare the results with team participants living in family house and storey house
6. Make a presentation. Recommended questions to discuss:
    - Are the diagrams of different consumptions the same or like to each other?
    - Which months seem to be particular for the different consumptions?
    - Give an interpretation for the diagrams.
    - Tell the proposed reason if there is a difference between the consumption diagrams of family house and storey house .

Expected results:

1. A survey of the monthly energy consumption of a family over a year period or over some years
2. Interpretation of the minimum – maximum values of the consumption
3. Comparison of different households needs

Materials needed :

- PC,
- access to bills of the energy providers

Tips for teachers:

- Explain the project (aim, tasks, runoff, expected results).
- Help in the team formation.
- Lead and administer the presentation.
- Let the student act free, to be innovative creative, to carry out own ideas.

School newspaper and radio

Module: 5 (Energy)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ✓ project ◯ discussion ◯ other:	Group size and duration ✓ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ✓ spread over a longer period	Teaching subjects: Language Art

Description:

In order to motivate learners, the teacher/trainer presents the learning activities and the goals that students need to follow in each activity. After this presentation, some general instructions follow about the working process for specific activities the students can choose:

a) crossword puzzle which contains words from Unit 1-3;
b) short strip which summarizes the main message of the Module 5
c) caricature about main errors in the management of energy in the household
d) article about how to save more energy in school
e) short radio clips about interesting and rare know facts in the field
f) a radio or newspaper interview with an expert or with other students who are active on this field;
g) a music or art competition focusing on Energy

Students who will work on a crossword riddle should use different types of dictionaries and crosswords handbooks, which will help them to match passwords in horizontal and vertical sequences.
Students who will work on strip or caricature can use tips from caricature and strip handbooks.
Students who will write articles and interviews need to use textbooks, which give examples about the required formal structure.

The teacher/trainer reviews the products and gives feedback. If the paperwork/article/sketch meets the expectation, it is added to the folder which will be submitted to the mentor who publishes the school newspaper and – if applicable - leads the school radio.

Materials needed : *dictionaries, handbooks, wi-fi access, computer or apps, pens, notes*

Tips for teachers:
The main goal of this activities is to motivate students to learn about new themes in more creative and also interactive ways.

Zero waste school

Module: 6 (Food and waste)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ✓ project ◯ discussion ◯ other:	Group size and duration ◯ individual ◯ small group ✓ large group ◯ short (< 15 minutes) ✓ medium (15 – 45 minutes) ◯ long (> 45 minutes) ◯ spread over a longer period	Teaching subjects: Sociology Biology Technology

Description:

Step1: Common school meals
Students and teachers/trainers are eating together and share their meals. The aim of this activity is to encourage students to reduce the number of food leftovers to a minimum. The common meals are also pleasant time of socialization.

Step 2: Sorting leftovers
After the meal, The teacher/trainer and students sort the leftovers into four containers. Above each is a poster with description of the components that go into it and the purpose of the further use:

1. Food that has remained intact and has a longer shelf-life. Intended for shelters, food bank.
2. Leftovers which are still edible. They might be used as an ingredient in other dishes.
3. Biological waste that can be used for composting.
4. Food residues which are no longer eligible for re-heat treatment, but they are still edible, are Mobilityed at the animal farms. This option is only practicable in rural areas, of course.

Step 3: Re-use challenges
Students are challenged to find potential reuse for any waste they generated. For example:

- scrap paper: making geometric shapes, paper decorations
- plastic packaging: vases, watering cans, cans for storage of different materials
- waste water: used for watering plants

Materials needed : 4 containers, 4 posters with description of the components that go into it and the purpose of the further use, plants of fruit trees, scrubs and flowers, vegetable and herb seeds, computers,

Tips for teachers:

Each of activity can trainer/teacher use in his learning class hour. If school decided to run a project, this activities should be implemented to all classes and supported by the majority of teachers to reach its main goal.
Common meals can also be used as time for more unformal talks between students and trainer/teacher to exchange views and ideas. Teachers, who decided to eat common meals with students should circulated between different groups.
Sorting leftovers is very simple but very effective activity, which will have a great influence on students'/pupils' believs and habits. School need to provide just 4 containers with 4 posters on which is description of the

components and the purpose of the further use in school dining room. Task of trainers/teacher is to presented the importance and role of reservoirs and practice use after shared meals.

