EURONET 50/50 max

Energy Saving at Schools

E-Pack for Secondary Schools

UfU
Unabhängiges Institut für Umweltfragen

EURONET 50/50 max

Co-funded by the Intelligent Energy Europe Programme of the European Union

EURONET 50/50 max

Energy Saving at Schools

E-Pack for Seconary Schools

CONTENTS

ABOUT

About EURONET 50/50 MAX:
In your hands, you hold the educational material handed to you by the partners of the EURONET 50/50 Max project. EURONET 50/50 Max is based in the project EURONET 50/50, which was run in 9 EU-Countries from 2009-2012. EURONET 50/50 project won the Sustainable Energy Europe Award 2013 in the category of “learning”. EURONET 50/50 Max is now aiming to disseminate the 50/50 methodology at 500 schools and 50 –non-school public buildings in 13 EU-countries.

Energy saving projects using the 50/50 methodology are aiming at achieving energy saving by changing the behaviour of the users of the building, in the case of schools these are pupils, teachers and other members of the educational community.

Environment and climate benefit from a reduced use of energy at schools due to lower CO_2-emissions. In EURONET 50/50 Max, the schools benefit, too – because they receive 50 per cent of the energy costs they save for their own use.

As one of the objectives of EURONET 50/50 Max is to avoid CO2-emissions, the main focus of the project and this E-Pack is energy. But it is possible to include the schools waste production and use of water in a 50/50 project. This E-Pack provides project material for these issues as well.

ABOUT THE E-PACK
The E-Pack aims at helping you to carry out the educational part of EURONET 50/50 Max in your school. The core of the E-Pack is the teacher’s guide and the worksheets developed by the Independent Institute of Environmental Issues (UfU) in Berlin, Germany. UfU has been carrying out energy saving projects in schools – many of them within 50/50 incentive schemes – since the early 1990-ies. Additional material gives additional information and tools.

UfU is aware of the fact, that the situation in schools and the curricula are different in the partner countries. We tried very hard to develop an education plan that is applicable in different circumstances. You are welcome to adapt it to your specific conditions, but you should keep the focus on pupils’ ideas and activities. UfU trusts the creativity and drive of children and youths in shaping their environment. And EURONET 50/50 can be one step more to empower the pupils to do so – in school, at home and in their future.

METHODOLOGY

The Methodology of
A 50/50 PROJECT AT A SCHOOL

ABOUT A successful 50/50 Project at a school requires will and drive both from the side of the school and from the side of the administration that is paying the energy bills. At the school one or two teachers should be the “engines” of the project. These teachers should have the support of the director of the school.

THE NINE BASIC STEPS FOR A SUCCESSFUL 50/50 PROJECT

The first two steps of the proposed methodology are preparatory. The steps 3-9 are carried out by the students, which are supported by the teacher using the material given in this e-pack.

1 Establish an Energy Team

The energy team consists of one school class or an interested group (which should be formed of the energy speakers of all classes), one or two teachers interested in the project and the school caretaker. Other persons can also join in, but the larger the number, the more difficult is the organisation of the work.

2 The Insider Energy Tour

The insider energy tour is done by the school director, the teachers involved in the project, the school caretaker and a representative of the administration paying the energy bills of the school. The aim of the insider is to assess the situation in the school building, to identify fields of action for the students and to strengthen the commitment of these key actors to the project

3 Theoretical Kick-off in the energy team

Introduction or recollection of topics like energy, sources of energy, green-house gases, green-house effect and global warming – and the reason and benefit of energy saving.

4 Energy Tour

The students get to know the way of the energy into and out of their school, find out what problems to look for when they set out to make the energy survey in the next step.

5 Making an energy survey at school including: an instant temperature profile, a long time temperature profile and a survey of the use of electricity.

The students make an instant temperature and energy use survey during class time. This step can be repeated to create a long time temperature survey of the building – or at a later stage or in the following year to check the results of the project.

6 Evaluate the results - Make Solution Proposals

The students evaluate their results, make calculations and/or do further research- They work out proposals to improve the energy performance of their school – and thus ways to avoid CO2-emissions and decide, who the different proposals should be directed at

7 Tell the School Public

The students work out ways to reach the target persons of the behaviour oriented proposals at the school, prepare and carry out the respective presentations

8 Communicate measures that need small investment

Even though 50/50 focusses on user behaviour, there often are small investment-related measures that can save a lot of energy and can thus make the 50/50-project even more effective. These proposals need to be communicated with the administration. The students develop the ways to do this.

9 Use and communicate the money the school gets for its efforts
When project receives its reward – the 50% of the money save, the success is communicated at the school and the money is spent. The energy team should have a say in what the money is spent for.

The steps above are mainly directed at a change of user behaviour in the use of heating and electric energy. 50/50 projects can also include the issues water and waste. The project material given about these issues in this E-Pack uses similar steps as described above, but also gives an incentive of finding out about the local conditions and some experiments.

THE EDUCATIONAL BENEFIT OF RUNNING A 50/50 PROJECT AT SECONDARY SCHOOL

BENEFIT

Running a 50/50 energy saving project at school provides an excellent opportunity to combine teaching and learning in specific subjects with practical experience as well as transdisciplinary approaches.
Due to the international character of EURONET 50/50 Max and the difference in school curricula we can only give a rough example for the integration of 50/50 into the curriculum.

Integration into Framework Curriculum for Physics/Science

Physics/Science Standard Issues

- Energy
- Transition of energy
- Forms of Energy
- Energy supply
- Alternative sources of Energy

Physics/Science Knowledge

- Planning, making, minuting and assessing experiments
- Energy from the socket
- Heating and cooking
- Energy and power
- Warmth
- Electric energy
- Calculating electricity

Transdisciplinary approaches

Geography

- Global future scenarios and ways to sustainability on the local and global level; Climate change and the influence of man on the climate; Scarcity of resources topical global issues

Social Science

- Employment and the relation between economy and ecology
- Budget and consumption; technology in everyday life; use of technology in everyday life; the circulation of material, energy and information in technical appliances; technisation of everyday life

Chemistry

- Hydrocarbons – fuels and resources: coal,
- natural oil and gas, biomass, scarcity of resources, solar energy, renewable resources
- Green-house gases – methane, hydrocarbons and water, origin and effects, the CO2-cycle

Mathematics

- “to derive conclusions from data”: critical analysis of statistical graphs, developments of adequate presentations of figures

Ethics
- International politics – the effects of globalisation processes

Biology
- Ecology and Sustainability

Transdisciplinary competence building

Native Language Class (insert your language)
- Designs and use of media and reporting
- Research technics
- Learn to understand technical terms
- Write non fictional-texts
- Presenting and informing
- Debating

Mathematics
- Dealing with math text problems
- Quantities and units
- Collecting, analysing and reflecting data

Computer Science
- Interconnected Information structures: the internet
- Governing and processing data: tables

Arts
- Designing pictures
- Communication and media design
- Inventing, developing and presenting

The development of skills
Following the concept of Education for Sustainable Development the development of competencies or skills is playing a central role in the education of young people. EURONET 50/50 Max helps students to acquire a higher level of the following skills.

Personal Skills
Describing the ability to act in a self-organised way, to develop productive attitudes, values, motives and images, to utilise one's talents und motivation, to set oneself aims and to learn from experience made while working in the project.
- Conscious use of energy in every-day life
- Development of an energy saving user behaviour
- Development of personal attitude towards climate and energy issues
- To raise conviction and motivation for energy saving in fellow students and parents

Activity and implementation oriented Skills
Describing the holistically self-organised acting aiming at the implementation of targets and plans – either for oneself or for others und together with others, in a team, an enterprise or an organisation
- The founding, organising and running an energy and the acquisition of the necessary information
- The making of information posters and energy saving symbols
- The conduct and analyse an experiment independently

- Using scientific work forms independently (e.g. the making and analysing of the temperature survey)
- Using different measuring instruments
- Practical implementation of ideas to save energy developed by oneself

Subject-related methodical Skills

Students learn to act mentally and physically self-organised when solving subject-related problems. They solve problems creatively and assess facts and finding in a meaningful way using their knowledge and skills.

- Knowledge of physical quantities and chemical formulas
- Knowledge about energy saving electrical appliances
- Knowledge about green-house effect, climate change and climate Protection
- Learning technical basics about energy supply at school and at home
- Development of research strategies while looking for energy consumers
- Assessment and systematisation of energy consumption data
- Making tables using word and excel formats
- Creative presentation of subject related content

Social-communicative skills

They cover the self-organised communicative and cooperative acting, to grapple and cooperate with others in a creative way, to conduct in a group and relation oriented way and to develop new plans, tasks and aims.

