ENERGY. TEACHER'S MANUAL

LEVEL 1

Energy and sustainability. OBJECTIVES OF THE LESSON

The aim of this topic is mainly for students to learn what energy is, where it comes from, how it is produced and what its environmental impact is so that they can make conscious decisions in their hairdressing salon.

In addition to this manual, two other manuals are available:

- The teacher's resource kit, where you will find activities, PowerPoint presentations and other tools to use in the classroom.
- The student handbook, in which they have all the information to prepare in advance or to use during the classes.

General objective of the lesson To know what energy is and its environmental impact.
Knowledge • Explain what energy is and its types. • Identify energy sources. • Distinguish between renewable and non-renewable energies. • To understand the environmental impact of energy. • Explain what clean energy is. **Ability** • Describe the energy used in the hairdressing salon. • Recognise and assess the feasibility of using clean energy in the classroom. • Calculate the energy consumption of a room. • Group discussion to share ideas and reflections, evaluating results. **Attitude** • Be aware of the need to choose clean energy. • Propose ways to reduce energy consumption. • Evaluate outcomes.

Additional learning outcomes
Additional competences in terms of knowledge, skills and attitudes are captured here, as some learners have a different pace of work or level of understanding. It can also be applied to differentiate between different levels of VET learning.

By the end of the topic, higher ability learners should be able to:

- To learn about various sources of clean energy applicable to the hairdressing salon.
- Investigate clean energy suppliers that can supply the hairdressing salon.

By the end of the topic, lower ability students should be able to:

- To know what energies are and which ones are applied in the hairdressing salon.
- Understand that energy use has a high environmental impact.

PROGRAMMING AND TIMING OF THE LESSON

In this lesson we focus on energy, its types, forms of production and uses in the classroom.

Total hours = 10-15h.

The programming has been carried out considering that each session is of one hour, however the material is adjusted to 50 min. to allow the initial reception of the students and the recapitulation of activities developed at the end.

Purpose of the lesson:

- Students should know what energy is.
- Students to distinguish the types of energy.
- Students to recognize clean energies.
- Knowledge about the environmental impact of energy use.

Planning:

Approximate scheduled time (total hours 10-15h = 10-15 sessions of 1 hour)		**What**	**How**	**Tools**
Session 1	10 min.	Introductory video	Video viewing 1. Refer to the teacher's resource kit.	Projector, digital whiteboard or computers.
	40 min.	Theory: General concept of energy and its properties, types of energy	Teacher's presentation.	Power-point. See the teacher's resource kit. Whiteboard and projector or

		and electrical energy.		digital whiteboard.
Session 2	10 min.	Activity 1	Students work in pairs to solve activity number 1.	Pair activity by completing the activity sheet. See the teacher's resource kit.
	15 min.	Discussion on activity 1: students report their findings to the group and discuss their truth or accuracy.	Student-centered. Teacher guides and corrects at the end.	Blackboard.
	15 min.	Activity 2	Students work on a one-to-one basis.	The teacher can provide different locations or leave it up to the students to decide.
	10 min.	Sharing of activity 2	Students present their findings.	
Approximate scheduled time (total hours 10-15h = 10-15 sessions of 1 hour)		**What**	**How**	**Tools**
Session 3	40 min.	Theory: Concepts of energy sources.	Teacher's presentation.	Power-point. See the teacher's resource kit. Whiteboard and projector or digital whiteboard.
	10 min.	Videos on renewable and non-renewable energy sources.	Watch videos 2 and 3. See the teacher's resource kit.	Projector, digital whiteboard or computers.
	5 min.	Video on blue energy.	Video viewing 4. See teacher's resource kit.	Projector, digital whiteboard or computers.
Session 4	15 min.	Activity 3	Students work on a one-to-one basis.	Computer or telephone.

