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LEARNING UNIT 4

HOUSING

AGE GROUP 2 (14-18 YEARS)

PART B ADDITIONAL CONTENT*

Version 2.0, Aug. 2020

This material is part of a course on the Ecological Footprint for students. The course consists of the following modules for two age groups:

Age group 1 10-13 years	Age group 2 14-18 years
Calculator	
General Introduction	General Introduction
Mini Hectare Workshop	Mini Hectare Workshop
Nutrition	Nutrition
Housing	A. Housing core B. Housing additional
Mobility	Mobility
Other Consumption	Other Consumption
Background information	

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calculator.e-co-foot.eu is an online tool, where students can log their daily activities and trace the Ecological Footprint of their habits. **elearning.e-co-foot.eu** is an e-learning with similar content as these lectures.
All the material can be downloaded for free at **www.e-co-foot.eu** in different languages.

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***Important notice!**

Learning Unit 4 has the following structure:

The material for Age Group 1 (10-13 years students) is the material for the younger students, containing basic information about the Ecological Footprint of Housing, to be taught in a 45-50 min. learning session.

Older students (14-18 years old), depending on their interest and prior knowledge, may study:

- the same material (named, in this case: Part A – Core content, which is common for both age groups). If they study it in class, deepen information and do both exercises, it should last 45-50 minutes, as well as for the younger age group;
- the students aged 14-18, with a greater interest in the Housing Ecological Footprint topic, can focus, in another learning session of 45-50 min. of the Part B – Additional content (designed as an extra content for the 14-18 years old students).

Part B (additional content), is optional.

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LEARNING UNIT 4

THE ECOLOGICAL FOOTPRINT – HOUSING

TEACHING MATERIALS FOR AGE GROUP 2 (14–18 YEARS)

The aim of this Learning Unit is that students understand the importance/the steps to reduce the Ecological Footprint of housing.

Short overview

Duration of Learning Unit: 45 min.

This Unit consists of:

- PDF document with description and input
- Power Point Presentation
- Materials for print

Description of the Learning Unit

After going through this Learning Unit, students should be able:

+to analyse the components of the housing Ecological Footprint;

+to become active supporters of energy saving and of using it from renewable sources;

+to explain the importance of home insulation to reduce the housing Ecological Footprint;

+to analyse the different house types after their energy index and functionalities;

+to become active in the common efforts to reduce housing Ecological Footprint, by their own solutions;

+to enrich their technical/foreign language knowledge and IT skills.

Connection to subjects: geography, biology, chemistry, physics, mathematics, nature sciences, environmental sciences, national language, English as a foreign language, other foreign languages, project lesson (country specific subjects).

Place of the activity: classroom

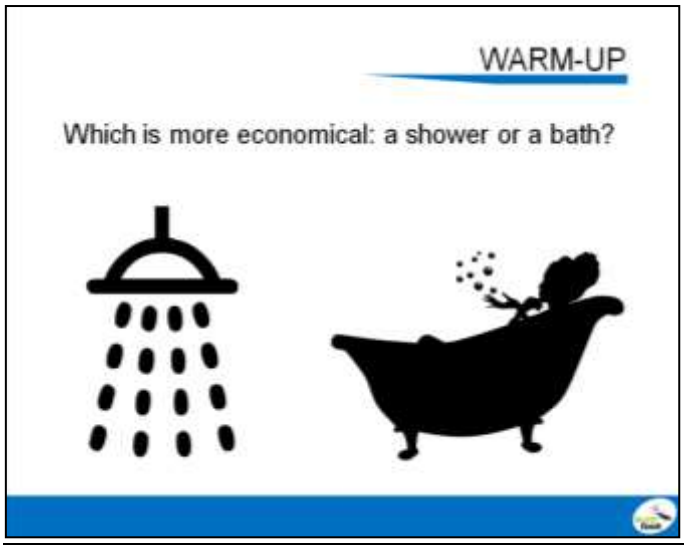
Materials: flipchart sheets, laptop, beamer.

Overview of content duration

1.	Warm-up	2 min
2.	Land use	3 min
3.	The type of energy we consume	5 min
4.	The way we consume energy	5 min
5.	The type of insulation	8 min
6.	The living space	5 min
7.	Conclusions: What can WE do?	2 min
8.	Exercise	6 min
9.	The five Footprint rule	2 min

Sequence

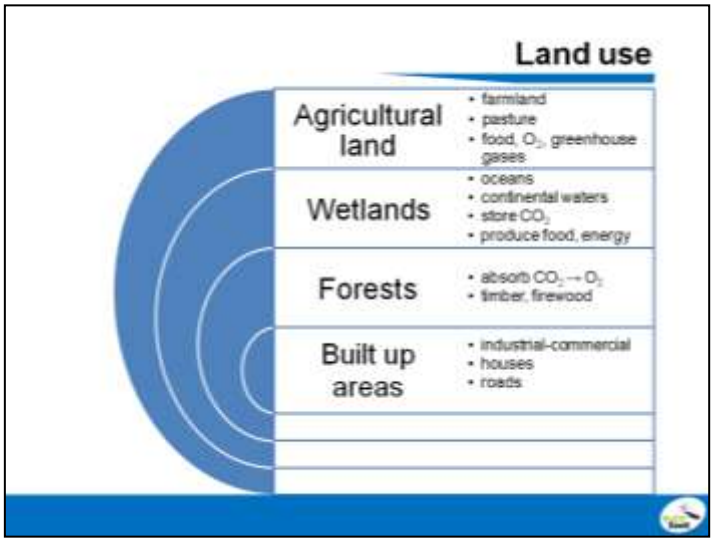
1. Warm-up



Discuss about the amount of energy consumed to take a shower or a hot bath - which one has a bigger Ecological Footprint?

Students must understand that both answers can be positive, depending on the water temperature, water flow or duration. And they should avoid unnecessary use of water and energy while bathing.

2. Land use



Look again at the land use categories. Which changes should people do, so that the biocapacity of the different fields to be preserved or even increased?

Students have to study the land use categories and indicate at least some of the following:

Examples for keeping or increasing the biocapacity:

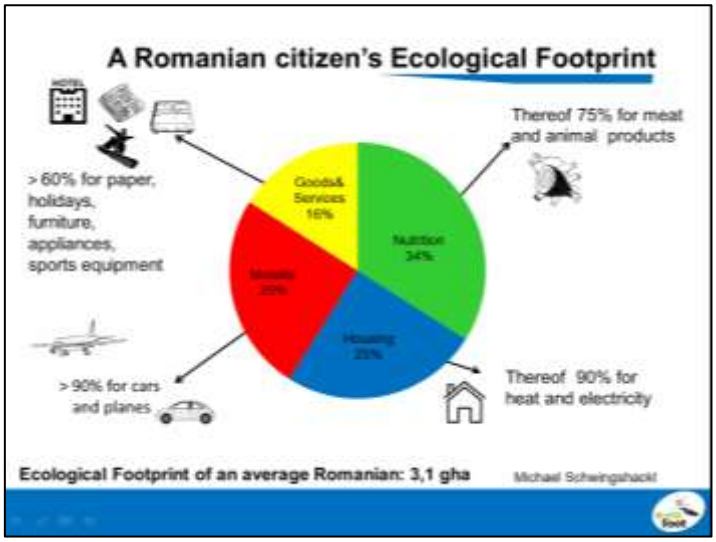
- Changing a deserted field (like the former garbage dumps, or the mining waste fields) into a park or productive farmland;

- not building shopping centres on the outskirts of towns that require large parking spaces, as valuable farmland is lost in the process;

- reforestation campaigns on the former wood exploitation fields;

- planting hazelnut or other native bushes or fruit trees instead of thuja hedges;

- producing something in your own garden, around our living place or on the balcony …



As you can see, all the activities of the average Romanian require 3,1gha – it means that, if all people in the world would live like us, we needed 1,7 planets! (if we compare it with the 1,6 gha fair share). What are the most Footprint-consuming activities?