- Presentation of the research results
- Public relations work at school
- The organisation of work processes during the project
- The organisation of events for the whole school

THE TEACHERS' GUIDE TO THE PROJECT DAYS

As described above, the 50/50 project can be supplemented with content from different subjects or even be integrated into the teaching of different subjects – and naturally we cannot describe them here due to the international character of the EURONET 50/50 Max project. The guide book at hand aims at giving you an easy to follow way to run the 50/50 project with the energy team. It is based on the experience of the Independent Institute for Environmental Issues (UfU) that has been running successful 50/50-projects since the early 1990-ies – as an external educator.

The UfU approach to 50/50 project focuses on independent work and capacity building in the participating students rather than teaching & lecturing by the teacher. Thus the teacher/educator is accompanying and helping as the students to go on their energy expedition and research opportunities to save energy. We encourage the students to do what they can on their own and to present their own work in front of the school public

We recommend integrating the project work in the regular school time as it is easier to assess the real energy use in the school when the building is in regular operation. Apart from this, the school public takes more notice of the project, when they see the energy team doing its work.

UfU usually works with a whole class as energy team, as this is easier to organise in school.

To carry out the project as described in this you need 5-6 "project days", with 90-120 minutes (without breaks) for the project activities, although the amount of time can differ depending how you integrate the project into the school, depending on how often you repeat the measuring and which means of communication you choose for telling the school public about the results of the project.

It is possible to concentrate the project on fewer days – but the project is more sustainable, if it is not carried out in just one or two consecutive days. UfU usually has one or two weeks in between the project days.

The following material consists of four units. Each unit consists of modules describing the project work with the energy team. In Unit 1 and 2, there is background information to support the teacher or educator.
All additional material, e.g. work sheets or experiment descriptions is mentioned in the descriptions of the module it belongs to. The name of these documents show where they belong to, e.g."Worksheet 1-2" means a worksheet belonging to Unit 1, Module 2. All additional material is attached at the end of this brochure in the order in which it is mentioned in the text of the units.

UNIT 1

UNIT 1: INTRODUCTION

TASK OF THIS UNIT:

The students learn or recall background knowledge on carbon cycle, green-house effect, climate change or climate protection and develop an attitude towards climate and energy related issues. As a long term target the students are to develop a sustainable use of energy resources and learn about individual opportunities to act.

PREPARATION:

- For experiment green-house effect: collect dark soil. If it is cold outside, do this on the previous day and store it in a warm place.

LEARNING TARGETS:

- The students know the chemical characteristics of the most important green-house gases, can explain the green-house effect and the effects of global warming for mankind and nature
- They discuss climate protection measures in different fields (politics, economy, technology, personal) and their effectivity.
- They can distinguish between power and energy and calculate with physical quantities
- They develop an idea about amounts of energy using practical examples and measuring

MODULE 1-1

SOURCES AND FORMS OF ENERGY

Activities and methods	Tool or Material
This module is used to start into the topic of energy saving. Talking with the students, ask for the different sources of energy. Note the sources of energy on the blackboard using different colours of chalk, sort them into fossil and renewable sources. Add the category “use of energy”, thus you can connect the source of energy and the use of energy, e.g. Oil => Warmth, Waterpower => electricity.	Image 1-1

MODULE 1-2

WHAT IS ENERGY? WHAT IS POWER?

Activities and methods	Tool or Material
After a short introduction about the difference between energy and power (see fact sheet for explanation), the students sort the different descriptions (written on paper) according to these two categories. After that they get cards with physical quantities in Watt or Kilowatt hours, which they have to match with a description. One group of students works on the category of energy, the other on power. The results are assessed using the answer sheet. You have to produce the pieces of paper beforehand. As a variant, the student can use the worksheet. The first step, the distinction between energy and power, is not done in this case. Finally, you can give the factsheet to the students and discuss it with them.	Worksheet 1-2 Fact sheet 1-2

MODULE 1-3

THE GREEN-HOUSE EFFECT

Activities and methods	Tool or Material
Using the image for the black board, you explain, how the natural green-house effect "works". You give a practical insight about the green-house effect using the experiment (fill a glass jar with soil, close it with cling film. Measure the temperature every five minutes, note down the results at the black board) or a model (balloon and scarf). Discuss with the students, which negative consequences the emission of more CO_2 has on the situation. Use the third image on I 1-3 to visualise this.	Image I 1-3, Experiment E 1-3 Glass jar with soil, Balloon with scarf

UNIT 1

MODULE 1-4

THE CO_2 CYCLE

Activities and methods	Tool or Material
What is CO2 and what effects does it have? At the blackboard, you collect examples, where CO2 is emitted and where CO2 is absorbed. Explain the CO2 cycle using the examples you collected (see teacher information) Use the guiding questions on image 1-3 to discuss the reasons for the higher concentration of CO2 and other green-house gases in the atmosphere. Do include the relation between the higher concentration and energy production/the consumption of resources. The students bring their own experience into the discussion.	Image 1-4
After this the students work in small groups using worksheet 1-4. Discuss the group results before gluing the arrows onto the base sheet	Worksheet 1-4

TEACHER INFORMATION – INTRODUCTION INTO THE TOPIC ENERGY SAVING AT SCHOOLS

MODULE 1-1

FORMS OF ENERGY

We distinguish between primary and secondary - or primary, final and useful energy. **Primary energy** refers to all resources from natural sources that are used to produce energy, e.g. fossil fuels (mineral oil, natural gas, coal, oil shale, tar sand), atomic fuels (Uranium, Thorium) and renewable energies (sun, wind, water, biomass, geothermics, tidal energy). Except geothermics, tidal power and atomic power, all sources of energy on the earth are of solar origin – they are stored energy of the sun. **Secondary energy** is the result of a transition process of primary energy. This includes coal products (coke, briquettes), mineral oil products (petrol, heating oil, and jet fuel), gas products (mains/city gas), electricity and district heating. **Final energy** is energy that is deployed by the consumer (secondary energy and primary energy). **Useful energy** is the energy really used by the consumer: warmth, light, electricity. In Germany, the useful energy is currently 1/3 of the deployed primary energy.

Forms of energy are mechanical energy (kinetic energy and rest energy), thermal energy, electric energy, chemical energy, atomic energy and electromagnetic energy.

MODULE 1-2

THE DISTINCTION BETWEEN ENERGY AND POWER

Usually, energy (E) is described as the capability of a physical body to do work. When this work is “done”, energy is transferred from one body to the other or one form of energy is converted into another form of energy.

Formula:	Energy
Units:	Joule (j)
	Kilowatt
Conversion:	1J = 1W

Formula:	Power P = Energy E / Time t (for E-constant), e.g. P = 6 kWh/3h = 2 kW
Units:	Joule per second (j/s), Watt
Conversion:	1W = 1 J/s

Power (P) is the work done at a certain moment. It describes the effort that is needed to achieve a certain effect.

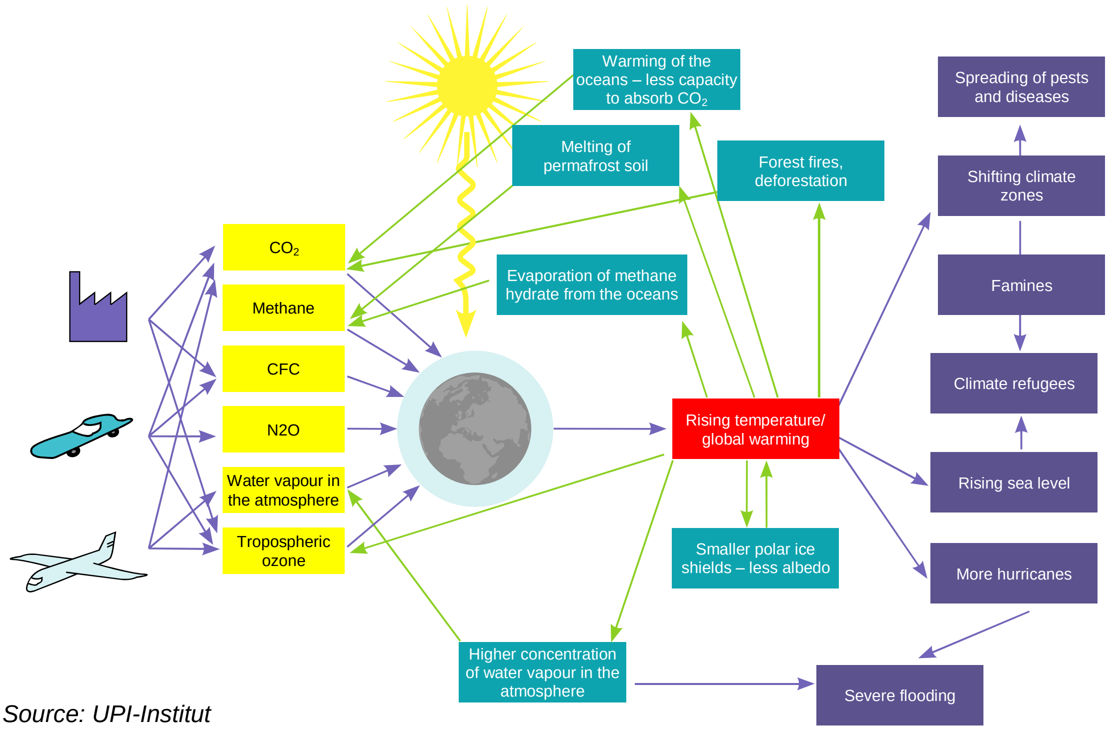
In a closed system, the amount of energy remains constant. That means energy does not get lost, but is transformed from one form of energy to the other. This **law of conservation of energy** is at the same time the first law of thermodynamics. However following the second law of thermodynamics, the user value of energy can degrade, as the different energy conversions are not of equal value. Kinetic energy can be completely converted into warmth. Thermal energy however cannot be completely converted into kinetic energy. If we speak about “the loss of energy”, we describe the unused energy in an energy conversion, e.g. the waste heat in an engine. The more effective the energy transition is (the lesser the energy used to gain a certain effect), the higher is the energy conversion efficiency resp. the lower the energy loss.