	15 min.	Sharing of activity 3	Students present their findings and discuss the importance of fossil fuels.	The teacher guides the discussion by proposing questions on fuel applications and possible alternatives.
	20 min.	Activity 4	Students work on a one-to-one basis.	Computer or telephone.
Approximate scheduled time (total hours 10-15h = 10-15 sessions of 1 hour)		**What**	**How**	**Tools**
Session 5	50 min.	Sharing of activity 4	Students present their findings and discuss energy use.	The teacher guides the discussion by proposing questions about the different energies and their options for use in the classroom.
Session 6	10 min.	Video on energy and the environment.	Video viewing 5. Refer to the teacher's resource kit.	Projector, digital whiteboard or computers.
	40 min.	Theory: Concepts on the environmental impact of energy and clean energy.	Teacher's presentation.	Power-point. See the teacher's resource kit. Whiteboard and projector or digital whiteboard.
Approximate scheduled time (total hours 10-15h = 10-15 sessions of 1 hour)		**What**	**How**	**Tools**
Session 7	5 min	Video on energy and the environment.	Video viewing 6. Refer to the teacher's resource kit.	Projector, digital whiteboard or computers.

	45 min.	Activity 5	Students work on a one-to-one basis.	Computer or telephone.
Session 8	35 min.	Sharing of activity 3	Students present their findings and discuss the importance of fossil fuels.	The teacher guides the discussion by proposing questions on different energies and encouraging debate on nuclear energy.
	15 min.	Video on nuclear energy	Video viewing 7. Refer to the teacher's resource kit.	Projector, digital whiteboard or computers.
Approximate scheduled time (total hours 10-15h = 10-15 sessions of 1 hour)		**What**	**How**	**Tools**
Session 9	30 min.	Activity 6	Students work on a one-to-one basis.	Computer or telephone.
	20 min.	Sharing	The teacher asks the students the meaning of each of the terms and clarifies doubts or expands on the information.	
Session 10	20 min	Video on energy and the environment.	Video viewing 8. Refer to the teacher's resource kit.	Projector, digital whiteboard or computers.
	30 min.	Theory: Concepts on the effects of energy on the environment.	Teacher's presentation.	Power-point. See the teacher's resource kit. Whiteboard and projector or digital whiteboard.

Approximate scheduled time (total hours 10-15h = 10-15 sessions of 1 hour)		**What**	**How**	**Tools**
Sessions 11 and 12	100 min.	Activity 7	Students work on a one-to-one basis.	Computer or telephone.
Session 13	30 min.	Activity 8	Students work in groups.	Computer or telephone.
	20 min.	Sharing	The actions are outlined and a complete checklist is generated.	Computer and digital whiteboard.
Session 14	50 min.	Theoretical test	Students respond to the questions posed.	Paper or Google Form.

ENERGY.

LEVEL 1
Energy and sustainability

In hairdressing salons, a lot of energy is used to perform professional services (hairstyling, drying, dyeing...) but also to condition the premises. Can you imagine a hairdressing salon without electricity or hot water? That is why we are going to try to familiarize ourselves with the concept and origin of energy, its consequences for the environment, and what we can do, in our daily life, to reduce consumption and save money, which is always necessary.

We are very used to using words such as renewable energies, sustainability, electricity... and perhaps we do not know very well how to differentiate between all these concepts. That is why the first thing we should address is what we are referring to when we talk about energy and its types, as well as the different sources of energy that exist.

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1. General concept of energy.

Energy is the ability of matter to do work because of its constitution (internal energy), its position (potential energy), its temperature (thermal energy) or its motion (kinetic or mechanical energy), among others.

To understand this definition we will give you an example: when you are drying a client's hair, the dryer emits air and heat thanks to the power of the motor and the electrical resistance (internal energy), if it runs at 220V it will emit more power than if it runs at 120V (potential energy) and, in addition, the air moves the hair (kinetic energy). Of course you could dry your hair using only heat or only movement, but the combination of both accelerates the process.

In short, we can say that energy is the capacity of bodies to do work and produce changes in themselves or in other bodies, allowing things to function.

If we look around us, we can see how energy is present everywhere. For example, the blades of a windmill move thanks to the energy produced by the wind, people walk thanks to the energy provided by food, bicycles move thanks to the energy produced by the movement of the pedals... Energy is therefore essential for life because it is the cause of the changes and transformations that we are constantly seeing around us.