After nutrition (where 3/4 is meat and animal product consumption) housing and mobility make each by one quarter of it. Heating our houses is the most important energy consumption activity, while electricity consumption in the household (domestic appliances) counts with another tenth.

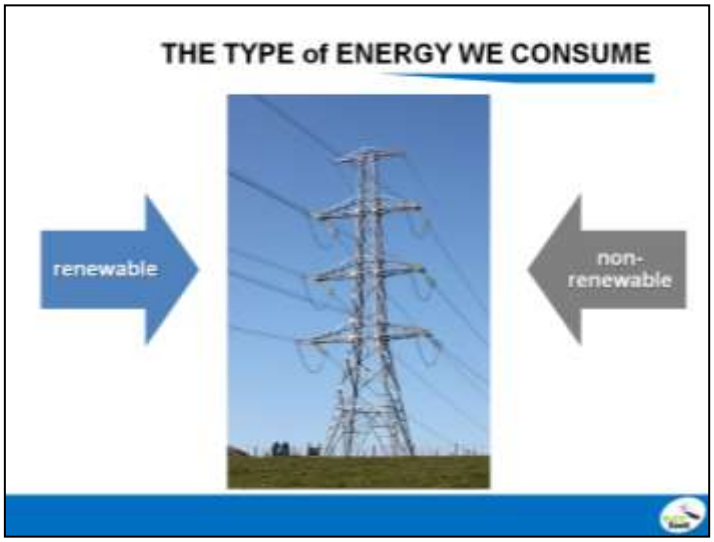
In the next minutes, we will analyse the best ways to reduce these parameters, so that our Ecological Footprint to be as much close to the fair share...

Influences on the Housing Footprint

We spend more than a third of our time in our houses. Living conditions are an important element of our lifestyle.

Ecological Footprint of our living is influenced by the energy we consume (its origin and Carbon Footprint), by the way we consume it to make our living as comfortable as we desire, by the insulation type we use for our houses, and by the size and location of our houses.

3. The type of energy we consume



Every kind of energy has a Footprint; even the renewable energy has a small one. After that, in the first lecture, we analysed the disadvantages of the non-renewable energy sources, what are our future prospectives, if we count on the renewable ones?

What are the possible Footprint sources, in the case of the renewable energies?

Students focus on some possible answers:

- The area needed to develop the technologies;

- Obtaining the construction materials and the components of the renewable devices;

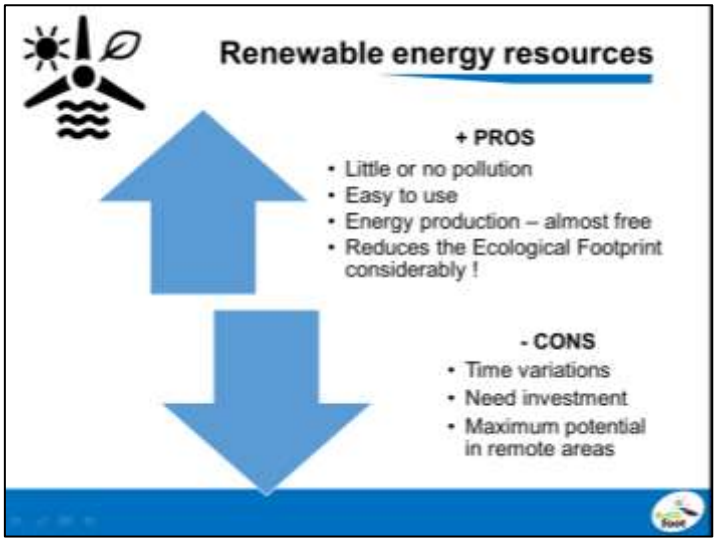
- Transport the energy at the consumers' places

- Binding the (small amount of) carbon emissions.

However, the energy generated by wind, solar or hydroelectric power plants has a very small Ecological Footprint compared to fossil fuels.

What is your opinion about using renewable energy sources now and in the future?

Students can use a paper sheet, with two sides (or two sections) - one for pros, one for cons. They can be sticked on the blackboard or on a flipchart sheet. They can work individually (with post-its) or on groups, depending on the study group composition: two groups for pros/two for cons, four-five groups for both aspects each ...



The main conclusion should be summarized by the teacher as:

Comments

Renewable energy sources are a cleaner alternative for a future sustainable development of the world.

Although they are not endless, they have enough potential for a better development of the society, if the consumption is kept at reasonable dimensions.

Producing renewable energy installations and devices using safe materials and cleaner technologies could be one of the most important challenges for the future.

Some of the renewable energy forms have their best exploitation potential in places like Sahara, Antarctica or other remote areas, where the energy needs are limited, at least in present times. However, for some of these regions, the existence of such a huge potential could be an advantage for a future sustainable development strategies (depending on the particular conditions).

The exploitation of the renewable energy sources is, in most cases, environmentally friendly. The exploitation costs may vary, but they are actually very low.

The energy we obtain from renewables could be more expensive nowadays, but its value is primarily ecological, not economical: it leads to a smaller Ecological Footprint, and that is priceless...

Every country has its own costs and conditions for the energy production and consumption (heating, water heating, electricity for domestic and commercial use).

How is it in your homes? Does your family care about how much you consume? Is it easy to pay the heating and electricity bills? Is there any concern for the environment in your consumption behaviour?

Students give examples from their households. In Romania, the main concern about electricity and heating consumption has economical reasons (the price of electricity, natural gas, firewood,

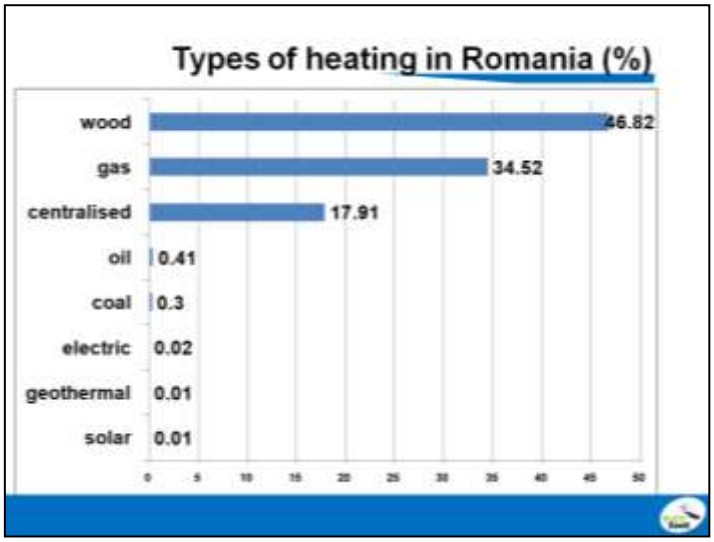
centralised heating services). In any other country, it depends on the level of environmental education and civic attitude/innitiatives.