MODULE 1-3

THE GREENHOUSE EFFECT

The greenhouse gases are a natural part of our atmosphere and they are essential for life on earth. Apart from carbon dioxide CO_2, methane (CH_4), nitrous oxide or laughing gas (N_2O), chlorofluorocarbons (CFC), ozone (O_3) and water vapour (H_2O). The greenhouse gases act like the glass shell of a greenhouse. They let the short-wavelength solar radiation – the sunlight – through to the surface of the earth, where is partly converted into thermal radiation. The greenhouse gases absorb this long-wavelength radiation and prevent the disappearing of the heat energy into outer space. Without this natural greenhouse effect, the earth would be an ice-desert with an average temperature of -18 instead of +15°C. 2/3 of this difference of 33K is due to water vapour, 21 % to CO_2 and the remaining percentage to the other greenhouse gasses and aerosols. Even though the proportion of the greenhouse gases in the atmosphere is very small, they have a very strong influence on the climate due to their chemical and physical characteristics. When their concentration rises, the greenhouse effect gets stronger, which result in global and regional climate change. The emission of greenhouse gases due to human activity has increased by 70% during the last 35 years. The rising concentration of gases originating from energy production, mobility, industry, deforestation, agriculture etc. causes an unnatural warming of the atmosphere. We call this the man-made or anthropogenic greenhouse effect, which can only be stopped, if we reduce our greenhouse gas emissions drastically. With 64%, CO_2 plays the most important role in the anthropogenic greenhouse effect, followed by CH_4 with 20%, CFC with 10% and N_2O. O_3 is not emitted directly, but is a reaction product e.g. I the burning of fossil fuels. Condensation trails and nitrous oxides from planes also increase the greenhouse effect. The effect of water vapour is still very small, but is going to increase due higher evaporation due to global warming. Sulphur dioxide emissions have a contrary affect. They have a cooling effect, as aerosols containing sulphur particles block out some of the sun radiation.

Sources and effects of greenhouse gases



Source: UPI-Institut

MODULE 1-4

THE CO2 CYCLE

Carbon dioxide (CO2) is a colourless, non-combustible gas. With a concentration of 0,04% it is a natural component of the atmosphere. Below a temperature of -78,5°C it is solid as dry ice. It reacts with water to form carbonic acid. Carbon dioxide has natural and – to a lesser extend – anthropogenic sources. Carbon is stored in forests, oceans, soils and minerals as well as coal, natural gas and mineral oil. Some of it reacts with oxygen, e.g. when plants are rotting, during forest fires or volcano eruptions (geological carbon cycle). Large amounts of CO_2 are emitted by burning coal, gas and oil in power station, factories, in heating systems and engines.

The carbon cycle is one of the most important cycles in nature, it transport the carbon essential for life on earth between soil, water and air. This transportation happens mainly via CO2. All animals produce CO2. CO2 is absorbed by plants and converted to oxygen and carbon (photo synthesis): the oxygen is emitted into the atmosphere. The carbon is stored in the plant. Animals – including man – feed on the plants, burn it with oxygen and gain energy from this process – an emit CO2 – and the carbon cycle starts anew.

UNIT 2

UNIT 2: ENERGY AT THE SCHOOL

TASK OF THIS UNIT:

In the unit, the students become energy experts. They get to know the energy supply of the school, how the energy is distributed and where it is used. They analyse opportunities to save energy and develop energy saving concepts. They design energy saving tool for other users of the building and -if possible – become active themselves e.g. by sealing windows or insulation the attic.

PREPARATION

- Module 2-1 Energy tour: Make an appointment with the school caretaker for the energy tour to get access to and information about the energy system of the school including heating cellar and relevant rooms in the school
- Module 2-2: measurements, temperature profile and energy research: you need electricity meters, luxmeters and instant thermometers (best would be to have 4-6 of the latter two, to be able to work in small groups), make arrangements with the director and other teachers as measuring will take place in class time, make arrangements with the caretaker to get access to all relevant roomsModule 2-3: User behaviour: Get laminator, scissors, cardboard
- Module 2-4 Get the necessary material in cooperation with director and/or school administration

LEARNING TARGETS:

- The students know how to use energy in a sustainable way
- The students can use the different measuring instruments
- Students discuss the energy supply in their school, they learn about heating, the use of electricity and water. They know which source the energy comes from and how consumption data are obtained
- They learn to use scientific work methods: subject related research, collecting and analysing data, systematisation and classification of data (in form of tables), Assessment of results using set criteria etc.
- They analyse the energy use in specific room and compare the energy use in different rooms
- They present the results of their energy research in a meaningful and understandable way
- They find saving potentials and develop applicable Ideas to save energy
- They develop an understanding of how much CO2 and cost can be saved by energy saving measures at their school
- They go in for climate protection at their school by implementing their own proposals for energy saving and motivation other users of the school to act responsibly (this is a long-term aim).

MODULE 2-1

ENERGY TOUR

Activities and methods	Tool or Material
The students make the tour of their school building together with the caretaker. They visit the heating cellar, the teachers' room, some relevant class rooms, the school yard, the gym, the cafeteria. During or after the tour the students fill in worksheet 2-1. The data logger(s) –if available – are positioned to make a long term temperature measurement. Photographs are taken for later documentation of the activities. Finally, the students identify the issues they are going to find out and	Worksheet 2-1-1 Energy Tour Building, Worksheet 2-1-2 Energy Tour Heating, instant thermometer, camera, data logger(s) (if available) Checklist energy tour

MODULE 2-2

MAKING A TEMPERATURE PROFILE OF THE WHOLE SCHOOL

Activities and methods	Tool or Material
The measurement for the temperature profile is to take place in a relatively short time (one lesson time). So the students work in groups – to be able to measure the temperature in all parts of the school building at almost the same time. This means you need at least 15 students in your energy team. Get additional helpers is necessary. The measurement has to take place in the morning during class time. Apart from measuring the temperature, the students note down different problems: broken thermostat valves, open windows, ask the person present in the room about their subjective temperature sensation. Apart from the information gained about the temperatures in the different parts of the building, which can lead to the recommendation for hydronic balancing, the measuring makes the energy saving project known at the whole school. After the measuring tour, the data collected are assessed and energy saving proposal are developed. Distinguish between measures concerning everyday behaviour and thus have to be communicated in the school public, measures that the energy team can implement together with the caretaker or other experts and those that have to be implemented by the local administration. See to it that the assessment of the results is completed, even if the students do not do it, so that you can continue the project later, e.g. by doing practical work like the sealing of windows. Take photos for later documentation.	5-6 maps of the school, Worksheet 2-2, instant thermometers, camera, Checklist heating

UNIT 2

If you used data loggers, please collect the data form them and include them in the assessment. If you do not use data loggers or if you want to check the effectiveness of your saving recommendations, you can repeat this measuring module in sensible intervals.	

MODULE 2-3

MAKE AN ENERGY PASS FOR ALL ROOMS

Activities and methods	Tool or Material
The students create an "energy pass" for the rooms of the school using one copy of worksheet 2-3 for every room, To do that they research the specific characteristics of the room including Lighting, electrical consumers, the heating and warm water supply situation. After researching all rooms, they evaluate the situation in each room, compare it with other rooms and work out energy saving proposals.	5-6 maps of the school, worksheet 2-3, luxmeter, electricity meter, camera, Checklist Lighting and electrical consumers, behaviour

MODULE 2-4

CORRECT USER BEHAVIOUR

Activities and methods	Tool or Material
Discuss problems and ways of user behaviour regarding heating, airing, electricity and the use of thermostat valves you found in different parts of your schools during the previous steps of the project. What measures should the users of the building take to improve the situation – and what ways of behaviour should be changed. Note your results and find ways to communicate the proposals. As a visual reminder you can use the signs at Master Copy 2-4 or created your own. Develop a way to spread and explain them, e.g. as in Unit 3 Module 2	Master copy 2-4 - Tools to improve user behaviour

MODULE 2-5

IMPLEMENTATION OF SMALL PRACTICAL MEASURES

Activities and methods	Tool or Material
The implementation of the small practical measures is at the same time a qualification measure for the whole energy team (Teacher, students and caretaker). Therefore, they should be carried out and/or supervised by an engineer or person with equal qualification. Such small measures can be: • The sealing of windows with sealing strip • The insulation of attics or cellars • The exchange of inefficient lamps • The re-adjustment of the heating control system	

TEACHER INFORMATION – ENERGY AT THE SCHOOL

The most important measuring instruments for the energy tours are:

1. **Instant thermometers:** for measuring the temperature in all rooms to assess the situation and compare the target with the real temperatures
2. **Electricity (cost) meter:** to measure electricity use and/or cost.
3. **Luxmeter:** to measure the strength of the light
4. **Data logger:** is used for the long term temperature measurement to check, how the temperatures are at night, during weekends and holidays.