Activities from part 3 and part 4 can be used in regular class work to break up the routine or as different type of homework or methods for raising motivation.

The journey of fruit and vegetables

Module: 6 (Food and waste)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ✓ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ◯ small group ✓ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) ✓ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Biology Geography Mathematics

Description:
This activity aims at raising awareness to the fact that the fruit and vegetables we eat on a daily basis sometimes travel huge distances to reach our plates, but at a cost in terms of pollution.

In preparation of the activity, go to a supermarket and note down where ten or so commonly eaten fruit and vegetables come from.
To begin the activity, each participant will 'go shopping' and choose 2 vegetables and 2 types of fruit in the established list. The origin of this produce will be revealed **after** everyone has made their choice. Everyone can choose according to what they like.
Then, the shopping baskets' "CO_2 cost" will be determined.
This value is approximate value but represents realistic average values. So as to simplifying the topic, only CO_2 emissions are addressed here.

Mobilityation method	Quantity Mobilityed (t)	CO_2 emission (g/km)	CO_2 emission per 1t (g/km)	Use
Small truck	3	300	100	Road Mobility (<100 km in distance)
Heavy goods truck	20	600	30	Road Mobility (>100 km in distance)
Boat (cargo ship)	20000	188000	9.4	Sea and ocean crossings

Using an atlas or a Google Earth-type web application, determine the distance between the place of production and the consumer. Then check the types of Mobility which are going to be used for each stage of the journey by using the indications in the table.
Then calculate the CO_2 cost per tonne of chosen merchandise. Ideally, the CO_2 cost for the same food should be compared, i.e. one produced locally and the other produced abroad.

Example: green beans
Produced in France
Distance: 200 km from Paris by road
Total CO_2 (per 1 tonne) = 200 x 30 = 6000g
Produced in Kenya
Distance: 600 km by road to reach the sea + 8600 km by boat + 600 km by road
Total CO_2 (per 1 tonne) = 600 x 30 + 8600 x 9.4 + 600 x 30 = 116000 g
The aim is not to provoke a feeling of guilt or to state that the foods produced a long way from where they will be consumed are of poor quality, but to make one realise that making a choice about food based on likes only, without thinking about their availability, can result in consumption which causes pollution.

Materials needed :
Tips for teachers: - To explain the seasonality of fruit and vegetable production - To raise awareness in the concept of "eating local" - To examine the geography of places where food is produced - To discover the maritime Mobility network

A visit to the local supermarket

Module: 7 (Shopping)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ✓ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ✓ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) ✓ long (> 45 minutes) ◯ spread over a longer period	Teaching subject(s): Languages

Description:

This exercise invites the trainer to make use of the topic of Shopping as a subject and engage into a language activity with the trainees.

The trainer divides the trainees in groups of 3 or 4 (depending on the group size). Each team receives a set of cards (10 cards per group) and 1 map. Each of the cards reads the name of a different product type (e.g. bananas, rice, orange juice etc.) in the language which is being taught.

Trainees then visit a local supermarket. They are given a timeframe (e.g. 10 minutes) and the countdown begins. Trainees disperse in their groups in the supermarket, locate the products found on their cards and read their labels in order to establish where the products come from. They then mark the place of origin of these products on their map. The team that locates and maps the products first wins.

The trainees then return to the classroom and each group presents their map and discusses their findings in the language which is being taught.