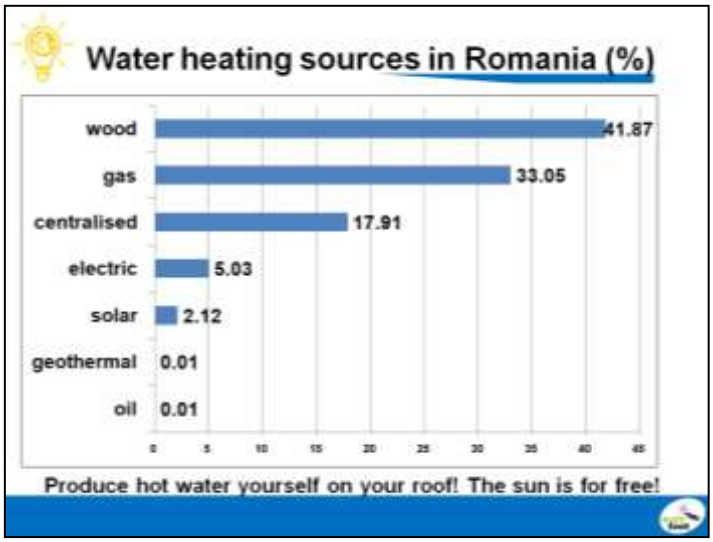
A lower energy price can stimulate over-consumption, while higher prices are more favorable to savings.

What if you were aware all time that, consuming less energy, you contribute to saving the planet?

What are you thinking of while turning a light off when not needed?

What other reasons than economy would you have to reduce the indoor temperature with one degree Celsius in the winter – or increase it with one degree during the summer (if you have air conditioning).





Let's take a look at the next two slides, about heating and water heating sources distribution in Romania:

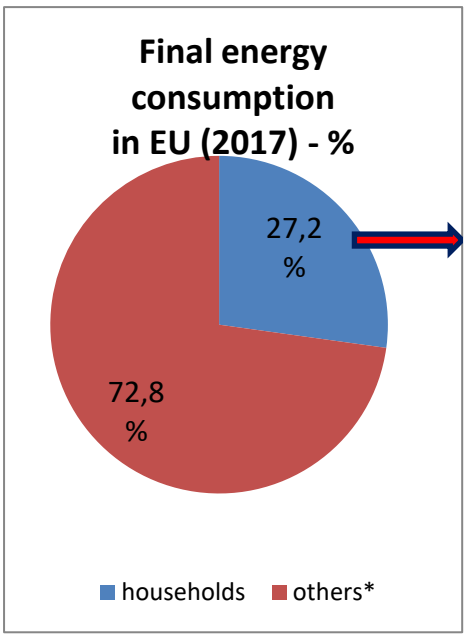
In Romania, the main source for heating/hot water is the firewood, followed by natural gas and the centralised heating systems, which provide hot water, too. Electricity has some importance only in water heating (~ 5%), more than for heating itself, because some households use electrical boilers,

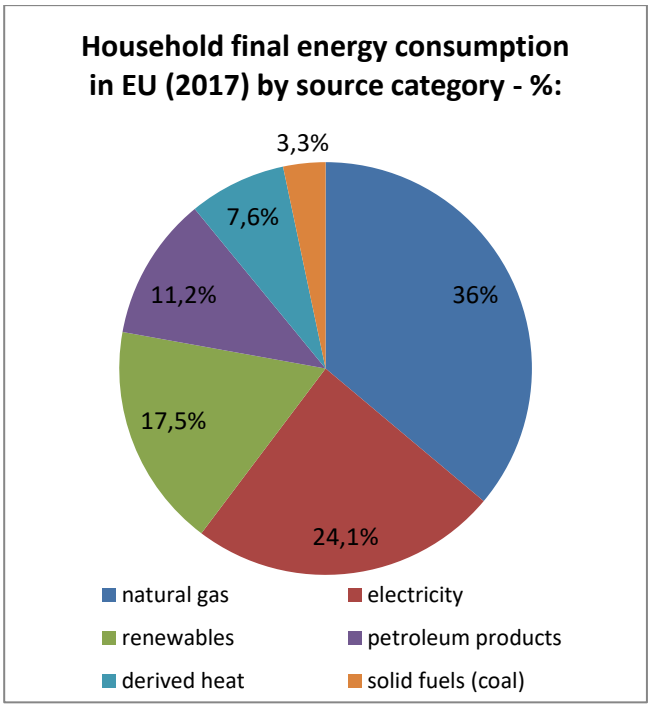
combined with traditional heating systems. The most common, traditional heater is the wood operated stove, especially in the countryside. It was replaced, lately, by the central heating systems, still wood operated.

What should be changed in the heating/water heating system, in order to reduce the housing Footprint?

People should replace their heating/water heating installations whith new ones, using more and more solar, wind, geothermal energies or biofules. Centralised solutions are more efficient, if well maintained.

Teacher information: On the EU level, the situation was (in 2017) as follows:

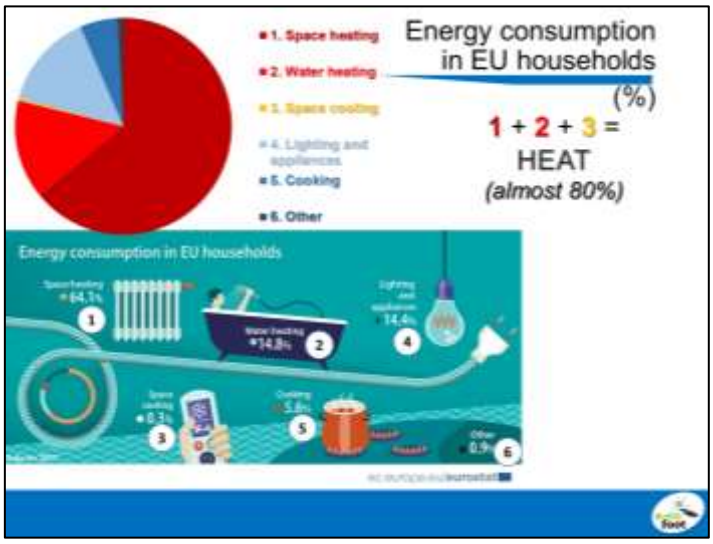




Other sectors of consumption are (according to https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20190620-1): agriculture, industry, road transport, air transport (aviation) other transport (rail, inlandnavigation), services and others (not specified).

On the EU level, households realised 27.2% of the final energy consumption (in 2017). Most of it – over a third (36%) - is covered by natural gas, followed by electricity, which counts for almost a quarter (24%). At the same time, the renewables share is 17.5%, overrating the petroleum products, derived heat and solid fuels (coal products, that still provide 3.3%).

Domestic energy consumption is distributed as follows:



It consists of almost 80% heating, heating water or cooling the space during the hot season. The other 20% are lighting and appliances, cooking and others.

Therefore, the most important ways to improve the household energy consumption (at EU level) are:

- a more efficient way to heat the houses, through modern heating technologies and a better insulation

- reducing the indoor temperature

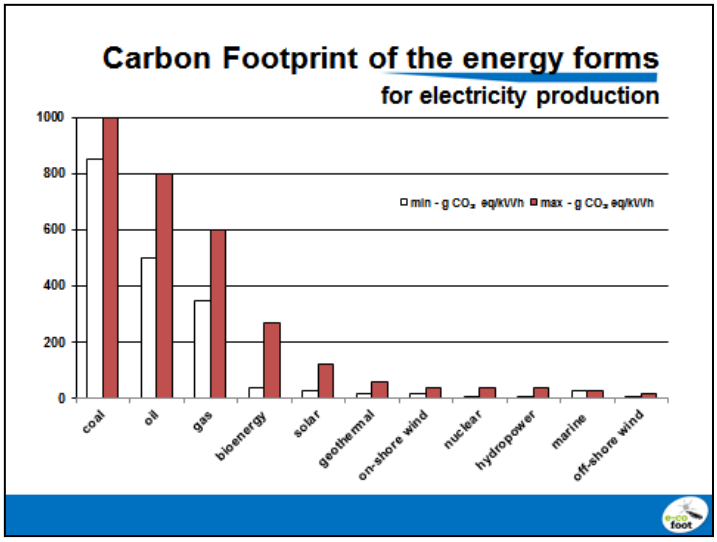
- heating water using renewable sources (more of them can function autonomously, like the solar panels on the rooftop)

- using the heat pumps (ideally - renewable energy operated) (see e.g. solartown.eu)

- reducing the energy consumption for cooking, lighting and other domestic uses.