You can ask the school administration, the facility manager and - in case of a EURONET 50/50 Max project – your local project partner to help you find these instrument.

CORRECT USER BEHAVIOUR

Heating

- To enjoy tropical temperatures in the class room in winter time does not just make the students tired, but can be really expensive. Every degree less saves 6% of the heating energy. The best temperature in class rooms is 20°C. In other rooms, corridors, on staircases and the gym it can be even less. The easiest way to regulate the room temperature is to use thermostat valves. The middle position guarantees 20°C. If the scale of the thermostat valve has 5 steps, there are 2 degrees between each step – so see to it that the valve is operated correctly. When opening the window to air the room, switch off the heating – especially the radiator below the window you are about to open.
- Is it very warm in the heating cellar? Probably the heating and hot water pipes are not insulated. So the cellar is heated very well, rather than the school. This is not just a nuisance, but it can even be violating by-laws in your country. You can improve this situation easily together with the energy team. Insulation material is easy to get, maybe the school administration can help you
- Your radiators are making strange noises? In most cases, the de-airing of the radiators will help. However, if there are radiators which do not heat up even though the thermostat valve is open, this is a case for an expert. The so-called hydronic balancing makes sure that every radiator gets the necessary amount of hot water. Precondition for the balancing is that you have adjustable thermostat valves. A well-regulated heating system saves up to twenty percent heating energy, so the visit of the expert pays off quickly
- Is the heating of your school working full power all the time? At the weekend, during the holiday and at night, when there is nobody at the school, the temperature can be lower considerably. Modern heating systems are easy to regulate and the running time of the heating can be adjusted to the school time.

Airing

- Tilted windows don't provide fresh air, but are just cooling the wall. Correct airing saves a lot of energy and is good for everybody's health. Too little humidity dries out everybody's throats and too much humidity – especially if the wall is cold – causes black mould. So in winter time, it is highly recommended to air the room by opening the window wide for a few minutes several times a day.
- You are sitting in a heated class room, but you are freezing nevertheless? Using a burning candle or something similar, you can check whether this is due to a draught. Use sealing foam or tape to close slits – but don't forget to air the room regularly nevertheless.

Electricity

- Pay attention to adequate lighting of the rooms. If the light switches are marked, it is easier to switch on just the lights that are needed. During the breaks, the lights can be switched off completely. Even with modern energy efficient lamps, it is worthwhile to switch them off.
- Electric appliances on stand-by use energy. Make it a point to switch everything off properly. Some computers use energy even when they are switched off. Switchable sockets help.

Thermostat valves

Thermostat valves are a local regulating element for the temperature in the room. They contain a temperature sensor that opens and closes the valves depending on the surrounding temperature. Most thermostat valves have a frost protection marking"*". At this position, the heating will come up when the surrounding temperature is down to +6°C. If the thermostat valves stand in the middle position, most commonly on 3, the temperature will reach 20°C. If the sun is shining into the room or a large number of people heat up the room, the thermostat valves detects the higher temperature and closes the hot water influx. If the temperature sinks, the valve opens again. Putting the thermostat valve up or down one digit, the temperature changes by 2 degrees.

MODULE 2-1

CHECKLIST ENERGY TOUR – BUILDING

During the energy tour, you can use this list to draw attention to issues related to energy consumption.

Issue	Questions
Lighting in the outdoor area	Does the outdoor area of the school (parking area, yard, paths, entrance) artificial lighting? Who does it get switched on for in the evening>? Are there timers and movement detectors?
Lighting in rooms and corridors	Is it too bright or too dark? Is there artificial lighting? Are lights on in unused rooms? Are there lamps that are obviously unnecessary? Can the light bands in the class room be switched on and off individually? Are there old lamps that should be exchanged with more efficient ones?
Thermal insulation	Is the building insulated? Is the unheated cellar insulated? Are the heating pipes insulated? And how about the attic? Are there places, where an additional insulation would be useful?
The radiators	Radiators not working properly waste energy. A broken thermostat valve is automatically geared to the highest temperature. Can radiators be regulated individually or is there a centralised control system?

Windows	During the heating period, windows that are permanently open or tilted are an indicator for incorrect airing behaviour. Often they are also an indicator for over-heated rooms and thus for a badly regulated or managed heating
Window glass, missing sealing and other causes for cold draughts	Cold draughts cause unnecessary loss of heating energy that have to be made up by the heating system. Applying sealing tape can have big effects at low cost.
Warm water consumption	For what type of warm water supply was the warm water system built and how high is real consumption? Are there hand sink, where the warm water supply is not necessary? Are there water saving taps? School kitchen and the cafeteria can be places where warm water is wasted, too.

Target temperatures	
Class rooms	**20°C**
Corridors	**16-18°C**
Staircases	**14-17°C**

MODULE 2-2

MAKING A TEMPERATURE PROFILE OF THE WHOLE SCHOOL

Issue	**Questions**
The temperature in the rooms	Is it too warm or too cold? Compare the temperatures in the different rooms of the school with the target temperatures. This analysis can show problems in the management of the heating system that go along with high energy losses. Are there any rooms heated that are rarely used (cellar, storage rooms, disused classrooms)

For visualising the temperature profile you should use a map of the school. The students insert the temperatures they measured using different colours.

Colour code:

Too cold	real temperature written in blue
Okay	real temperature written in green
Too hot	real temperature written in red

Target values for lighting:
300 lux on work places in regular class rooms
500 lux on work places in specialised class rooms
100 lux in secondary rooms

MODULE 2-3

CHECKLIST ENERGY RESEARCH AT SCHOOL

Issue	Questions
Lighting in rooms and corridors	Is it too bright or too dark? Is there artificial lighting? Are lights on in unused rooms? Are there lamps that are obviously unnecessary? Can the light bands in the class room be switched on and off individually? Are there old lamps that should be exchanged with more efficient ones?
Warm water consumption	Are there hand sink, where the warm water supply is not necessary? Are there water saving taps?
The temperature in the rooms	Is it too warm or too cold? Compare the temperatures in the different rooms of the school with the target temperatures. This analysis can show problems in the management of the heating system that go along with high energy losses. Are there any rooms heated that are rarely used (cellar, storage rooms, disused classrooms)
The radiators	Radiators not working properly waste energy. A broken thermostat valve is automatically geared to the highest temperature. Can radiators be regulated individually or is there a centralised control system?
Major electricity consumers	Are there fridges, drinks vending machines, water boilers, airing systems, pottery stoves anywhere in the school? Are the obviously unnecessary consumers? When and how often/for how long are these consumers used? Are the temperatures of water heaters and fridges
Stand by and similar silent consumers	Are there any electricity consumers that are on stand-by or that draw energy even though they are completely switched off (often the case in appliances with transformers - check these for heat

IT and modern teaching equipment	Check the computer rooms of your school. Are there computers switched on or on stand-by even though they are not used? Does your school have smart boards? How long are they switched on and how much of that time are they really used?

UNIT 3: PUBLIC RELATIONS WORK AT THE SCHOOL

TASKS WITHIN THIS UNIT

To make an energy saving project a success, it is essential to inform and motivate all users of the building to take part. This unit is dealing with public relations work at the school, which is vital part of any energy saving project including EURONET 50/50 Max projects.

PREPARATION

- Module 3-1 Posters: large paper, pens, scissors, glue and other material
- Module 3-3 Energy saving market: negotiating with director and caretaker about the date and the extent of the market. You can organise that energy advisers and suppliers of renewable energies to take part or find sponsors who provide energy efficient lamps in exchange for old-fashioned ones.

LEARNING TARGETS:

- The students present the results of their energy research and other project steps in a meaningful and understandable way
- They develop energy saving ideas and visualise them
- The organise an school event to publish their findings
- They document the results of the energy research in an understandable way on posters; they develop speeches and presentation on this topic.

