

## SAFE ENERGY | ENERGY FOR FUTURE

### Educational materials in relation to “Safe energy for future” open lesson

#### **Aims:**

1. The lesson aims to form and develop students’ cognitive skills and enrich their knowledge about energy from renewable sources.
2. Development of critical thinking skills.
3. Forming and developing self-cognition skills, formulation of problem and working hypothesis, problem solving and solution finding approaches.
4. Expanding ecological thinking and behaviour.

#### **Methods :**

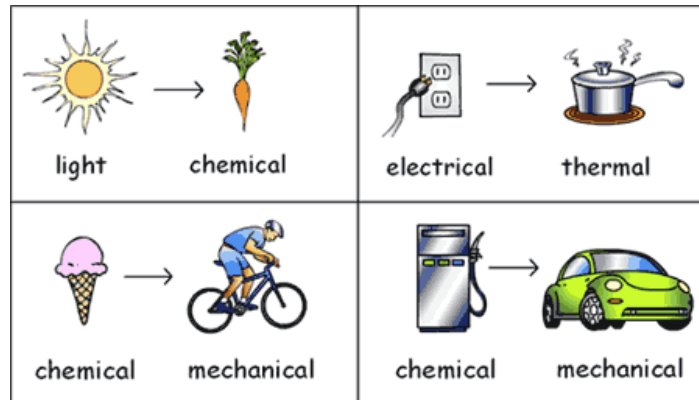
1. Heuristic talk;
2. Monitoring;
3. Demonstration;
4. Discussion and debate;
5. Project - based education.

Some students were given the task to prepare powerpoint presentations and models related to the advantages and disadvantages of the renewable energy – photovoltaic sources, wind hydropower, geothermal energy, biomass, energy from tides and others.