Energy has 4 basic properties:

- **It transforms.** Energy is not created, but transformed, and it is during this transformation that the different forms of energy manifest themselves. E.g.: the sun's heat is transformed into mechanical energy when it heats the air and creates wind; or electrical energy is transformed into light energy when we switch on a lamp.
- **It is conserved**. At the end of any energy transformation process there can never be more or less energy than there was at the beginning, it is always conserved. Energy is not destroyed.
- **It is transferred or transported**. Energy passes from one body to another in the form of heat, waves or work.
- **It degrades**. Only a part of the transformed energy is able to produce work and the other part is lost as heat or noise (unwanted mechanical vibrations).

In short, energy is neither created nor destroyed, it is only transformed into another type of energy.

2. Types of energy.

Energy can manifest itself in different ways and, depending on the actions and changes it can bring about, we can speak of energy:

Thermal. It is associated with the amount of energy that passes from a hot body to a colder body in the form of heat.
Mechanics. It is the energy created by bodies due to their motion.
Electrical. It is the energy generated by the movement of positive and negative electrons inside conductive materials.
Chemical. It is the one that manifests itself through different chemical reactions.
Electromagnetic. It is generated by the movement of electric and magnetic particles that move and oscillate at the same time and propagate through space.
Nuclear. It is the energy resulting from the disintegration of some atoms, as a consequence of the release of the energy stored in their nuclei.
Luminous. It is that which is present in light etc.

There are others but they are not applicable to the hairdressing salon, such as gravitational or radioactive.

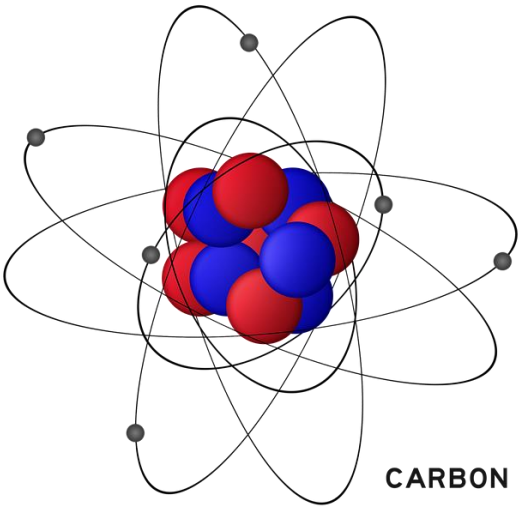
3. Electrical Energy.

Of all the types of energy that exist, we are going to take a closer look at electrical energy because it is the one we use most in our daily lives and because, in a hairdressing salon, electricity is responsible for the operation of all large and small electrical appliances (washing machines, hairdryers, irons, etc.), lighting and, in most cases, air-conditioning.

We don't usually stop to think about how electricity is generated, how it reaches our homes or businesses and why, at the flick of a switch or push of a button, we suddenly have light, can cook or listen to music. All around us there are all kinds of devices, vehicles and appliances that run on electricity. It seems like magic, and we have become so accustomed to this magic that we cannot conceive of life without electricity.

But behind every magic trick there is a scientific reason and that is what we are going to explain.

3.1. Concept of electrical energy



All bodies, or matter, are composed of atoms. The atom is the smallest part of a substance, and has a nucleus (center) composed of protons (positive particles) and neutrons (uncharged particles). Electrons (negative particles) move around the nucleus.

It is precisely this movement and interaction between the positive and negative electric charges inside conductive bodies that generates energy, which is what we call electricity.

This energy generated by electrical charges can manifest itself in four domains: physical (nature), luminous (light), mechanical (motion) and thermal (heat).

3.2. Electricity production.

Unlike primary energies that are obtained directly from nature (sun, wind, water, gas, etc.), electrical energy requires prior transformation before it can be consumed, which is why we say that it is a secondary energy.

How do we make this transformation?

The step-by-step process is as follows:

a) **Power generation**: Electricity is created in power plants capable of obtaining electricity from primary energies. These electricity generating plants are wholly or partly owned by private companies that sell the energy generated to the companies that market them (traders).

