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| **Title** | **Module** |
| **Aims** | 1. Be aware of bioenergy and biofuels as a resource in our lives. 2. Be familiar with the different uses of bioenergy and biofuels in domestic, agricultural, industrial areas and understand their importance. 3. To develop critical thinking to the use of biofuels. |
| **Key competences.** | **With this module our students will develop the following competences:**   1. **Linguistic competence**: being able to express and interpret concepts, facts and opinions; interacting linguistically in an appropriate and creative way. 2. **Mathematical competence**, applying mathematics to interpret events and situations. 3. **Competence in knowledge and interaction with the physical world**, recognizing processes and describing them, representing data in the form of a graph or a scheme. 4. **Competence in the treatment of information and digital competence**, using Internet, pc, smartphones, etc. in the search of and the treatment of information. 5. **Social and civic competence**, participating in group work in an effective and constructive way, expressing active position towards the use of bioenergy and biofuels. 6. **Cultural and artistic competence,** having necessary values and principles, and demonstrating appropriate attitudes and behaviour; taking photographs, creating posters or other pieces of information on the topic ”Bioenergy. Biofuels”. 7. **Competence in learning to learn**, building on prior learning and life experiences in order to use and apply knowledge and skills in a variety of contexts. 8. **Competence for autonomy and personal initiative,** empowering the critical approach in order to confront the topic of biofuel and search for responsible solutions. |
| **Approx. time** | 6 sessions (Material Annex) |
| **Methods** | Different methods are used |
| **Age** | 12-19 |
| **Assessment** | SESSION 6  Answering the questions about the issues the students have learnt during sessions 1-5. |
| **Necessary material** | PC, projector, smartphone / tablet with access to the Internet, camera, board, pens, coloured pencils, etc. |
| **Remarks** | Background information for teachers (Annex 2) |
| **WEB LINKS** | * http://biofuel.org.uk * http://www.biofuelstp.eu * <https://www.youtube.com> * http://www.alternative-energy-news.info |

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| **ACTIVITIES** | **SUBJECT / AREA** | **LEVEL /AGE** |
| 1. **Group Work** (time for this work – up to 1-2 weeks). | IT, LANGUAGES | 12-19 |
| * 1. Search the information about biofuels on web pages.   e.g. <http://biofuel.org.uk/>, <http://www.biofuelstp.eu/> or use other web pages. |
| * 1. Answer the questions:      1. What types of bioenergy are used in your country/region?      2. What types of biofuels are used in your country/region?      3. What is the most abundant type of biofuels found in your country/region?      4. What types of biofuels are produced in your country/region? |
| * 1. Create an infografic showing the use of biofuels in your household/region/country |
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| **ACTIVITIES** | **SUBJECT / AREA** | **LEVEL /AGE** |
| 1. **Group Work** | LANGUAGES,BIOLOGY | 14-19 |
| * 1. Look through the web pages. Read 1-2 articles from each page. Be ready to discuss about the issues you have read.   <http://www.alternative-energy-news.info/headlines/biofuels/> .  <http://biofuel.org.uk/biofuel-news.html>  (You can choose articles from the local web pages). |
| * 1. Answer the questions “What new has happened recently? What is their opinion about that? |
| * 1. Students work in groups and complete the sentence **“Biofuels may be good for the climate — but they could be bad for......”.** |
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| **ACTIVITIES** | **SUBJECT / AREA** | **LEVEL /AGE** |
| 1. **The biofuel cycle** | ART, CHEMISTRY, BIOLOGY | 12-19 |
| * 1. Look at the picture and discuss the biofuel cycle.   http://image.shutterstock.com/z/stock-vector--biofuel-life-cycle-biomass-ethanol-from-corn-sugarcane-wood-diagram-illustration-392427910.jpg  http://www.shutterstock.com/pic-392427910/stock-vector-biofuel-life-cycle-biomass-ethanol-from-corn-sugarcane-wood-diagram-illustration.html?src=zDKHSeZLSNAaPhlmYeAgtA-1-11 |
| * 1. Create a poster promoting the use of biofuels |
| **TEXT:**  **CO2 cycle**  The carbon cycle is the circulation and transformation of carbon back and forth between living things and the environment. At normal temperatures carbon dioxide is a colourless gas that exists naturally in the Earth’s atmosphere. The air that we breathe has about 0.03% of carbon dioxide in it. Carbon dioxide is an important part of the carbon cycle and essential for life on Earth. Without it temperatures on our planet would be very low.  Plants use carbon dioxide in a process known as photosynthesis. During photosynthesis, plants give off oxygen as a waste product. Carbon dioxide moves from the air into the leaves of plants through tiny openings in the plant’s leaves. Oxygen moves out of the plant leaf through these same openings.  All animals, including humans, require oxygen to survive. Animals breathe in the oxygen made by plants and breathe out carbon dioxide as a waste product. Even animals that live underwater need oxygen. These animals pass water over their gills to take in dissolved oxygen that is made by water plants. The water plants in turn take in the dissolved carbon dioxide from the water.  The gas is also produced when fossil fuels are burned. Carbon dioxide that has been stored for millions of years in coal, oil and natural gas is set free. It is emitted from volcanoes and hot springs. Deforestation sets carbon that is stored in trees free.  If too many trees are cut down, or if too much carbon dioxide is created by the burning of fossil fuels, an area may become polluted with an excess of CO2. This can result in an unhealthy balance and may contribute to global warming.  (Sources: <http://expeditieaarde.blogspot.lt/2015/02/carbon-dioxide.html>  <http://teeic.indianaffairs.gov/er/carbon/carboninfo/cycle/>  https://www.smore.com/6k7zg-carbon-dioxide-oxygen-cycle) | | |
| **ACTIVITIES** | **SUBJECT / AREA** | **LEVEL /AGE** |
| 1. **Creative work** (timefor this work – up to 1 week). | LANGUAGES | 12-14 |
| Write a short article (50-80 words) „Are biofuels needed in our life?” |
| Write a short article (90-130 words) „Why should we start using biofuels in our life?” | 15-19 |
| 1. **Assessment** | **SUBJECT / AREA** | **LEVEL /AGE** |
| * 1. Answer the questions.  1. What do you know about biofuels? 2. What kind of things is biofuel produced from? 3. What do you know about CO2 cycle? 4. What types of biofuels are produced in your country/region? | ANY LESSONS | 12-14 |
| * 1. Answer the questions.  1. What do you know about bioenergy? 2. What do you know about biofuels? 3. What kind of things is Biofuel produced from? 4. What do you know about CO2 cycle? 5. What are first-generation biofuels? 6. What are second-generation biofuels? | 15-19 |