Lesson

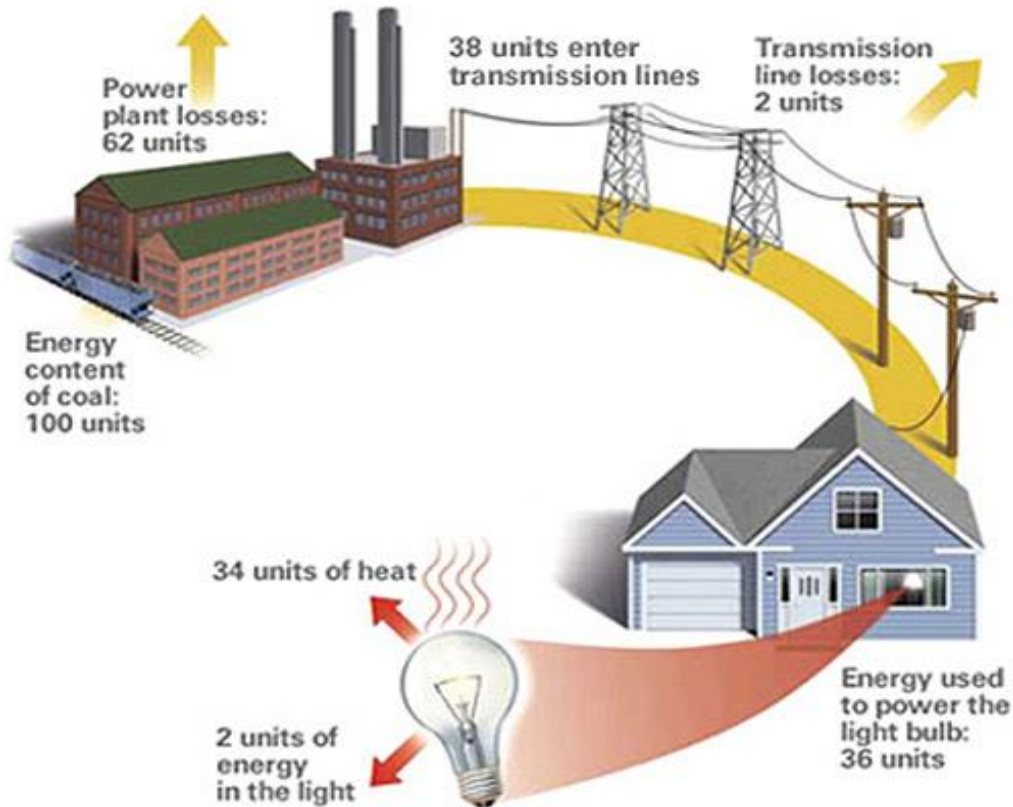


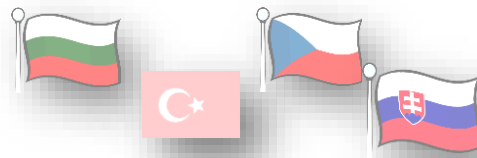
- The beginning of the lesson focuses on the conservation of energy. The energy that nature creates does not disappear or die, rather it transforms from one state to another. Following, there are some experiments related to energy conversion. In addition, it is discussed where and how the energy we use in everyday life is obtained, and the differences between heating, hydro and nuclear power plants.



Summary

- The energy today: coal, oil, natural gas – fossil fuels (created by the decay of plant and animal species).
- Consumed much faster than created.





- Non-renewable.
- Burning of fossil fuels leads to pollution has harmful effects on the environment.
- Uranium nuclear fuel – there is a problem with radioactive waste.

Question: Do we need to change the way we obtain energy and if yes – why?

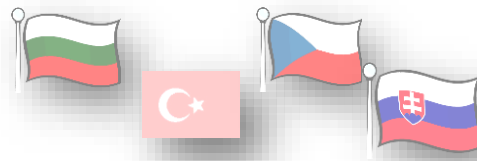
Possible answers:

- Issues related to demographics – the population keeps growing, and with it the need of energy.
- Environmental issues.
- Currently, there is a lack of sustainable development.
- There is a need for energy sources that are timeless and do not pose threat to the environment.

What follows is the students' presentations. Here is the information they have prepared.