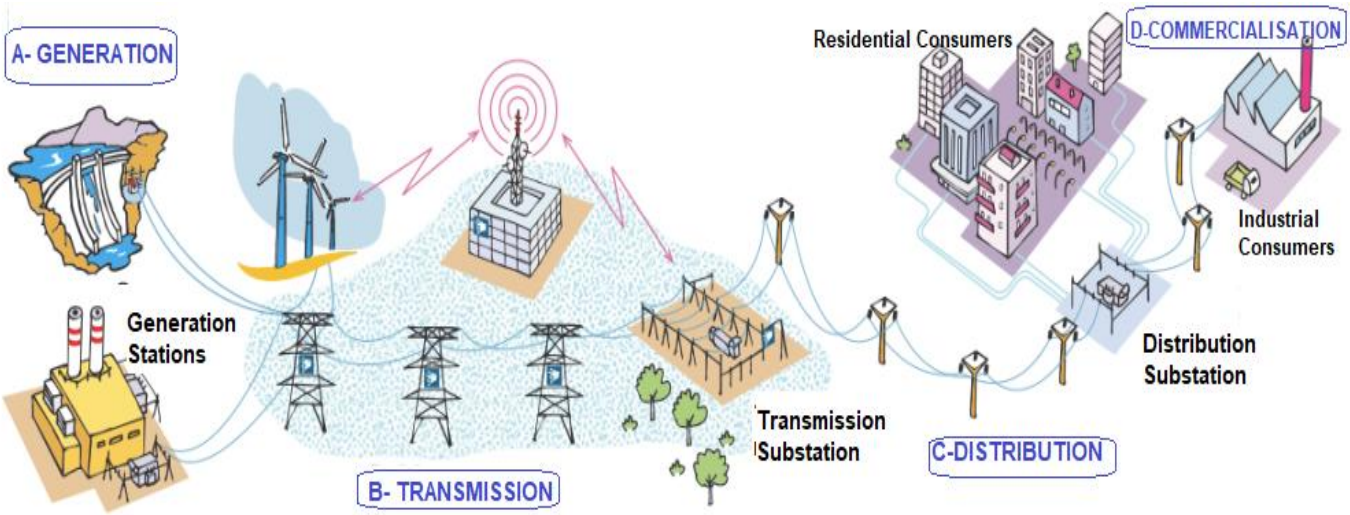
Did you know that? On a small scale and on an individual basis, we can also become a central electricity generator, for example by installing a solar panel on the roof of our house. This is called self-consumption, and even if we generate more electricity than we need, we can sell it and get financial compensation for it.

b) **Power transmission**: once the energy has been obtained and converted into electricity, it is transmitted overhead (pylons) or underground from the power plants to the substations. Substations are necessary to process the electricity and maintain the right voltage and are usually located outdoors near the power plants and/or on the outskirts of cities. If they are not very large, they can exceptionally be found in the city itself, inside a building.

c) **Energy distribution**: From the substations, electricity is sent to the nearest homes and industries. As a receiver of energy and a consumer, you cannot choose your distribution company, since depending on the area in which you live, you will be

assigned to one or another. The company you choose will be responsible for ensuring that the electricity reaches your home correctly and will deal with any faults. It is also the owner of your electricity meter, and sends the meter readings to your electricity company (which is the one that charges you).

d) **Energy commercialization**: your **energy** commercializing company is the one you can choose and it will always be the one that sends you the bills, as it is the one that buys the energy from the generation companies and sells it to you. The energy suppliers will provide you with different rates and offers, although in Spain there is a free market where you pay according to the conditions of your contract, as in any other service rate (mobile, wifi, etc.) and a regulated market (you pay what is established by a system designed by the government).



4. <u>Energy sources.</u>

In the previous point we have indicated that electricity is produced from other sources of energy that we originally found in nature without having been previously transformed, such as coal, natural gas, sun, oil... These primary energies are what we refer to when we talk about "energy sources", since without their prior existence we would not be able to generate electricity.