MODULE 3-1

POSTERS

Activities and methods	Tool or Material
The students document the results of their work on posters. They are to be presented at a very populated spot at the school in order to reach the wider school public The drafting, design and finalising of posters and different means of communication often takes two project days to get satisfactory results	Large size Coloured paper and cardboard, photographs from the project, pens,, glue

MODULE 3-2

PRESENTING PROJECT RESULTS

Activities and methods	Tool or Material
The students make another tour around the school giving speeches about their project activities as energy team. At the same time they can hand out the material for energy saving produced in Unit 2.	Material promoting behaviour change from Unit 2, Notepaper for the speeches

MODULE 3-3

ENERGY SAVING MARKET

Activities and methods	Tool or Material
The students plan an energy market, where they will present the results of their work in the energy saving project. The find the place where and when the market is supposed to take place: during break-time or at a project day. Why not present the project results at a public market in the vicinity of the school? The students define and distribute preparation task. The students do the organisation work themselves – either in their spare time or during project time.	

MODULE 3-4

PRESS WORK - INTERNET AND SCHOOL NEWSPAPER

Activities and methods	Tool or Material
The results of the project work are presented at the schools' website or in the school newspaper. Apart from energy saving proposals, photos and other documentation of the project work are presented. This is a way to document project results over the course of several years and to reach people who have not yet been involved in the project.	

UNIT 4: SUPPLEMENTARY MATERIAL FOR TRANSDISCIPLINARY TEACHING

MODULE 4-1

SPEECHES

Activities and methods	Tool or Material
By preparing speeches on their own, in small teams or larger groups, the students compile transdisciplinary knowledge on their own. They present their speeches in front of the class and prepare a hand-out with the most important content. The students are encouraged to design their speeches in an easily understandable way with photographs, tables and graphics. An additional task could be to prepare a poster that can be displayed at the school afterward. The timeframe for the preparation should be agreed at the beginning. The list of topics for the speeches is designed in a way that the topics in front and on the back side of the card; there are hints about sub-topics to speak about.	List of topics 4-1 Internet, printer, photos, posters

MODULE 4-2

GAME

Activities and methods	Tool or Material
With the help of the charts from the list of speeches, The students develop a game on energy saving. They have the task to formulate a certain number of bullet points for every subject given on the back of the speech-cards and note them down of fresh cards. Now they have to obtain a game board (like for Ludo), playing figures, dices etc. Then, in accordance with rules they set for themselves, they can create the game. They can work in groups, with one group formulating questions and answers, the other designing the game. If the energy team is very large, you can create a number of games and sets of questions and answers und exchange them between the groups, so that everybody has a new game he/she does not know.	List of topics 4-1 Material for the game boards, figure, paper

UNIT 4

MODULE 4-3

INTERVIEWS ON ENERGY SAVING AND CLIMATE PROTECTION

Activities and methods

The students make interviews on Energy and climate issues outside their school. They develop a questionnaire before setting out. The interviews are conducted in teams of three (one interviews, one speaks to the passers-by, one documents the answers.

The results of the interviews are presented in class, the main issues raised are noted down. As a result you can define issues for further action inside and outside school

Tool or Material

Notepad, maybe camera, black board

IMAGE 1-1

SOURCES AND USE OF ENERGY

You can approach the topic using the following questions:
Energy and energy saving – Why is it necessary to save energy?
Possible answers: to save money, protect the climate, to stop greenhouse effect,…

What sources does our energy come from? How do we use energy?

Primary Energy		**Final Energy**
Fossil Sources of Energy	Renewable sources of energy	Useful energy
Gas	Water	warmth (heating)
Coal (and lignite)	Sun	electricity (TV, mobile phone, light…)
Mineral oil	Wind	Mobility (car, walking…)
Nuclear source of energy Atomic Energy	Biomass (wood, plants)	

> First write the examples given by the pupils on the blackboard forming the three columns. Put the headings on top and discuss what they mean. When atomic power in mentioned, put it separate, as it is neither a fossil nor a renewable energy.

Renewable: Sources of energy, which are not finite, which are always available or grow again.

Fossil: Fossil fuels are of ancient origin like fossils (petrified plant or animals), but they originated from dead plants that came under high pressure. They contain the carbon that was stored by the plants before they died. They are not renewable. Carbon contains energy that is mobilised by burning (oxidation).

Bridge to the following issue: Greenhouse effect:
What do you need to burn carbon, e.g. for heating? If there is no answer: What happens when you put a glass over a burning candle? What is missing? - Answer: Oxygen (Air)

C + O_2 = CO_2
Carbon + Oxygen = carbon dioxide

> *Probably everybody has heard about carbon dioxide. It is one of the so-called greenhouse gases and most responsible for the anthropogenic greenhouse effect. It is formed whenever something containing carbon is burned. In this process, energy is released.*

WORKSHEET 1-2

ENERGY AND POWER

Energy (E) is described as the capability of a physical body to do work. When this work is "done", energy is transferred from one body to the other or one form of energy is converted into another form of energy. Thus Energy is work done/power used over a certain time.

Formula: Energy E=Power P x Time t, e.g. E= 2kW x 3h = 6 kWh
Units: Joule (j), Kilojoule (kJ), Watt second (Ws), Watt hour (Wh), Kilowatt hour (kWh)
Conversion: 1J = 1Ws, 1 kWh = 3600 kJ

Power (P) is the work done at a certain moment. It describes the effort that is needed to achieve a certain effect.

Formula: Power P = Energy E/Time t (for E-constant), e.g. P = 6 kWh/3h = 2 kW
Units: Joule per second (j/s), Watt
Conversion: 1W = 1 J/s

TASK:
What activity needs how many Watt (W) power? What consumes resp. produces how many Watt hours (Wh) energy? Please connect the activities and physical units using arrows and transform the Watt- resp. Watt hours into the units given in the right columns.

POWER

High speed train		20 W	kW
Computer (PC)		200 W	kW
20 m2 solar cells		2.000 W	kW
Sleeping baby		20.000 W	kW
Large combined heat and power unit		200.000 W	kW
Gas turbine power plant		2.000.000 W	MW
Domestic water heater		20.000.000 W	MW
Wind power plant		200.000.000 W	MW

ENERGY

600 km car trip		20 Wh	kWh

Watching TV for 10 minutes		200 Wh	kWh
Human turnover per day		2.000 Wh	kWh
Daily sun radiation on a soccer stadium		20.000 Wh	kWh
7 coal briquettes		200.000 Wh	kWh
Content of 40 oil tanks		2.000.000 Wh	MWh
2500 km plane trip		20.000.000 Wh	MWh
Solar power unit per year		200.000.000 Wh	MWh
Old fashioned light bulb in 2 hours		2.000.000.000 Wh	GWh

WORKSHEET SOLUTIONS 1-2

ENERGY AND POWER

POWER

Sleeping baby	20 W	0,02 kW
Computer (PC)	200 W	0,2 kW
20 m2 solar cells	2.000 W	2 kW
Domestic water heater	20.000 W	20 kW
Wind power plant	200.000 W	200 kW
Large combined heat and power unit	2.000.000 W	2 MW
High speed train	20.000.000 W	20 MW
Gas turbine power plant	200.000.000 W	200 MW

ENERGY

Watching TV for 10 minutes	20 Wh	0,02 kWh
Old fashioned light bulb in 2 hours	200 Wh	0,2 kWh
Human turnover per day	2.000 Wh	2 kWh
7 coal briquettes	20.000 Wh	20 kWh
600 km car trip	200.000 Wh	200 kWh
Solar power unit per year	2.000.000 Wh	2 MWh
Daily sun radiation on a soccer stadium	20.000.000 Wh	20 MWh
2500 km plane trip - Ankara	200.000.000 Wh	200 MWh
Content of 40 oil tanks	2.000.000.000 Wh	2 GWh

ENERGY AND POWER

HOW TO DISTINGUISH BETWEEN ENERGY AND POWER

Power can be measured at any time, whereas energy is measured over a defined rime span, e.g. a second, an hour or a year.

How to imagine 1 kWh?
Some examples, what we could achieve with 1 kWh if there is no energy loss.

We need 1 kWh to:

- Lift a body with the mass of one ton 367 m
- Heat 9,5 l of water from 10°C to boiling temperature
- Fill a 30 l compressed air tank with air up to a pressure of 200 bar
- Accelerate a body with the mass of one ton from 0 auf 85 m/s (= 305 km/h)

What contains 1 kWh of energy (rough figure)?