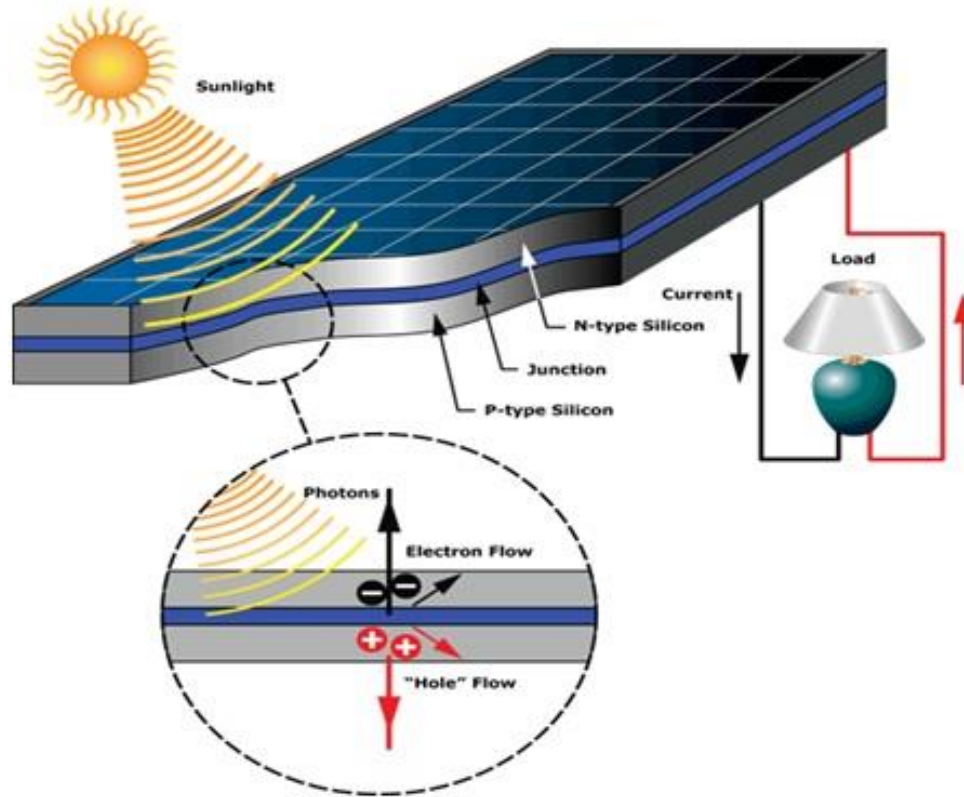


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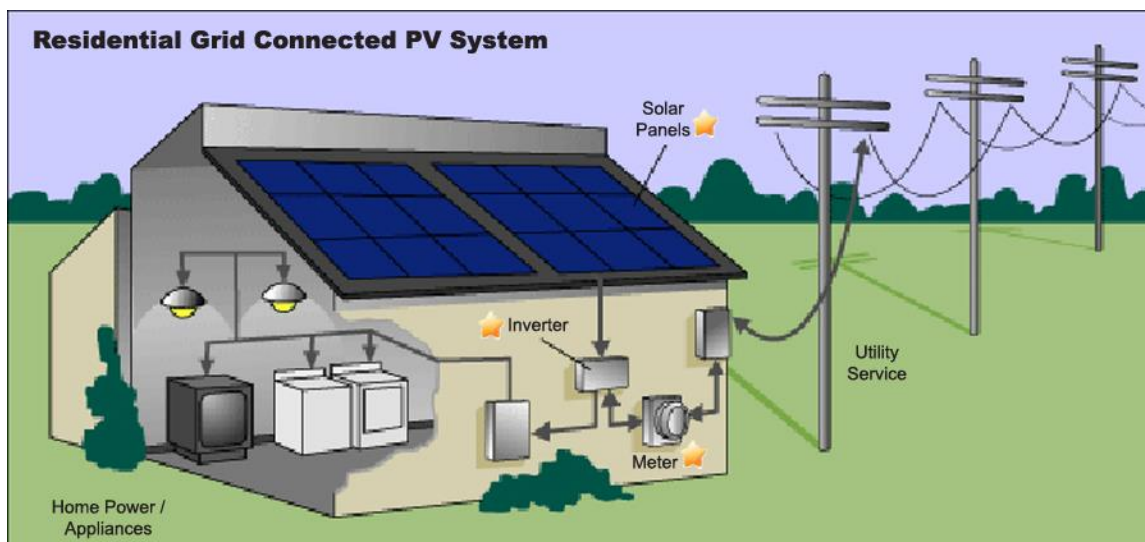


## Solar Energy

Solar energy is probably the most used alternate renewable energy source. It is produced by a solar panel which absorbs the energy from the sun and generates electrical energy by subtracting the absorbed charges into positive and negative. Analogous to batteries which have positive and negative poles if we connect them to some sort of device it starts consuming electrical energy. For example if it is a light bulb it will start glowing.



And here's an example of how solar panels are mostly used. It is a very convenient option. They are installed on buildings' rooftops. The absorbed energy transfers to an inverter and there it is distributed



to the building's devices and it is also connected to the global network. What's more, the building is not obliged to use energy only from its panels but because of its connection to the global network it is able to consume energy from it. This is useful when there's shortage on solar energy during night or when it's cloudy.

Now some facts about solar energy's history. In 1883 Charles Frits invents the very first photovoltaic panel which is not quite efficient but is still the first prototype of all modern panels. During the years people have seen its potential and started developing it. And now its efficiency is approximately 17% which isn't much compared to HPPs, TPPs and NPPs but it's still significant and if we install enough photovoltaic panels in places where there's much solar energy like a desert for instance, we can produce a lot of energy. There actually are a lot of similar projects in progress.

In conclusion we can say that solar energy more oftenly finds application in various cases.

## **Hydroelectricity**

Hydroelectricity is the term referring to electricity generated by hydropower; the production of electrical power through the use of the gravitational force of falling or flowing water. It is the most widely used form of renewable energy, accounting for 16 percent of global electricity generation – 3,427 terawatt-hours of electricity production in 2010, and is expected to increase about 3.1% each year for the next 25 years.