Energy sources can be classified into two main groups:

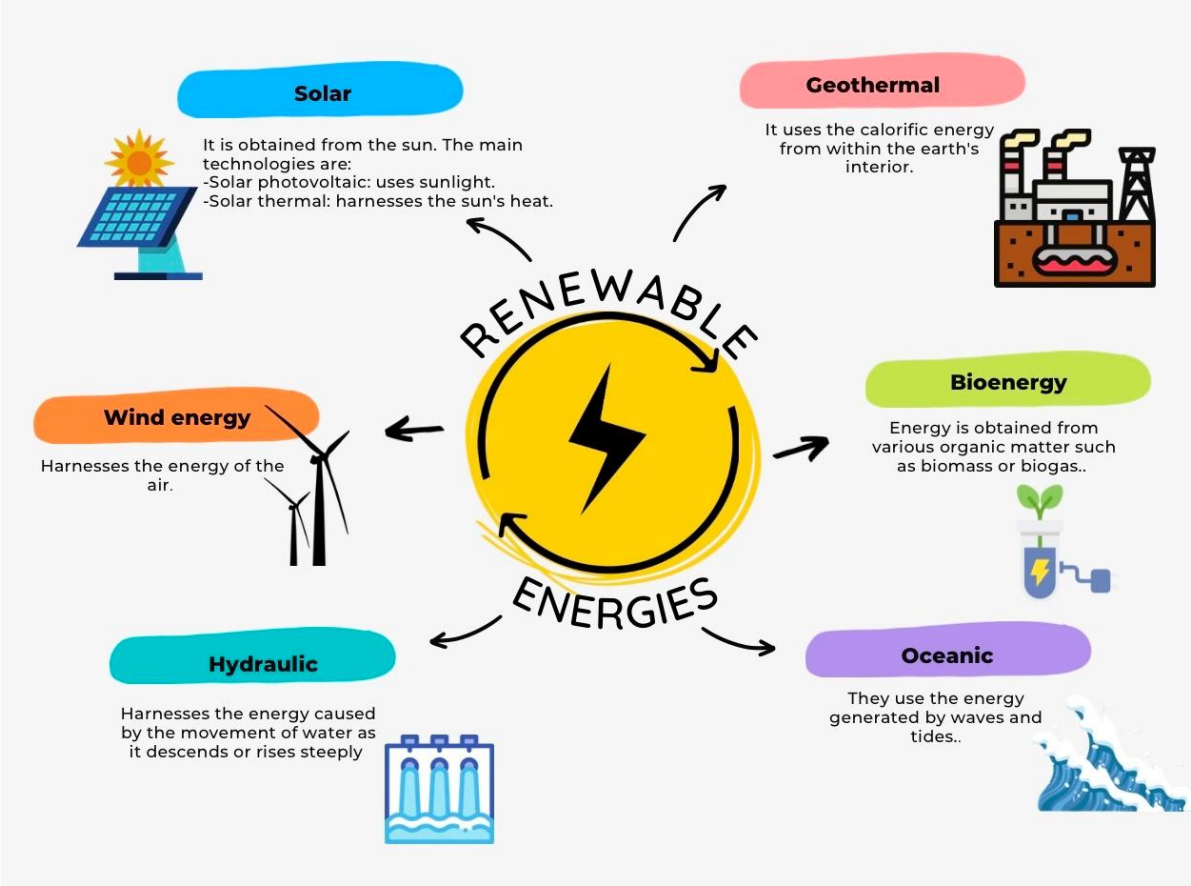
- Renewable energies.
- Non-renewable energies.

Renewable energies are a type of energy derived from inexhaustible natural sources, either because they contain an enormous amount of energy, such as the sun or the wind, or because they are capable of regenerating themselves in a short time, such as biomass.

Non-renewable energy sources are those energies that take millions of years to form and, therefore, their high consumption leads to their depletion (coal, oil and gas).