The greenhouse gas emissions are the most important components of the pollution, generated by our increasingly higher living standards.

Carbon Footprint of the electricity produced using different energy forms[1] can be compared from the graph below:



There are differences between minimal and maximal Footprint values, because exploitation and production (natural conditions, distances, costs, facilities and many others) are very different from one country to another, even at regional level.

Which of these energy forms should be considered as the future alternatives?

Ideas students should produce, under teacher's guidance:

- Renewables have, in general, the lowest Carbon Footprint:
- coal has the highest Carbon Footprint, around 66 times higher than the off-shore wind (which has the lowest values);

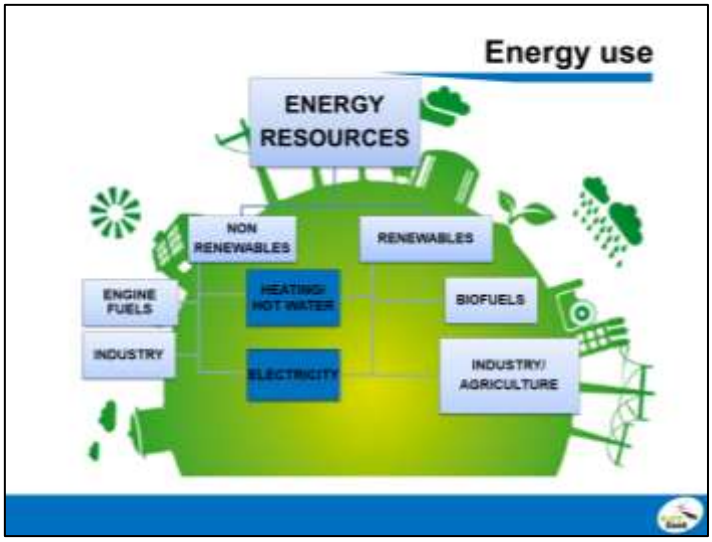
[1] data source: http://energyforhumanity.org/en/nuclear/fact-file-carbon-footprint/ adjusted

- natural gas has the lowest Carbon Footprint from all the classical fossil fuels, but much higher than any renewables;
- nuclear power has the lowest Carbon Footprint from all the non-renewable sources; however, it is less and less used to generate electricity, after the two MAJOR nuclear catastrophes (Chernobyl, Ukraine - 1986 and Fukushima, Japan - 2011);
- bioenergy has the highest Carbon and Ecological Footprint from all renewables, being the most land consuming; however, all the other renewable energy sources have extremely low Carbon Footprint.

Some facts about the use of renewable energy in Romania

- the ”Casa Verde” (Green House) programme allows people to deduct a part of the expenses to install hot water solar panels or heat pumps, but it can take even five years to be accepted and approved, then you can receive the money
- some municipalities spent money on improving the energetic efficiency of the collective buildings –they partially or totally supported the expenses for exterior walls insulation and/or renewing the glazing systems (but they did it for all the families, instead of helping only the ones, with lower incomes, so that more citizens in need to benefit from these measures)
- there are regulations that, theoretically allow the expenses for energetic efficiency of the private households to be deducted from the taxes, but they are not fully operable
- for the citizens who install photovoltaic systems, energy providers must take the extra amount of energy, at convenience prices

Conclusion->in the situation of responsible actions and good governance, political leaders (or state authorities) should support/encourage the most environmentally free technologies, and, subsequently, issue prohibitive measures against the most “Footprint-consuming” ones.



A changing world, in accelerate development, needs a lot of energy to function on its continuously (and worrying) growing parameters...

- the fossil fuels are used for electricity generation, transportation, or as raw material in different industries; the nuclear energy-operated electrical power plants are crucial for some countries, which aim to rely less on imported fossil fuel burning (most of them, oil or gas)

- the use of the renewables is increasing in volume and importance, in parallel with technology improvements. They generate clean electricity. The renewable energy forms are used to generate hot water and heating energy (as solar panels or heat pumps), to heat houses and other buildings (as biomass and biofuels), in combustion engines (ethanol, biofuels) …

What is electricity used for? Can you give examples?

- electricity use – not only for housing, but also for:

  - food producing and processing

  - transportation (of people and goods, access to information)

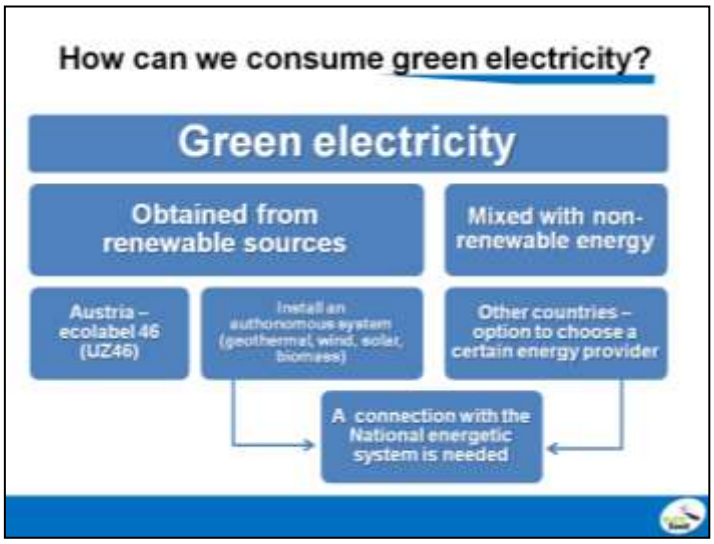
  - production of a variety of goods (industry)

  - commerce, tourism, public and other services - everything is electrically operated

- heat and hot water – for housing, but also for heating and maintaining all the non-residential buildings (private/public institutions, hotels, offices, and many others).

It means that energy demands for the living are in permanent competition with the industrial, commercial, food and transportation energy needs – THEY ARE INCREASING, TOO!

It forms a significant part of the personal Footprint, but of the grey Footprint, as well (see Learning Unit 2).



How can we consume only (or mainly) green electricity in our homes?

How can we be sure the electricity we consume is from renewable sources?

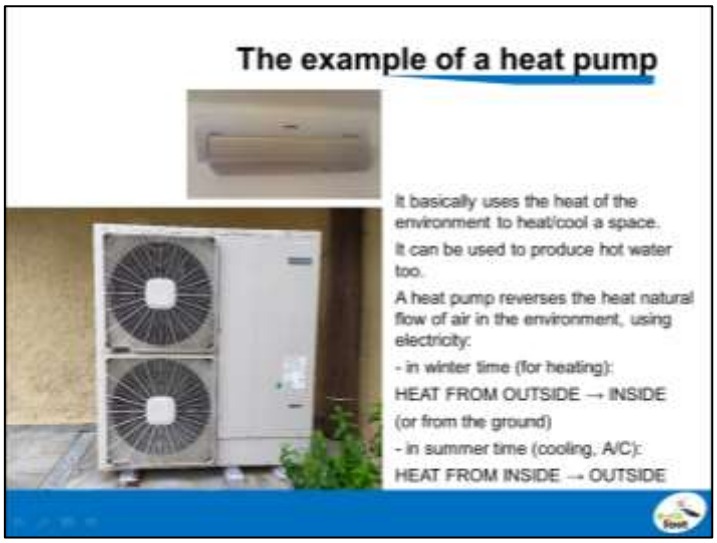
In Austria, the best electricity suppliers to choose are the ones that have been awarded with the Austrian Eco label 46 (UZ46). The eco-label ensures that the product meets particularly strict requirements, for example, at least one percent of the electricity must come from photovoltaic sources (For Austria):

https://www.umweltzeichen.at/cms/de/idart_2261-idcat_550-content.html?dosearch=1&searchScope=uz&searchFilter=%22signLabelId%22%3A108%2C%22guidelineId%22%3A45&searchterm

In Romania there are only some small electricity providers that offer exclusively their own electricity (hydroelectrical power plants or solar/wind farms), but they prefer to work with industrial consumers.