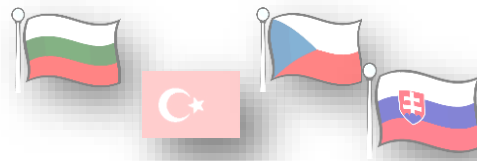


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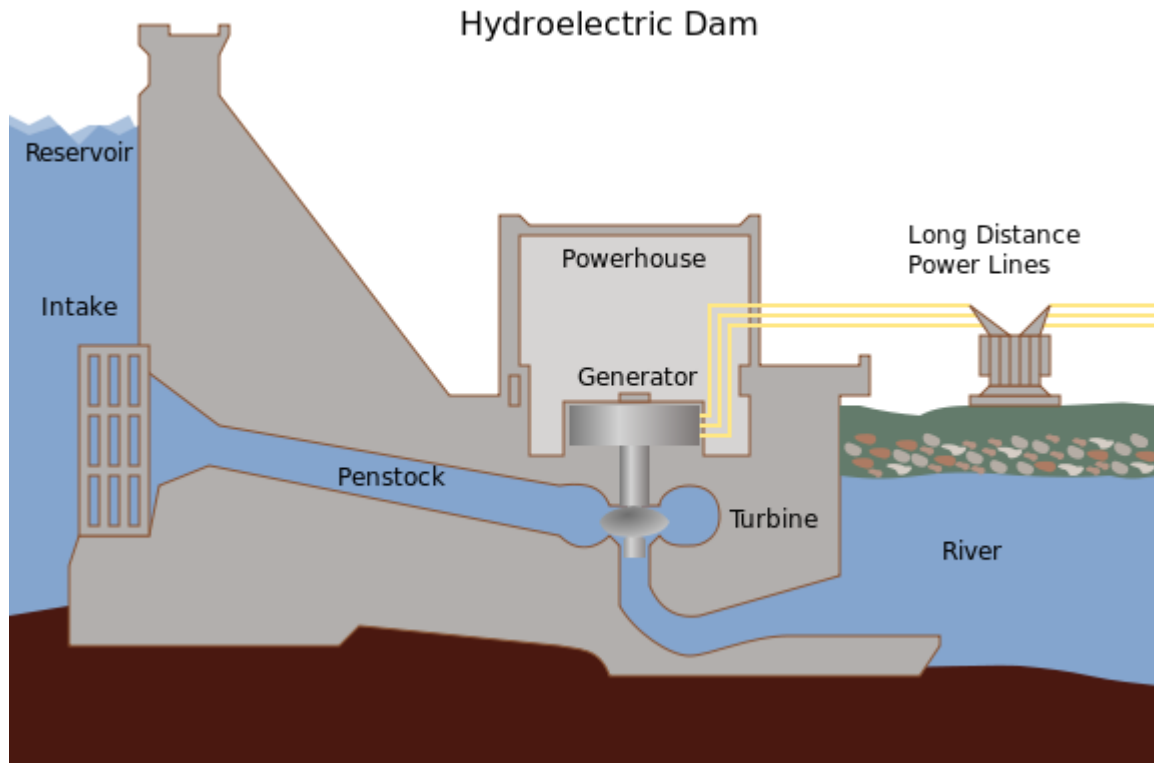




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Hydropower is produced in 150 countries, with the Asia-Pacific region generating 32 percent of global hydropower in 2010. China is the largest hydroelectricity producer, with 721 terawatt-hours of production in 2010, representing around 17 percent of domestic electricity use.



The cost of hydroelectricity is relatively low, making it a competitive source of renewable electricity. The average cost of electricity from a hydro station larger than 10 megawatts is 3 to 5 U.S. cents per kilowatt-hour. It is also a flexible source of electricity since the amount produced by the station can be changed up or down very quickly to adapt to changing energy demands. However, damming interrupts the flow of rivers and can harm local ecosystems, and building large dams and reservoirs often involves displacing people and wildlife. Once a hydroelectric complex is constructed, the project produces no direct waste, and has a considerably lower output level of the greenhouse gas carbon dioxide (CO<sub>2</sub>) than fossil fuel powered energy plants.

### **Wind Energy**

Wind energy is one of the three most popular renewable energy sources. So what is it? It represents the movement of air masses in the atmosphere. It can be converted to usable energy via wind turbines and is most commonly converted to mechanical and electrical energy. There are a lot of benefits like the fact it is a renewable source, it doesn't pollute the environment and it doesn't cause any climate anomalies.