Materials needed :

- Cards (prepared by the trainer beforehand, and each reading the name of a different product type). 10 cards per group.
- Maps (1 per group)
- Pens
- Means of Mobilityation from classroom to the supermarket and back

Tips for teachers:

It is important that trainers choose the products to put on the cards carefully. These products must form a combination of products which are usually locally sourced, products which are imported exclusively, and products which can either be locally sourced or imported. The repetition of some cards between groups may provide results that show that the same products can be found either from local productions or imported, thereby allowing for discussion to take place. A prior visit to the local supermarket to spot these products may be useful. It may also be beneficial to inform the local supermarket beforehand about the planned visit.

Shopping habits

Module: 7 (Shopping)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ✓ project ◯ discussion ◯ other: _____	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ✓ spread over a longer period	Teaching subjects: Social sciences Environmental sciences

Students, participants make a research on the shopping habits of families and evaluate the results.

Design, tasks to be performed:
Trainer:

18. Explains the importance of deliberate, prudent shopping
19. Creates teams of 3-5 participants
20. Helps the teams to allocate tasks on teams according to expected results and team requests.
21. Helps on collections of shopping habits to be surveyed
22. Moderates the presentation and discussion

Participant teams:

1. Distribute tasks and roles among team participants
2. Compile of shopping habits to be surveyed, researched
3. Prepare a questionnaire from the habits compiled in printed or e-form
4. Carry out the research by interviews or on e-mail
5. Make documentation of the research activity by photos, videos
6. Evaluate the results. Prepare table and diagram.
7. Present the results, discuss the best and less suitable shopping behaviours
8. Show the benefit of good shopping habits mark the habits to be changed for a sustainable society
9. Promote the project results to the local community and media.

Expected results:

1. Ideas, awareness to change for better shopping habits
2. Get an overview on own best and less applicable shopping practice
3. Get internal constraints for paradigm change

Materials needed :

- PC,
- camera, mobile phone,

Tips for teachers:

- The project can be carried out by more teams simultaneously
- Lead and administer the presentation and discussion of the teams participated in the work
- Let the student act free, to be innovative creative, to carry out own ideas.

More shopping

Module: 7 (Shopping)

Type of activity
- ◯ experiment
- ◯ exercise
- ◯ case study
- ◯ role play
- ✓ project
- ◯ discussion
- ◯ other: _____

Group size and duration
- ◯ individual
- ✓ small group
- ◯ large group

- ◯ short (< 15 minutes)
- ◯ medium (15 – 45 minutes)
- ◯ long (> 45 minutes)
- ✓ spread over a longer period

Teaching subjects:
Social science
Economy
Psychology

Description:

Write down all your purchases for the last month, or check it up in your internet bank or on your credit card bill. What of all these are necessary for your survival?

Which of the items you have bought are necessary for you to feel good? Does the first and second list have great differences between you and your classmates? What on your list have the greatest climate impact? Do you usually consider your impact on the climate when you are shopping?

Is there anything on the list that you could have avoided? What else can money be spent on? (Fairtrade shopping, charity, ethical consumerism etc.). Is there any better way for you to spend your money and still feel good?

Materials needed: Paper and pencils, list of one months purchases.

Tips for teachers:
Compare an ordinary month to the month before Christmas or another big holiday and discuss the differences. Do we spend more money on “good” things before holidays?

Clean air

Module: 8 (Promoting Climate Literacy)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ✓ project ◯ discussion ◯ other: Investigation	Group size and duration ✓ individual ◯ small group ◯ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ✓ spread over a longer period	Teaching subject(s): Geography Social science

Description:

Trainees are asked to identify in their national inventories, three of the main sectors that cause major air emission of pollutants in their countries, and more specifically in their regions concerning greenhouse gasses (CH_4 and N_2O), NH_3 and other significant emissions when relevant.

These emissions should be related to socioeconomic activity of the geographical areas under study. The students are requested to identify and propose or identify three cost-efficient abatement techniques in each sector.

Additionally, students should pay attention and identify which data are available and mandatory for the national governments to be reported to the European Union and under which European legislation.