Installing our own autonomous electricity, heating or hot water systems (photovoltaic panels, home use wind turbines, heat pumps, hot water solar panels, biomass systems) can reduce the energy bill, the dependency to the centralised systems, and save some money by injecting the extra electricity into the grid.

Example - heat pumps:



The natural flow of heat is the heat to be transferred from high temperature to low temperature conditions. The heat pump manages to reverse this natural flow. So in the case of a house, the heat pump during, for example, the summer, removes (pumps) the heat from inside the house to outside, expelling it into the environment. As the interior loses its heat, it begins to get colder.

On the contrary, in winter it draws the heat from the environment and directs it inside the house in order to increase the heat of the interior.

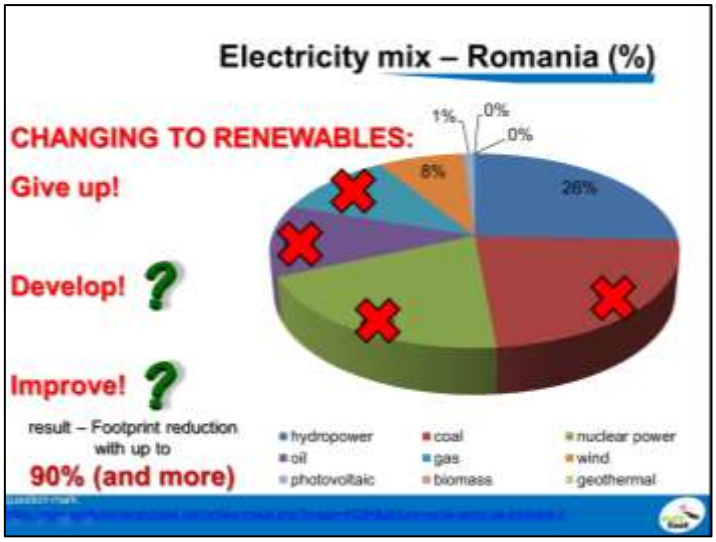
So basically, the heat pump uses the environment to heat or cool a space.

The use of electricity is required only at the stage of heat pumping and the user only pays the cost of electricity required for pumping.

Moreover, we can use them in order to heat water.

Which of these solutions could work in your homes? Why? Why not? (examples from the students)

An average Romanian household consumes about 1,700 kWh (kilowatt hours) of electricity per year (2016).



Romania can reduce the electricity Footprint up to 90% or even more, by switching the electricity mix to renewable energy forms of green energy. It is a long-term solution, but how do you think we should start?

Answers: students identify the most affordable solutions to switch on renewable energy. They should guess what are the sources that need to be given up (right before the animation shows an "X" over their values), then – they should indicate where we have to develop more capacities, or even start from almost zero in the field of green energy production. Last but not least, improvement in the hydro-energy generation should be mentioned – we need more energy from our hydroelectrical powerplants!

In the case of Romania, they are:

- reducing constantly (up to GIVING UP) the fossil fuels energy generation AND eventually, the nuclear power facilities

- developing NEW solar, wind and bio-energy facilities (last ones – in the situation that ecological balance must NOT be affected!)

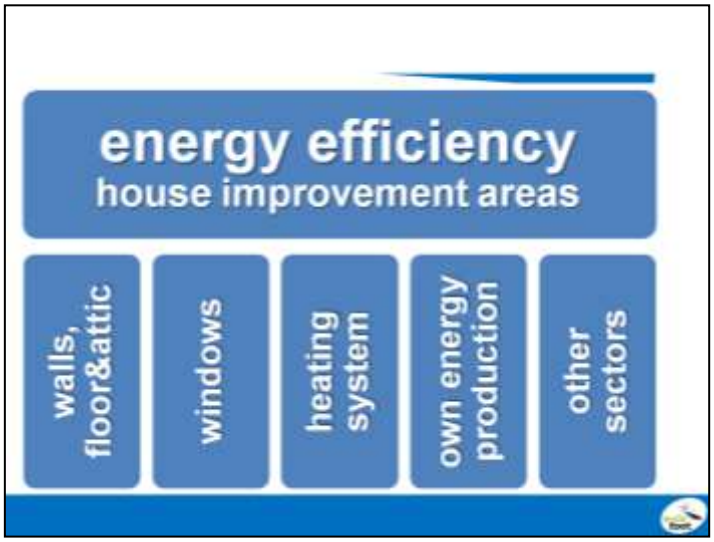
- encouraging the heat pump use, for heating/providing hot water in private houses/institutions, as well as the geothermal energy use, on a strategic level

- improving our existing hydroelectrical powerplant capacities, so that they provide green electricity in environmentally safe conditions.

Who can help to this action?

Possible answers: people themselves, local authorities, governments, NGOs.

4. The w ay we consume energy



Main intervention areas in order to reduce the housing Footprint by lowering the energy consumption (discussions with the students):

- walls, floor and attic (lower heat transfer – INSULATION!);

- windows (EFFICIENT window frames, AT LEAST TRIPLE glazing system and UV PROTECTION FOILS, to reduce heat transfer in both senses);

- heating (MODERN heating/water heating systems, THERMOSTATS to control temperature, INSULATED boilers and pipes);

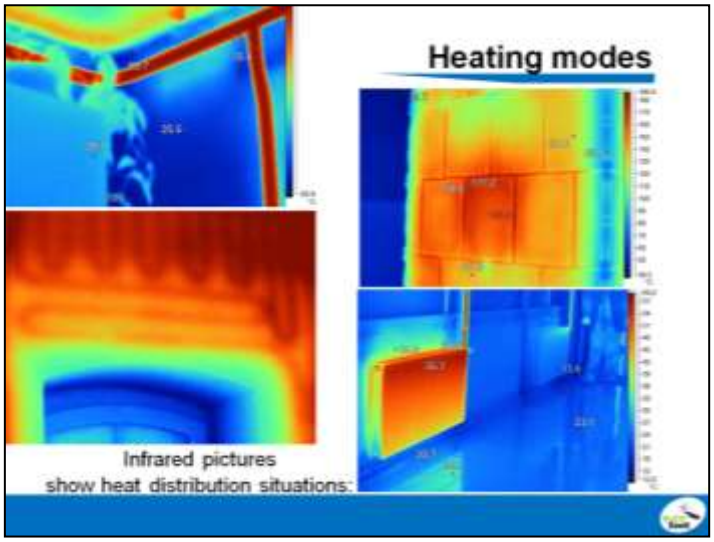
- own energy production (SOLAR photovoltaic systems/water heating panels, BIOMASS use or HEAT PUMPS to heat the rooms or the water);

- other measures (efficient LIGHTING system, new HOME APPLIANCES, saving water, including the ENERGY to bring it to the final consumers…)

IN CONCLUSION, THERE ARE TWO WAYS TO REDUCE THE HEAT LOSSES:

- IMPROVEMENT OF THE HEATING SYSTEM;

- REDUCTION OF THE LOSSES IN THE HEATED SPACE.



Heating is the main energy consumption field in a house. It depends on how we choose to heat our homes, using the most economical heating solutions.

As a result of a study about some heating devices (the most common ones), infrared pictures show how the heat is distributed, how it is spread around the room and where are the most important losses: windows, non-insulated pipes, stove doors.