4.1 Types and characteristics of renewable energies.

Renewable energy sources are classified according to their origin:

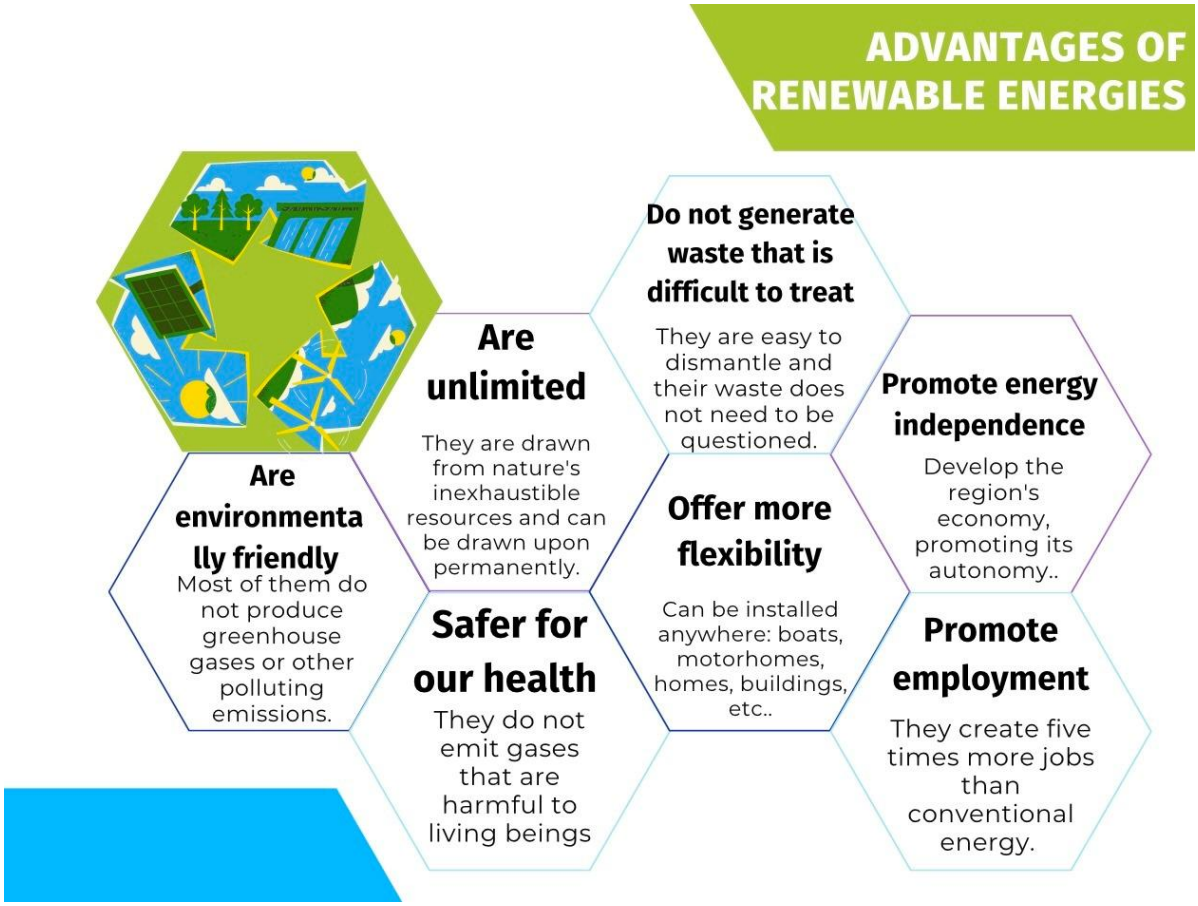


Did you know that?

- There is a type of energy that comes from the physical interaction between fresh and salt water and is called **Blue Energy**.
- That we can extract the ambient energy contained in the air temperature and transfer it to air-condition a room or heat water by means of **aerothermal energy.**

Renewable energies are therefore universally accessible, available in all geographical areas of the planet, and within the reach of all countries regardless of their economic power.

In the following diagram you can see the advantages of renewable energies:



However, it must be borne in mind that the performance of renewable energies is intermittent (there is not always sun or wind, droughts, etc.), so the supply of electricity from these sources is also variable. Research is therefore continuing on how to store this energy in order to avoid having to resort to non-renewable energy sources.