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| **ACTIVITIES** | **SUBJECT / AREA** | **LEVEL /AGE** |
| **1. “Warm-up”** | ANY LESSONS |  |
| * 1. Watch the videos and discuss the information.   <https://www.youtube.com/watch?v=iqhLi1ORxf4> | 12-19 |
| * 1. Watch the videos and discuss the information.   <https://www.youtube.com/watch?v=T_S7Q3Uede4>  <https://www.youtube.com/watch?v=xAms3Q_3pXg> | 15-19 |
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**ANNEX 2 Background**

**Bioenergy**

Bioenergy is [renewable energy](https://en.wikipedia.org/wiki/Renewable_energy) made available from materials derived from biological sources. Biomass is any organic material which has stored sunlight in the form of chemical energy. As a fuel it may include [wood](https://en.wikipedia.org/wiki/Wood), wood waste, [straw](https://en.wikipedia.org/wiki/Straw), [manure](https://en.wikipedia.org/wiki/Manure), [sugarcane](https://en.wikipedia.org/wiki/Sugarcane), and many other by-products from a variety of agricultural processes. In its most narrow sense it is a synonym to [biofuel](https://en.wikipedia.org/wiki/Biofuel), which is fuel derived from biological sources. In its broader sense it includes [biomass](https://en.wikipedia.org/wiki/Biomass), the biological material used as a biofuel.

(Sources: <https://en.wikipedia.org/wiki/Bioenergy>;

https://www.iea.org/topics/renewables/subtopics/bioenergy/)

**Biofuel**

**Biofuels** are liquid and gaseous fuels produced from biomass – organic matter derived from plants or animals.

There are agricultural products specifically being grown for [biofuel](https://en.wikipedia.org/wiki/Biofuel) production. These include [corn](https://en.wikipedia.org/wiki/Maize), and [soybeans](https://en.wikipedia.org/wiki/Soybeans) and to some extent [willow](https://en.wikipedia.org/wiki/Willow) and [switch grass](https://en.wikipedia.org/wiki/Switchgrass) on a pre-commercial research level, primarily in the United States; [rapeseed](https://en.wikipedia.org/wiki/Rapeseed), [wheat](https://en.wikipedia.org/wiki/Wheat), [sugar beet](https://en.wikipedia.org/wiki/Sugar_beet), and willow (15,000 ha or 37,000 acres in Sweden) primarily in Europe; sugarcane in Brazil; [palm oil](https://en.wikipedia.org/wiki/Palm_oil) and [miscanthus](https://en.wikipedia.org/wiki/Miscanthus) in Southeast Asia; [sorghum](https://en.wikipedia.org/wiki/Sorghum) and [cassava](https://en.wikipedia.org/wiki/Cassava) in China; and [jatropha](https://en.wikipedia.org/wiki/Jatropha) in India. [Hemp](https://en.wikipedia.org/wiki/Hemp) has also been proven to work as a biofuel. [Biodegradable](https://en.wikipedia.org/wiki/Biodegradable) outputs from industry, agriculture, forestry and households can be used for biofuel production, Examples of [biodegradable wastes](https://en.wikipedia.org/wiki/Biodegradable_waste) include straw, timber, manure, rice husks, sewage, and food waste. The use of biomass fuels can therefore contribute to waste management as well as fuel security and help to prevent or slow down [climate change](https://en.wikipedia.org/wiki/Climate_change), although alone they are not a comprehensive solution to these problems.

Biomass can be converted to other usable forms of energy like methane gas or transportation fuels like ethanol and biodiesel. Rotting garbage, and agricultural and human waste, all release methane gas—also called "landfill gas" or "biogas." Crops, such as corn and sugar cane, can be fermented to produce the transportation fuel, ethanol. Biodiesel, another transportation fuel, can be produced from left-over food products like vegetable oils and animal fats. Also, Biomass to liquids (BTLs) and cellulosic ethanol are still under research.

(Source: https://en.wikipedia.org/wiki/Biofuel)

**First generation biofuels**

"First-generation" or conventional biofuels are made from sugar, starch, or vegetable oil.

(Source: https://en.wikipedia.org/wiki/Biofuel)

**Second generation biofuels**

“Second – generation” biofuels, also known as advanced biofuels, are fuels that can be manufactured from various types of [biomass](https://en.wikipedia.org/wiki/Biomass). First generation biofuels are made from the [sugars](https://en.wikipedia.org/wiki/Sugar) and [vegetable oils](https://en.wikipedia.org/wiki/Vegetable_oil) found in arable crops, which can be easily extracted using conventional technology. In comparison, second generation biofuels are made from woody crops, agricultural residues or waste, which makes it harder to extract the required fuel.

(Source: https://en.wikipedia.org/wiki/Biofuel)