Conclusions:

- most of the heating sources are efficient only in the closest proximity, while the rest of the room is cold;

- uninsulated pipes are sources of heat losses, too;

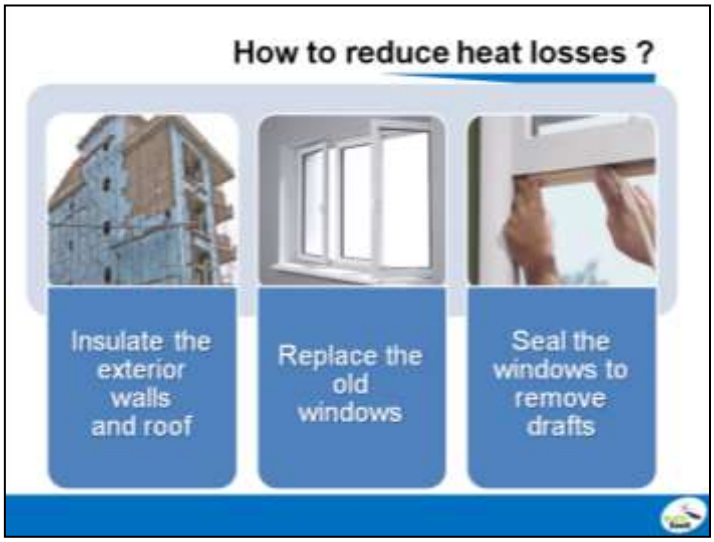
- the best solution is to install heating systems on the walls (or on the floor) that allow a more uniform heating distribution;

- the main problem is: HOW MUCH HEAT DO WE NEED???

Many specialists say that an indoor temperature of around 20 degrees Celsius is more than optimal for the human body. There are cases when people extra heat their houses, being accustomed to 23-24 degrees Celsius or even higher temperatures in winter. They also use to cool excessively the inside air in summer.

It is better to wear a sweater or a jacket inside, and fix the thermostat at max. 20 degrees, than heat the rooms and wear only a T-shirt. Also, when nobody is at home, heating should work only at a

minimal level – it is healthier, and it also saves money on the energy bill!



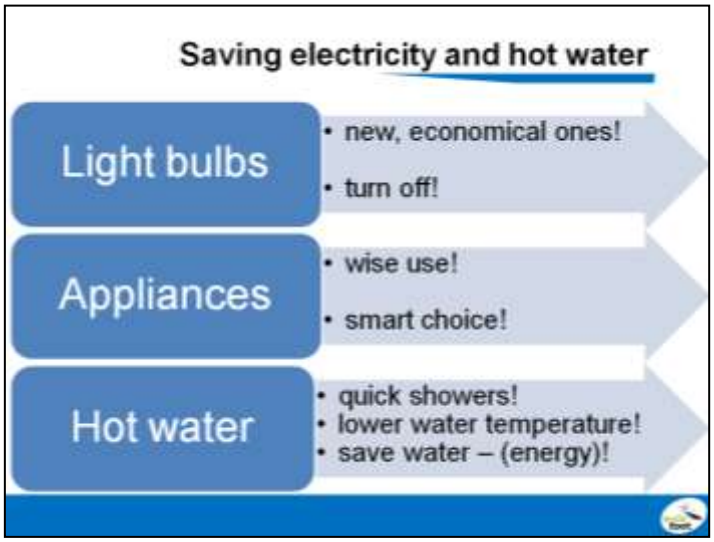
What can we do to reduce heat losses, in order to lower our energy bill?

The most important measures to reduce heat losses are connected with the improvements we can make, in order to minimise the heat transfer between the indoor space and the exterior:

- improvement of the exterior walls and roof insulation – the main thermal barrier to the heat losses

- replacement of the old windows with new ones, having (at least) performing double glazing system

- sealing the windows to remove drafts (and the doors thresholds, and any other contact surfaces).



These measures act to reduce our expenses, but also the housing Footprint by lower energy consumption.

How about saving electricity and hot water? Imagine you have to lower your hot water and electricity bills. Name one-two measures you could apply in these situations:

Students must think and offer solutions – subject to the class debate.

5. The type of insulation

As you have already found out, insulation can reduce the housing Footprint to more than a third, by creating a thermal barrier between the interior of the house and the external temperatures.

How does the insulation look like? How can you install it?

They can be used under different forms and purposes:

- rigid or flexible boards, sheets or pre-formed shapes (for pipes, walls, irregular or curved segments);

- foams (for flat or irregular surfaces or holes);

- pre-formed rigid panels (polystyrene, cork, others);

- flexible blankets and rolls (for wall and loft insulation, pipe insulation as well).

Teacher asks students some questions about the insulation materials' characteristics, in a way that a profile of the best insulation materials to be created.

Using insulation materials, such as natural fibres, waste from wood processing or paper production, or chemical industry products, would help insulating the whole house area. The best insulation must be:

- thick – how thick a wall insulation, for example, should be?

- with the lowest possible heat transfer index – does it help if it allows heat to pass through the walls/roof/attic?

- continuous – what if we have interruption between insulated layers/areas?

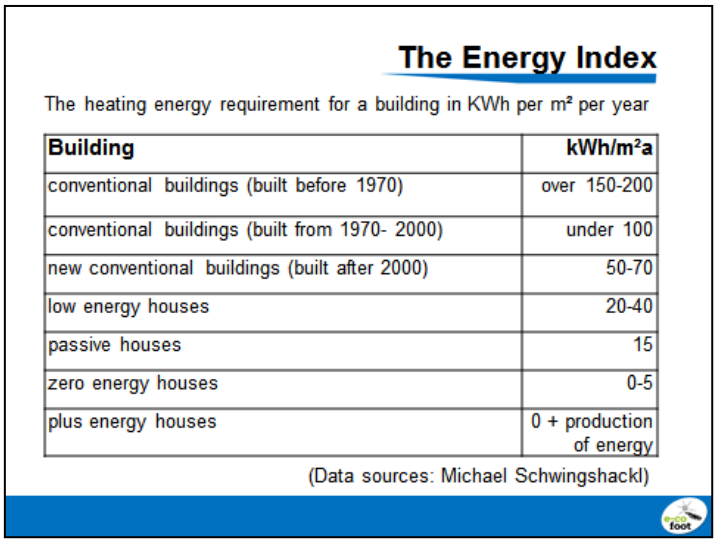
- healthy for both the people living in the house and the environment–who guarantees that some of these materials can't harm the health or the environment?

- durable in time – once installed, for how long do we need the insulation?

- fireproof – what happenns in a case of fire?

- affordable and easy to install–how expensive is to buy insulation materials/to install them?

- look nice from the outside and comfortable inside! – is it possible that insulation ruins the look of the house or reduces the useful space?



The Energy Index

The heating energy requirement for a building in KWh per m² per year

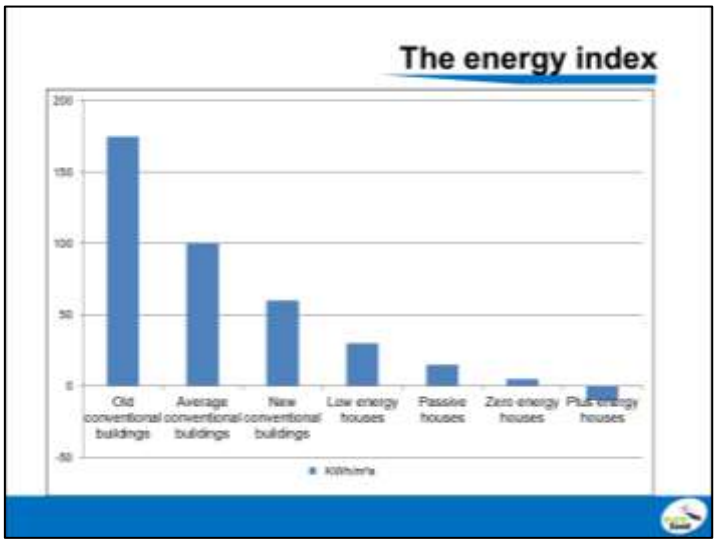
Building	kWh/m²a
conventional buildings (built before 1970)	over 150-200
conventional buildings (built from 1970- 2000)	under 100
new conventional buildings (built after 2000)	50-70
low energy houses	20-40
passive houses	15
zero energy houses	0-5
plus energy houses	0 + production of energy

(Data sources: Michael Schwingshackl)

Do you remember what the energy index is? Yes? Who can tell?