- 1 fully charged large battery for a diesel-car (85 Ah)
- 0,1 l petrol or diesel
- 0,25 kg fire wood
- 0,13 kg black coal
- 0,12 m^3 natural gas

Different levels of energy conversion efficiency

Depending on the level of energy conversion efficiency, a different amount of primary energy has to be deployed to achieve 1 kWh of useful energy. Here are some examples of the different levels of energy conversion efficiency:

- Production of heating energy: 90-100 %
- car engines: 20-45 %
- Big water turbines: up to >90 %
- waterwheels: 70 %
- human muscles: 10-20 %
- electric engines: 70-90 %
- incandescent lamps (no longer used): 5 %
- energy saving bulbs: 15 %
- coal fires power station: ca. 45 %
- atomic power station: ca. 40 %
- combined heat and power unit: 80-90 %
- solar cells: 10-18 %

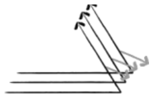
Energy conversion efficiency

The energy conversion efficiency describes the relation between the deployed and the used energy. It gives the percentage of the deployed energy actually used after the energy conversion. E.g. candescent lamps use just 5% of the deployed energy. The remaining 95% are emitted as warmth.

IMAGE 1-3

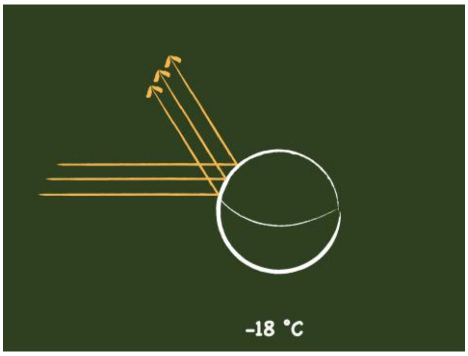
THE GREEN HOUSE EFFECT

sunlight + reflections



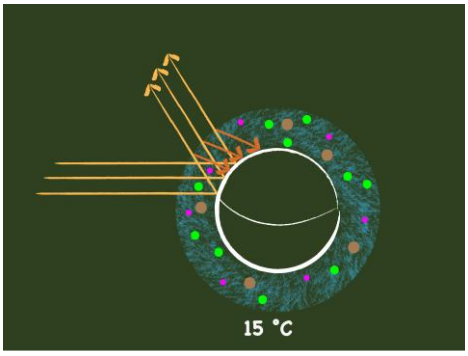
earth + equator

atmosphere +
gas molecules



Top: the earth without an atmosphere. The average temperature would be -18°C – thus no life would be possible. The sunlight hits the surface of the earth – it is transformed into thermal energy. The thermal energy is reflected into outer space.

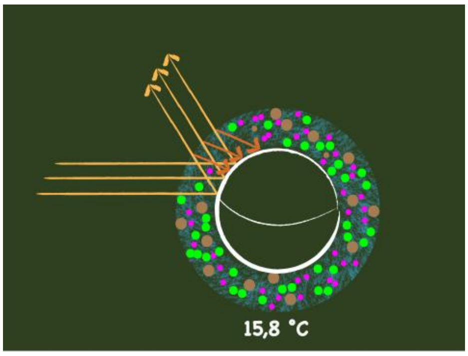
(Some of the incoming light is reflected back into space straightaway as light, in order to keep the drawing simple, this is not depicted here)



Centre: You draw an atmosphere around the second globe. You write “atmosphere” – as the word is not common to all.

You make a few dots into the atmosphere to symbolise the gas molecules. Name some gases – e.g. oxygen, carbon dioxide (draw them in different colours). Mention that there are more.

Sunlight hits the surface after passing the atmosphere and is transformed into thermal energy. Some of the thermal energy is reflected into outer space, some is kept inside the atmosphere by the green house gases, e.g. carbon dioxide. Due to the composition of the atmosphere (concentration of greenhouse gases), the average temperature on earth one hundred years ago was +15°C.
Explain what average means in this case.



Bottom: Make considerably more dots in the atmosphere of the third globe. They symbolise the increased CO2-emission due to human activity: By burning fossil fuels, which contain carbon, we are emitting CO2 into the atmosphere. As a result, the atmosphere becomes less permeable for thermal energy and thus stores more thermal energy. That is why the average temperature on earth is rising. During the last one hundred years, the average temperature rose to +15,4°C. We call this global warming and it causes climate change.

Guiding question for the discussion about greenhouse gases and greenhouse effect:

- What are the reasons for the increased concentration of greenhouse gases in the atmosphere
- How long do the greenhouse gases stay in the atmosphere? How are they reduced?
- What is the relation between greenhouse effect and energy use?
- What are the reasons for the higher energy consumption worldwide?
- How much energy do we need?
- What energy resources are there in the world? How are they used? What is the geographic distribution of energy resources?

EXPERIMENT 1-3

EXPERIENCE GREEN HOUSE EFFECT

In addition to the explanation about the greenhouse effect at the Blackboard with the images given in appendix 1.1 the following experiment can be used to help the students explore the transformation of light energy to heat energy and the green house effect.

You need:

- a large empty glass jar
- a thermometer
- transparent film
- some dark soil

Setting up the experiment:

- put the soil into the jar
- cover the jar with the transparent film
- put the jar onto the window sill, if the sun is shining or put jar under a lamp
- measure the temperature in the jar every five minutes
- record the results
- develop a way to visualise the results

THIS EXPERIMENT CAN BE DONE BY GROUPS OF STUDENTS
OR IN FRONT OF THE WHOLE CLASS.

Possible variations:

- take a second jar put white paper at the bottom and proceed in the same way as with the other jar. The white paper reflects a larger part of the light, the temperature will stay lower
- take a second jar with dark soil, but don't cover the jar. Proceed in the same way as with the other jar. This would show a much smaller greenhouse effect.

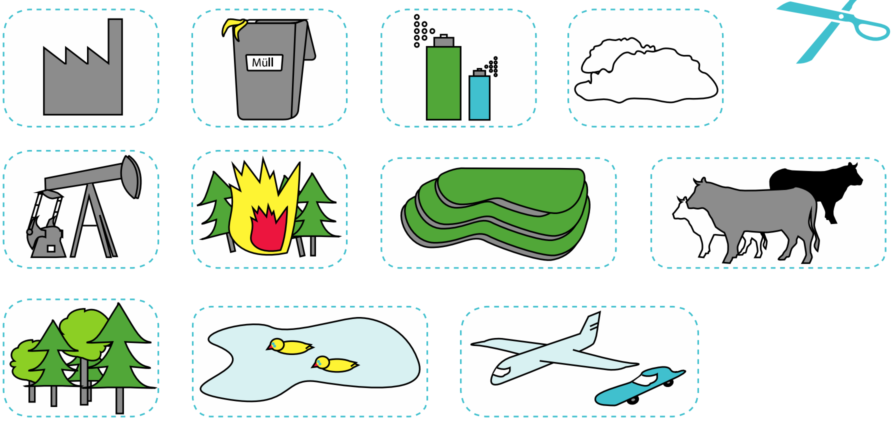
WORKSHEET 1-4

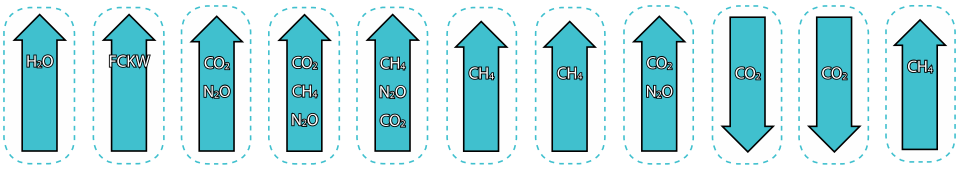
GREENHOUSE GASES AND THEIR EFFECTS

TASK FOR GROUP WORK:

Make a chart on the effects of the greenhouse gases

1. Cut out the pictures, text boxes and arrows
2. Glue the pictures with the correct text boxes onto the globe
3. Put the arrows in the correct place, pay attention to the direction of the arrows (upwards: emission of… , downwards absorption of…)
4. Check your results using the solution sheet. Then glue the arrows to the graph.