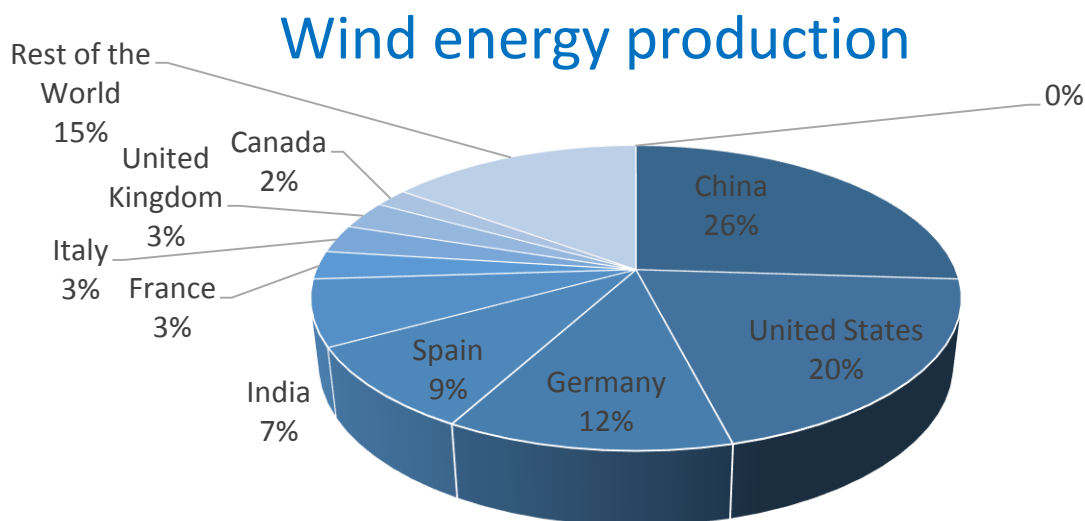


What is not really great is that it is a really expensive investment and that's why there aren't too many parks of this kind.

Anyway, in order to obtain such energy we need wind turbines. How do they work? They have fins which are attached to a rotor. The wind causes the fins to spin and a generator converts the produced mechanical energy to electrical energy which is then transferred to the global network.

Wind energy is used in water as well. It is not similar to hydroelectric power because it doesn't use water pressure but uses something called water wind instead. The principle of work is the same – the flow makes the fins spin and energy is produced. However, in order to put these turbines on the bottom of a sea or an ocean you need special equipment. If we want to put them to lie on the bottom just like that we can do it at maximum 20-30 meters of depth. If we want to place them deeper we need special pylons. But military forces are against such projects because turbines cause the so called radar chaos. In other words if you place a plane radar near a turbine park you will think that foreign military air force squadron is invading your country. In order to stop that from happening there are a lot of projects in development.

Now here is some data about wind energy production throughout the world. In 2008 the total of wind energy production was 121.2 GWh. China has the biggest share in this achievement with 26% followed by US, Germany and some other countries. All countries which are not shown on the diagram produce 15% of this kind of energy.





## Unusual Sources

Except the three basic renewable energy sources there are some more sources which are rather unusual and still haven't been applied much but they are a potential substitute for the former three.

First, we'll talk about energy from salt water. When you insert salt water in sweet water a lot of energy is released. So if we put special power plants there we can gather that energy and it can easily be transferred to the global network. It is based on an event called osmosis. Salt water reduces the concentration of sweet water by applying a lot of pressure. This pressure can be absorbed with special turbines.

Next source is related to biofuel. The source is called helioculture. The process of gathering energy involves combining solar energy, salt water, nutrients, photosynthesis and carbon dioxide and converts them directly into carbon fuel. There's no need of filtration or refinement.

Piezoelectricity is also a very interesting source. It is about converting kinetic energy into electric energy. In this case when people step on a special piezo crystal some physics is involved and energy is produced. They are put in people's shoes, on big squares, there's even a highway built with this crystal and passing cars create energy. Thermal energy can be gathered from the oceans by simply using the temperature difference between water at the bottom and water on top.