Students give answers, based on their core content aquired knowledge.

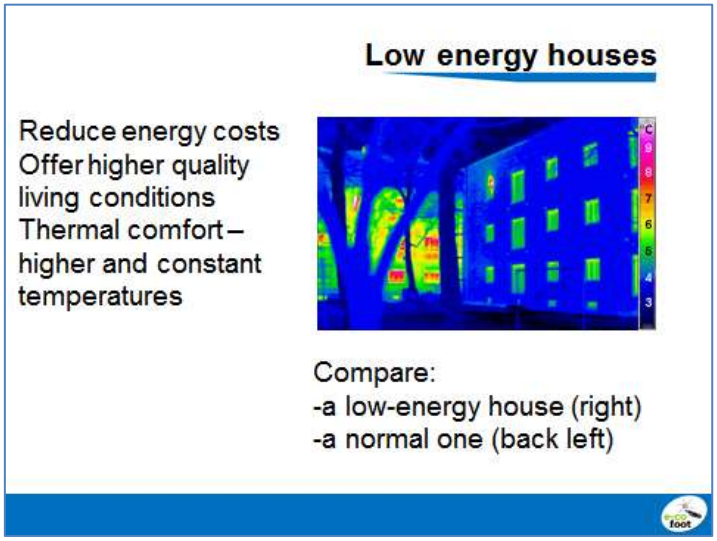
As we already said, an energy index is calculated for all houses/buildings. It helps establishing the energy performances of a house. The energy index can be improved, in some cases, by insulation and other measures.



Apart from the traditional houses (which are very different, depending on their construction year, materials and insulation level – if there is any), other four categories of houses are defined upon their energy index. What can you say about the differences between these types of houses?

- An **average insulated house** (energy index of 100) has a heating footprint that is **7 times higher** than that of a **passive house** and more than **20 times higher** than that of a **zero energy house**.
- NOTE: It is POSSIBLE to **insulate also older houses**, it is not always necessary to build new ones!

The houses with improved energy index are the following:



In this picture you can see the infrared image of two neighbour residential buildings from Germany. What can you say about their thermogram?

The one from the right has significantly less heat losses - due to the insulation and modern window system. It is a low energy building, compared with a classical one.

The next picture is a case study of a passive house - it has at least four types of installations to save heat and electricity:

- a complete, thick and efficient insulation (roof, exterior walls, floor);
- a modern system of triple pane glazing;
- sunlight orientation, (which allows solar thermal panels - it is optional, but very efficient to be installed on the rooftop), so that the house collects maximum sun energy through the windows;
- a system of heat exchangers for the air ventilation, which allows the hot air from the ground to enter, and recovers the heat of the outgoing air.

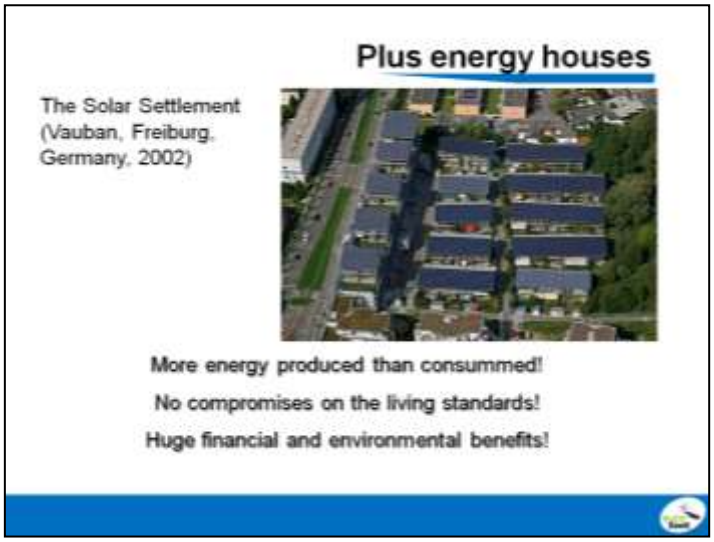
Thus, the Energy Index is lowered to one tenth, compared to one of the least modernised conventional buildings (EI = 15 for a passive house – 150-200 for some of the older conventional buildings)

Zero-energy houses: they are insulated to the highest standards, but they also produce their own energy (e.g. by solar energy systems for hot water and electricity production). During a year they produce as much energy as they need.

Do they rely entirely on the self-produced energy?

Of course, there are times when they consume **extra** renewable or even non-renewable energy (from the electrical grid) but they can use the grid for energy storage. When the sunlight and wind potential is the highest, they produce more than needed, and the extra energy is injected into the grid. When the consumption is higher than their own energy production, these houses absorb an extra energy from the grid, but the yearly energy balance is always around zero.

In addition to that, most of the houses use heating pumps, which provide a constant flow of heating energy (hot water, warm air). The pumps have their own electricity consumption, needed to re-circulate the water/air flow.



Plus-energy houses: they generate more energy than they consume during a year. The majority of the energy-plus houses are equipped with all the modern conveniences, like any other building.

The first energy-plus settlement was built in 1994 in Freiburg, Germany. It combines insulation and smart energy consumption with other energy-saving building methods, also obtaining a significant amount of electricity and heat by itself. These houses are money-savers, since they receive money from the electricity providers, for the injected energy.

Conclusions: what are the most important features of an intelligent house?

Based on what they studied, students will mention:

- electricity, heating and hot water generation (using solar, wind, biomass or geothermal energy)

- efficient insulation of the walls, windows, roof and loft

- efficient lighting and wise use of A+++ domestic appliances, lower temperatures and smart energy use controllers (thermostats, smart meters and others).

The students can also be challenged to draw a small sketch of an intelligent house, figuring at least two-three of these features on their right place.

6. The living space

The better your home is **connected to public transport**, the more often and easier you can use public transport and less dependent you are on cars.

There are some governmental measures that help citizens improve their living conditions, but many of them are not so relevant, because the financing is not consistent and with interruptions.

Size and location of the living space

- Do not live in oversized living space, but **compact**!
- Choose a location for your house that has a good access to **public transport** and not too remote

Would you like to live in a cosy, new and modern flat, with a good insulation and modern appliances (where all maintenance costs are lower), or a house on the ground? Why? Why not?

These choices are very important when buying or building a house:

- the construction field must allow sun-orientation of the building

- the house must be in a sunny area, with the highest outdoor temperatures possible. If it is in a cold region, additional construction measures should be adopted (insulation comes first!)