Forest

Cattle breeding

Slash and burn land clearance

Increasing evaporation of water

Power plants and industry

Garbage

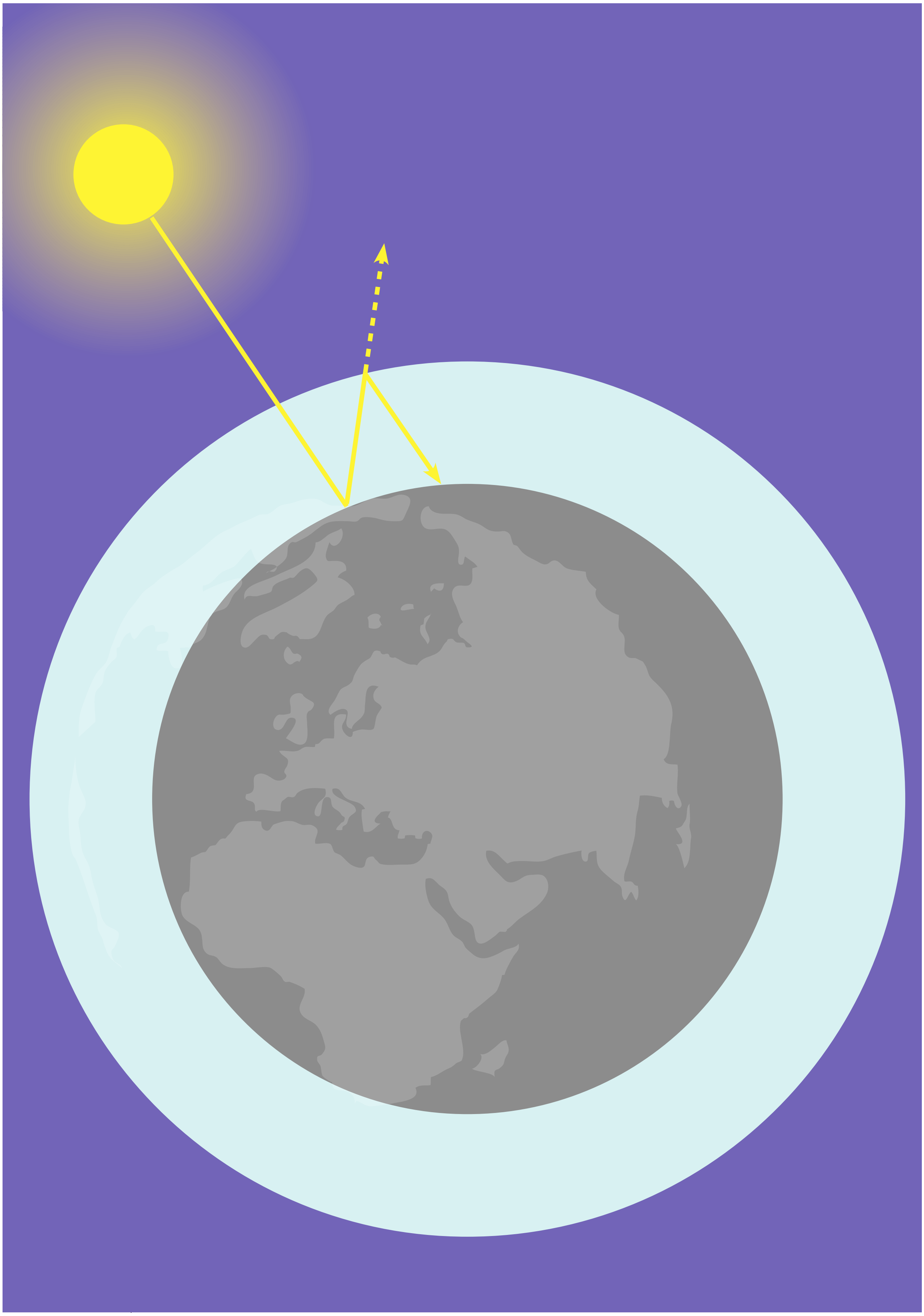
Chemical industry

Water rice cultivation

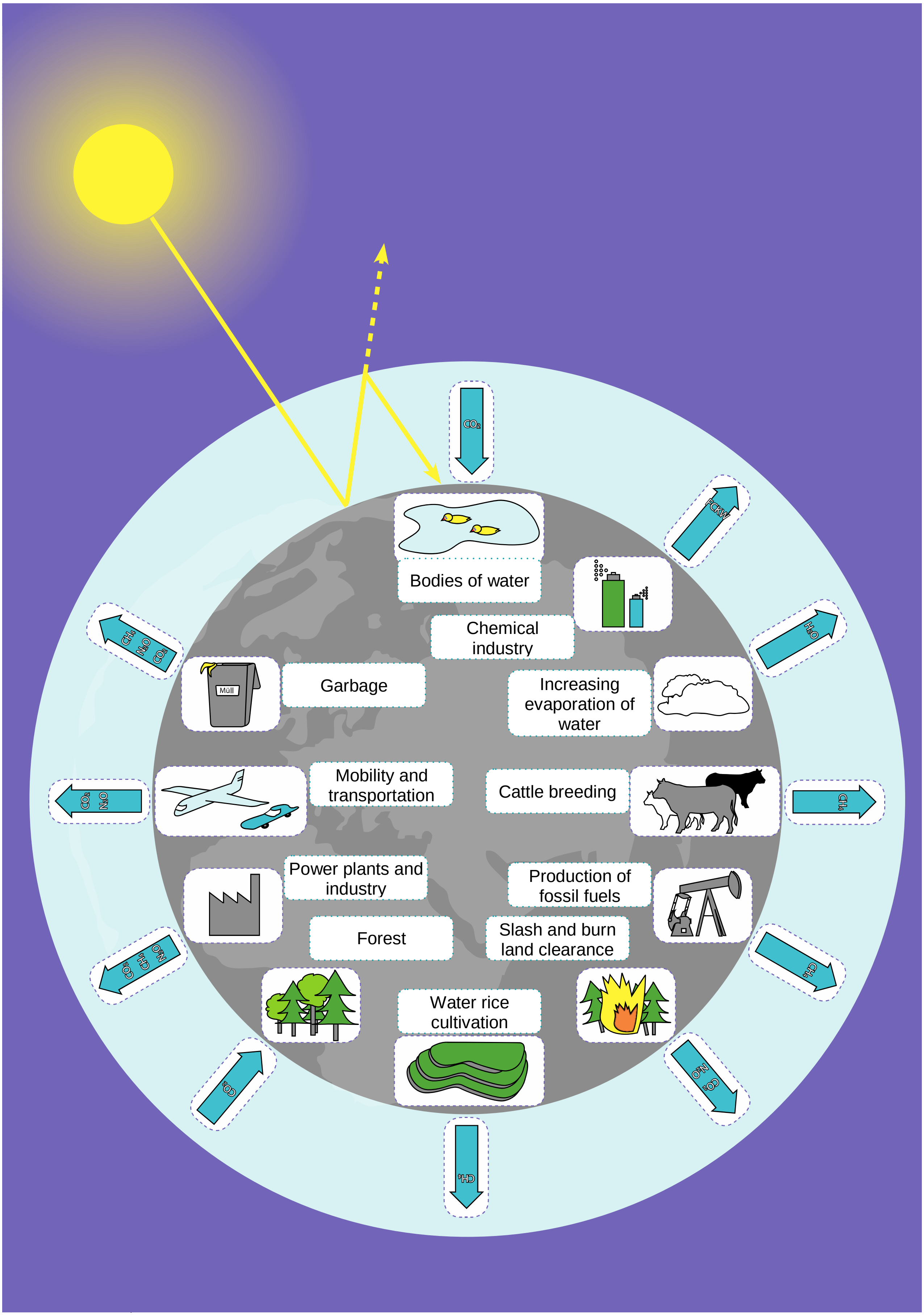
Bodies of water

Production of fossil fuels

Mobility and transportation



GREENHOUSE GASES AND THEIR EFFECTS



WORKSHEET 2-1-1

ENERGY TOUR BUILDING

ENERGY TOUR INFORMATION ABOUT THE SCHOOL BUILDING

TASK:
Draw an outline of your school.
Encircle the heated part of your school with a red pen
and the unheated part with a blue pen.

General Information:	**Day:**					
	Outside temperature (°C):					
Information about **the building:**	**In which year was the school built?**					
	Floor space (m²):					
	Heated Floor Space (m²):					
Cellar:	Is the cellar heated?	Yes			No	
	Is the cellar ceiling insulated?	Yes		cm	No	
Attic:	Does the school have an attic?	Yes			No	
	Is the attic used/heated?	Yes			No	
	Is the attic insulated?	Yes			No	
Outside insulation:	Is the school building insulated?	Yes		cm	No	
Outside lighting:	There are ___ lamps.	___ of them are switched on.				
Windows:	There are ___ windows.	___ of them are open				
		___ of them are tilted/half open.				
Doors:	There are ___ door.	___ of them close automatically and				
		___ have to be closed by hand.				
		___ Doors don't close properly				
Water:	Is the rainwater collected?	Yes			No	
	Is the rainwater used in the school area?	Yes			No	

ENERGY TOUR HEATING

ENERGY TOUR INFORMATION ABOUT THE HEATING

Yearly consumption of heating energy: kWh

Heating control system:

The heating system can be regulated can be regulated and in run as follows:

Regular School Days:

Heating is on from to

Target temperature for classrooms: °C

Saving option for weekends:

Heating is on from to

There is no saving option for weekends.

Target temperature for saving option: °C

Saving option for school holidays:

Heating is on from to

There is no saving option for school holidays.

The heating pipes in the cellar are insulated not insulated.

UNIT 2: WORKSHEET 2-1-2

How is warm water generated?

- [ ] centrally with the school heating
- [ ] in the classrooms with electrical boilers
- [ ] with a solar thermal system

Where does the electricity come from?