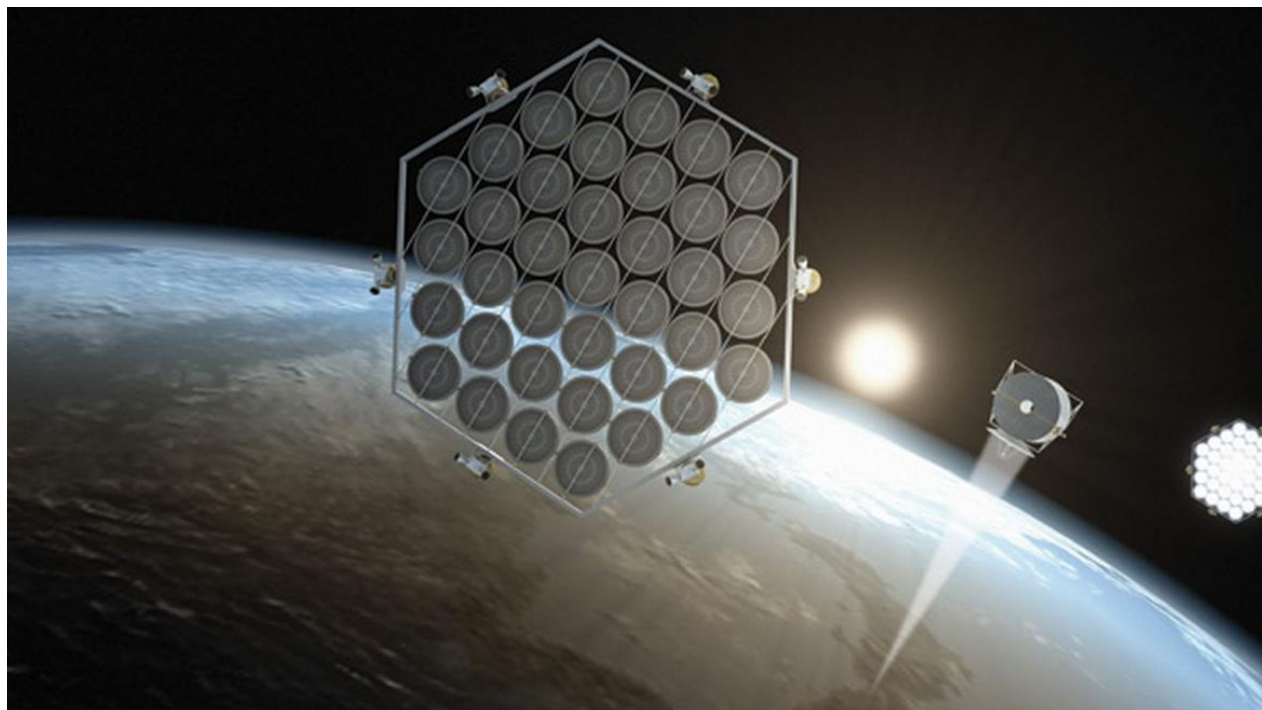
Another interesting source is human excrement. It is exactly what you think it is. Actually, there even are some projects in England for buses powered by this source. It is a type of biogas. It isn't very efficient but there is a lot of material in sewers from all over the world and it can be used to create a lot of energy.

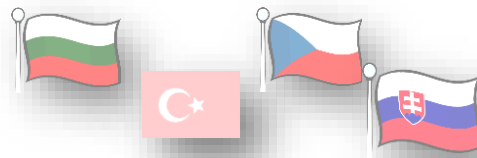
Another one – obtaining energy from dry heated rocks. By injecting cold water in rocks buried deep beneath in the earth crust and heated by Earth's mantle, we heat the cold water, it then evaporates and special steam turbines create energy. The advantages are that this process can be executed constantly and it can easily be controlled.

Now more about energy from evaporation. Scientists inspired by plants' natural mechanism have created artificial leaves which gather evaporated water and condense it and then they produce energy.

We can also obtain energy from the moon. There is a nonradioactive isotope called Helium-3 which is very productive and efficient but there's not much of it on Earth. But there's lots of it on the moon. There are a lot of projects about obtaining this substance from there.

Another source – energy from space. The Sun radiates energy in space all the time – no matter what's the clock or what the atmospheric conditions are. That's why there are projects in development for planting special panels in space to absorb the energy and then send it back to Earth. In order to do that scientists are trying to create wireless energy transfer by microwaves.





## Summary

Moving forward, it is believed that people should change the way they obtain energy and use renewable energy sources. Following, the students were asked if they could give examples of renewable energy, if they have seen or used them. After students' presentations about various sources of renewable energy, the disadvantages and advantages were outlined and discussed.

In addition, after the project tasks are presented conclusions and summary can be made of the benefits of an increase in the obtained energy obtained from renewable sources.

In a global sense – Society's sustainable development is defined and outlined that one of the objectives of "Europe 2020" is the reduction of greenhouse gas emissions and increase in energy that is generated from renewable sources.

Definition of Sustainable development – using natural resources to meet people's needs and at the same time preserve the natural balance in the environment, so that these needs can be met both now and in the future.

- Reducing greenhouse gas emissions
- Reducing secretion of acids
- Improving air quality
- Solving the social problems that currently accompany the use of energy.

The lesson ends with a strong message to the students: **What we do today defines our lives tomorrow!**