Materials needed :

- Pens
- Papers
- Computers to do online search

Tips for teachers: It is important for the teacher to have carried out in advance this research work in order to discuss with students their findings and orientate them about where to look for.

School board for climate change

Module: 8 (Promoting Climate Literacy)		
Type of activity ◯ experiment ◯ exercise ◯ case study ◯ role play ✓ project ◯ discussion ◯ other: activities	Group size and duration ◯ individual ✓ small group ◯ large group ◯ short (< 15 minutes) ◯ medium (15 – 45 minutes) ◯ long (> 45 minutes) ✓ spread over a longer period	Teaching subject(s): all

Pre-activities:
The teacher, with the consent of the headmaster, presents the idea and purpose of the Climate Literacy School Board for which students from each class can candidate. The School board also includes membership of teachers as mentors, of the headmaster as manager, and of the school administration as external collaborator. The main idea of the project is that students become more actively involved in the creation and implementation of sustainable life in school.

Examples for the roles for students:

- Representative for saving energy and water at school
  Representative for the greening of school spaces
  Representative for green Mobility
  Representative for a zero waste school project
- Representative for media

Other students have a role of active members: they give suggestions, proposals, engaging in projects and attend boards meetings.

Step 1: Presentation of candidates and elections

The class candidates are chosen by their classmates through voting. School elections could be arranged with e-voting or as school event. Board meetings need to be regular, but not too often (once per month). Other students and teachers give suggestions to the representatives and receive different weekly tasks to do.

Step 2: Weekly and monthly tasks

They should be connected with different school projects, events, practical work, or regular school work. This will allow students to acquire some new learning contents, gain more practical knowledge, develop new ideas and influence the school community to become more conscious and responsible.

Examples of tasks, which can be part of everyday lesson:

a) use day light instead of electric.
b) use energy-saving lamps for classrooms
c) draw a plan for a school herb garden

Step 3: Monitoring progress and measuring membership satisfaction

Students of informatics establish a data collecting and monitoring system and design measuring devices and green solutions based on smart information technologies.
Students in physics, chemistry and techniques engage with the data analysis and make proposals for the improvement of processes, technologies, management and devices in school.
Student in arts and language can design and take care for more and attractive green spaces inside and outside of school, recycling furniture and appliances, They can produce videos, online and print publications, and prepare cultural school events for raising awareness.
Students in sociology, history, philosophy and psychology can research how climate and life style are connected, when social problems start to influence our beliefs and habits, and which activities will motivate more students and teachers to take part.

Materials needed :

Tips for teachers:

This activity can become an effective system for solving conflict and problems.
You should enable as much as possible equal representation of interests and take into account the wishes and needs of different groups.
Celebrate each successes! Insist. Help each other! Believe in your work and that of your students!
Praise good work!

School campaign

Module: 8 (Promoting Climate Literacy)

Type of activity
- ◯ experiment
- ◯ exercise
- ◯ case study
- ◯ role play
- ✓ project
- ◯ discussion
- ◯ other: _____

Group size and duration
- ◯ individual
- ◯ small group
- ✓ large group

- ◯ short (< 15 minutes)
- ◯ medium (15 – 45 minutes)
- ◯ long (> 45 minutes)
- ✓ spread over a longer period

Teaching subjects:
Social science
Natural science
Mathematics

Description:

Create a campaign on your school to enlighten the issue of climate change. Try to write down as many day to day easy changes of lifestyle to increase the use of material and services that creates greenhouse gases. Make a contract to sign a commitment to these new habits. Try to estimate the reduction in greenhouse gases every time you follow your new habit.

Spread the contract to your parents, neighbours and friends. Estimate the reduction in greenhouse gases if all the contractors follow their commitment for one year.

Materials needed: Paper and pencils, campaign material.

Tips for teachers:
Sum up all the commitments from the students to show that small action make big changes if many contribute.