- [ ] photovoltaic system
- [ ] combined heat and power unit using ______________ (wood, plant oil, biogas, natural gas, oil,…)
- [ ] public grid
- [ ] green electricity from a supplier using renewable energy sources

Current meter reading: ______________

Annual electricity consumption: ______________

Energy output of photovoltaic system ______________

WORKSHEET 2-2

TEMPERATURE PROFILE OF THE SCHOOL

TASK:

Not all rooms in the school have the same temperature. There can be different reasons for these temperature differences. To find out whether and where it is too warm in your school, you have to measure the temperature in every room. Additionally, you should ask the persons present in the room how they feel about the temperature in the room. If the room is empty, ask yourself.

For making the temperature profile of the school you need:

- a map of the school
- instant thermometers

Target Temperatures

20°C	in classrooms
15-18°C	in other rooms and the gym
14-17°C	on stairs and in corridors

Example: 22°C –Too warm

The sheet for minute taking reads like this:

Date		Minute taker:	
Class		Outside Temperature:	

Room no.	Temperature	Thermostat valve Adjusted to			Open Windows	User survey		
						Too warm	Too cold	Okay

ENERGY RESEARCH AND ENERGY PASS

TASK:

Research the energy situation in the room and find out, where you can save energy. For the measuring, you need a luxmeter (for measuring the light), an instant thermometer and an electricity meter, that you can plug in between the electrical appliance and the socket.

You will research the aspects lighting, electricity use, room temperature and Warm water consumption, thus all energy related aspects of a number of rooms. Therefore – after assessing the situation in all these rooms you are asked to evaluate the energy performance of this room in comparison to other room in the school. This is a kind of energy –passport you are making for the room.

Room no.:

Target values for lighting:
300 lux on work places in regular class rooms
500 lux on work places in specialised class rooms
100 lux in secondary rooms

Light

Side of the room	Number of lamps	Strength of light (in lux)	Personal assessment (too dark, too warm, okay)	Opportunity to switch the lights individually (yes/no)	Energy saving proposals
Window					
Wall					
Front					

Electricity use

Electrical appliance	Quantity/number	Power in Watt	State (standby/on/off)	Energy saving proposals

Target temperatures

Class rooms	**20°C**
Corridors	**16-18°C**
Staircases	**14-17°C**

Room temperature

	Real temperature	Target temperature	Thermostat valves adjustable yes/no	Subjective assessment of temperature Too war, too cold, okay
Temperature				
Energy saving proposals				

Airing habits

	Quantity/ number	How many open	How many tilted	Airing habits (e.g. always tilted, wide open for short time, never airing at all)
Windows				
Energy saving proposals				

Warm water supply

The room get warm water from

- Solarthermic element
- Boiler
- Tankless heater
- Central warm water supply
- No warm water

Circulation: in a central hot water supply, the warm water is circulated in the using a pump in order to get warm water from the tap instantly. This is necessary for some rooms, but it uses additional electric energy

How is warm water used in this room (for washing one's hands, cleaning, experiments…)?	If there is central hot water supply, is it with or without circulation?	Is hot water really needed in this room?	Energy saving proposals

Evaluation

In comparison with other room at our school this room is evaluated as follows:

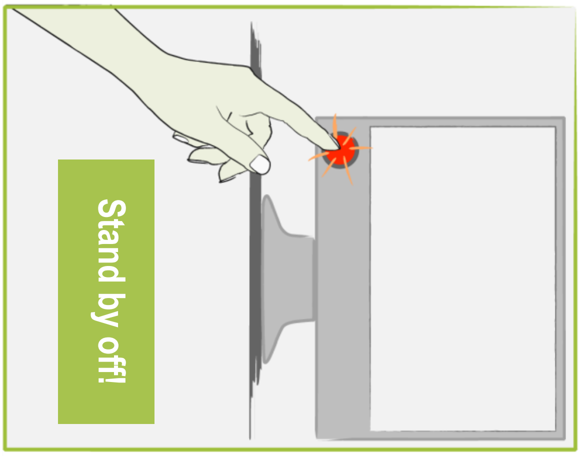
A	B	C	D	E
Low energy consumption				**High energy consumption**

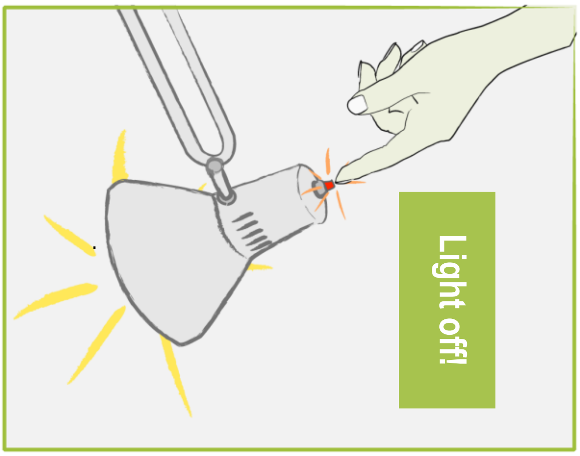
UNIT 2: MASTERCOPY 2-4

OPEN
THE WINDOW PROPERLY

... and switch off
the heating
before
you open the window.

BETTER:
Open the window WIDE
for a SHORT TIME,
THAN having it HALF OPEN
for a long time.



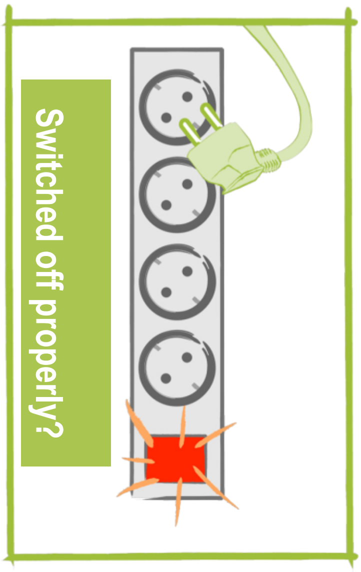


N.B.: you have to check what is available in your

Wall

Black Board

Window



Not more than 3 –
Otherwise
It gets too warm

TOPICS FOR SPEECHES

Topic	Possible content and sources of more information
Fossil Energy	• Coal, natural gas, mineral oil • Energy supply in your country • Energy resources in your country • Worldwide energy resources • Combined heat and power units *Printed material in your country* *Websites/other contacts in your country*
Renewable Energy	• Solar energy • Wind energy • Biomass *Printed material in your country* *Websites/other contacts in your country*
Embodied energy	• Energy in production of raw materials • Energy in production • Energy in transportation • Useful energy • Energy in waste and recycling *Printed material in your country* *Websites/other contacts in your country*
Ecological footprint	*Printed material in your country* *Websites/other contacts in your country*
Equity (responsibility towards following generations, other countries, other groups of society)	• Equity in the field of climate and resources • Intergenerational equity • Intragenerational equity *Printed material in your country* *Websites/other contacts in your country*
Sustainable Development	• Sustainable development • UN-Conference in Rio de Janeiro in 1992 • The Brundtland Report • Sustainably forestry • The triple bottom line of sustainability *Printed material in your country* *Websites/other contacts in your country*
Sustainable consumption	• Fair trade • The triple bottom line of sustainability *Printed material in your country* *Websites/other contacts in your country*
Combined heat and power generation	• Energy efficiency • Energy efficiency concepts

UNIT 4: LIST OF TOPICS 4-1

	Comparison combined heat and power generation – traditional power generation Advantages of combined heat and power generation *Printed material in your country* *Websites/other contacts in your country* *Practical examples in your country*
Energy consumption per capita	Per capita consumption in your country in comparison with other countries Consumption of primary energy CO2-emission per capita *Printed material in your country* *Websites/other contacts in your country*
Energy saving at home	Energy consumption of private households Energy saving potentials in private households Consumption of heating energy Consumption of electricity *Printed material in your country* *Websites/other contacts in your country*
International climate protection aims	United Nations Framework Convention on Climate Change The Kyoto Protocol Club of Rome The EU Green Paper "A 2030 framework for climate and energy policies" UN conference on Environment and Development, Rio de Janeiro *Printed material in your country* *Websites/other contacts in your country*
National climate protection aims	Climate protection aims of your country CO2 reduction aims of your country Climate protection aims for our school *Printed material in your country* *Websites/other contacts in your country*
Zero Emission School – reduce energy consumption!	Mobility of teachers and students Energy consumption at our school Energy saving and energy efficiency at our school Use of renewable energy at our school Waste management at our school Development of a zero emission scenario for our school Printed material in your country Websites/other contacts in your country
Place for specific topics of yours!	*Place for specific topics of yours!*

For further information please contact:
Unabhängiges Institut für Umweltfragen (UfU) e.V.
Independent Institute for Environmental Issues (UfU)
Greifswalder Str.4
10405 Berlin
www.ufu.de
almuth.tharan@ufu.de

Project Website: www.euronet50-50max.eu
50/50 Network website: www.euronet50-50max.eu/en/area-for-schools
Coordinator contact address: euronet@diba.cat

Co-funded by the Intelligent Energy Europe
Programme of the European Union