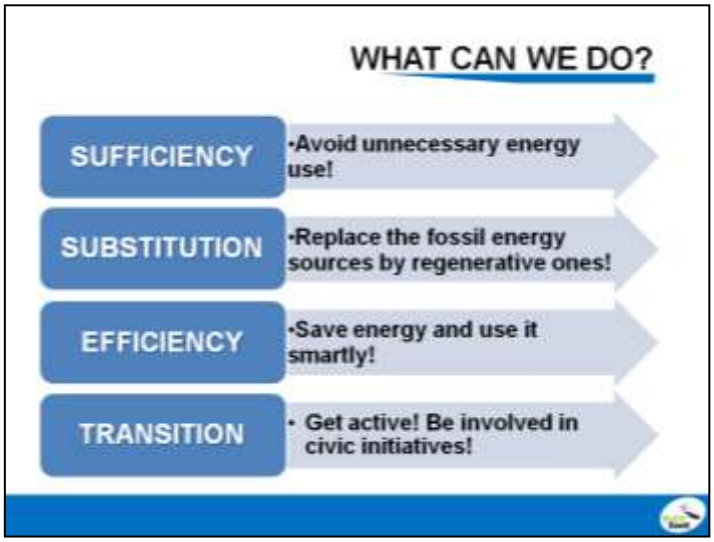
- the new construction and/or the choice for buying a house must meet the living space criteria: WHY BUILDING/BUYING A LARGER HOUSE? We must estimate correctly the budget to pay all the heating, hot water and electricity bills!!!

- Is it better to buy an old house, or to build a new one? Why? Why not?

- When you grow up and need a house on your own, should it be an individual house, or an apartment? What are they dreaming of? Students explain.

7. Conclusions: what can WE do?

There are <u>four areas</u> in which you can get active:



A) SUFFICIENCY - AVOID ENERGY USE, ESPECIALLY WHEN IT IS NOT REALLY NEEDED!

Insulation (MOST IMPORTANT measure):

- Insulate **external walls, the attic and the cellar, cracks under windows and doors** with good thermal insulation. Install **insulation boards or foils behind radiators**.

If possible:

- Install **insulation on windows.**
- Move into, or build **a house with good thermal insulation.**
- Follow and search for the possible **external financings for insulation** (state, municipality, private initiatives, discounts ...)

Small measures: **Lighting/Electrical and IT equipment**

- Use **LED or energy saving lamps**. Good energy saving lamps can save about 2-3% of the whole footprint for electricity, modern LED lamps about 4%.
- Consciously **avoid all standby functions** (unplug them). Where technological solutions aren't available, switch the devices off completely when not in use.
- Use **socketstrips with a power switch**!
- Use a good **power-saving management of your computer**; if you don't need your computer for a longer time, shut it down! Even if the overall Footprint of the energy consumption is comparatively small for computers, you can save a significant amount of the energy used by them, just paying attention to this.

B) SUBSTITUTION - REPLACE FOSSIL ENERGY SOURCES WITH REGENERATIVE ONES!

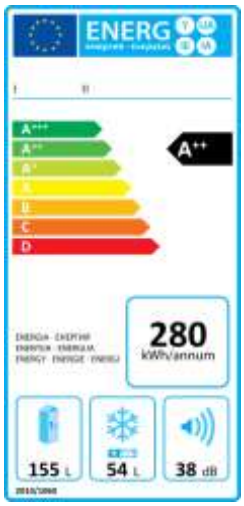
- **Switch your energy supplier to green energy (Very IMPORTANT measure with great improvement potential):**
- Since the liberalisation of the electricity market, switching the energy supplier is easy –even a lot of money can be saved!
- **Produce green energy** (for hot water or electricity) **yourself** (solar systems on your roof)!

C) INCREASE EFFICIENCY - SAVE ENERGY AND USE IT INTELLIGENTLY FOR:

Heating

- **Lower the temperature**: Every degree lower saves around 5% of heating energy!
- **Choose the right temperature for different rooms**. Sleeping rooms need far less temperature than living rooms and some rooms may not need any heating at all.
- Use programmable **thermostats**.
- For airing the room in the heating period, **open the windows fully for 3-5 minutes** several times a day instead of leaving them tilted the whole time.

Cooling:



- Place the refrigerator in a **cold position** (not directly next to the stove or heating).
- Do not choose an unnecessarily cold refrigerator **temperature** (7°C is enough) and use the temperature **zones** of your refrigerator thoughtfully: vegetables, meat and fish should be kept at the bottom of the fridge since it is the coolest place, butter can be kept in the warmer zones at the top (by this, it also stays more spreadable). It is crucial to prevent food from rotting since food has a much larger Footprint than the energy to cool it.
- **Defrost** the fridge and freezer from time to time. If there is an ice layer, electricity consumption rises sharply.

Cooking/Baking/Defrosting:

- Except for sensitive dough it is usually **not necessary to preheat** the oven.
- **Use also the waste heat** of the stove after switching off.
- A **lid on the pot** when cooking meals reduces energy consumption by a quarter.
- **Pressure cookers** save another 50 % of the energy.
- Bring pasta or tea water to the boil in an **electric kettle**!
- Use the **microwave** only for small quantities!
- Remove **frozen food** from the freezer at an early stage and do not place it directly in the oven. If you put it into the refrigerator first, it will take longer, but you save extra energy.

Use of (hot) water and drying clothes

- **Use hot water only when necessary**. Regularly, take a quick shower instead of a full bath.
- **Wash your clothes at 30 or 40 °C but not hotter than 60 °**C. Most pathogens die at 60°C. A prewash is normally not necessary.
- Allow the laundry to **air-dry.** Tumble dryers need a lot of energy.
- Always **fill the drum of the washing machine** fully with clothes.

A very important, general possibility to reduce the Footprint is to pay attention to the **quality** of the products we buy and buildings we build, because this increases their **lifespan**. This does not only save

money on the long term but also energy and resources. It is better to buy fewer things with a higher quality instead of many with a low quality.

Apart from focusing on the other tips to save energy we mentioned above (that have less impact, but are important, too), it isVERY IMPORTANT to be involved in civic initiatives aimed at supporting insulation financing and the local use of renewable energy!

Therefore:

D) GET ACTIVE FOR AN ENERGY TRANSITION!

There are many civic initiatives that promote renewable energy, housing insulation and other ways of consuming energy in our everyday life.

- Find out if there this kind of groups in your area, support them (financially or by participating) and take part in changing the political framework!
- Be active on-line to support the environmental groups that want to raise awareness on the future of our planet!
- Be an example for your parents, your family members and your colleagues!

8. The 5 Footprint rule

What are the most important fields where we can act to reduce our own Ecological Footprint??? What does our Earth need most? These rules are like the 5 fingers of your palm – you must act to respect them as future adults, responsible citizens.

The 5 Footprint rule (and the take-home messages students should aquire):

Enjoy life with a smaller Footprint: more friends, family, time, fun...	A quiet life, less stress ... Value things that count more
Act together to create a sustainable world that supports living on a small Footprint!	Activism, civic attitude, responsibility Friends

Reduce meat and animal products! Prefer local and seasonal products, as much as possible from organic farming.	Eat less – save the rest! Eat healthy food, eat more plant-based food Enjoy fresh food!
Travel with a small Footprint – with train, bike and bus. Don´t fly! Ride cars less, never alone, with green electricity!	Travel wisely! Enjoy travelling by train or public transport Fewer victims in car (plane, boat...) crushes! Travel+Sports (walking, trekking, cycling)=Health! Give an example!
Home green home! With green energy, well insulated, smaller, access to public transport...	No energy waste! More comfort, less consumption! Figure your future home!

Exercise

The worksheet is in the zip-file, named as follows:

ecofoot_Housing_Exercise_agegroup2.pdf

Following a worksheet with values from the data source https://ec.europa.eu/clima/sites/campaign/pdf/table_appliances_en.pdf students will have to calculate, under the supervision of the teacher, the weekly electricity consumption of some of the most important electrical devices in their household.

Then, they have to suggest ways to reduce the consumption by 20%. They have to discover which devices should they give up on using, which ones – to reduce their duration of use. The idea is that students must try to put these suggestions in practice, home or even at school, where possible.

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