Here you can find a very entertaining and easy-to-follow video that summarizes all this information:

4.2 Types and characteristics of Non-Renewable Energies.

Most of the non-renewable energy sources are fossil fuels: coal, oil and natural gas, with carbon being the common element in all these fuels.


COAL


OIL


NATURAL GAS

All fossil fuels were formed in a similar way hundreds of millions of years ago, even before the dinosaurs, and therefore, once they have been consumed, we will not be able to generate them again.

Advantages:

- Fossil fuels are a valuable source of energy.
- They are relatively cheap to extract.
- They can also be stored, channeled or sent anywhere in the world.

Disadvantages

- Non-renewable energy sources are located in certain places (Persian Gulf, United States, Venezuela, Russia) and the countries where these deposits are found trade with these natural resources and impose their economic conditions, sometimes impossible, on other poorer countries or communities. According to the UN, more than 790 million people still do not have access to electricity.
- The burning of fossil fuels is harmful to the environment and is the main cause of climate change. When coal and oil are burned, they release particles that pollute the air, water and land.

A transition from fossil fuels to renewable energy is therefore essential if we are to achieve economic prosperity for all and for all, and a nature safe from the crisis caused by man's action and involvement in climate change.

4.3. Nuclear energy.

Nuclear energy will be dealt with separately because there is currently a great debate on whether it is considered renewable energy or not.

Nuclear energy is obtained from the fission or fusion of uranium and plutonium atoms. These materials occur naturally in some terrestrial rocks, and do not come from fossilization as coal does. This might lead us to believe that it is therefore renewable.

However, the tons of uranium and plutonium that man consumes to produce electrical energy do not regenerate themselves, and in the long term, these materials could be depleted, which is why some argue that it is non-renewable.

Another aspect that is also discussed with regard to nuclear energy is whether it is clean and sustainable energy, as most nuclear reactors only emit water vapor into the atmosphere; no CO2, no methane, no other pollutant gas that aggravates the climate change crisis, but that is something we will see in the next section.

5. <u>Environmental impact of energy</u>

We have already seen how electricity is generated and how renewable energies offer many more advantages than non-renewable energies. However, in this section we are going to look at how energy generation and consumption have an impact on the environment and reflect on this.

From an environmental point of view, the important thing is that the energy sources we use are clean and sustainable, and it is clear that non-renewable energies are dirty and depleting. The CO2 emissions we put into the atmosphere when we generate electricity from coal, natural gas or oil have a major impact on the climate change we are already experiencing. Numerous experts point to the Mediterranean region as one of the areas of the planet most vulnerable to climate change, accelerating the deterioration of resources essential to our well-being such as water, fertile soil and biodiversity, and threatening the quality of life and health of people.

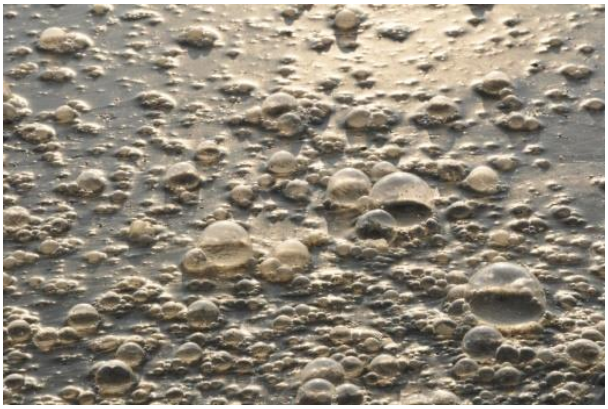
It is therefore essential to replace fossil fuels with renewable energies. Does this mean that all renewable energies are clean and "green"?

5.1- Clean energy.

As we have already seen when talking about nuclear energy, there are different opinions on when to consider clean energy. Of course, these opinions depend on the large number of interests of all kinds at stake, for let us not forget that energy is the foundation of our economic development and of our present and future well-being.

For some countries and companies, Clean Energy is any energy that emits low CO2 emissions into the atmosphere, more specifically, that has an emission rate of no more than 100 kg/MWh, regardless of the rest.

On the opposite side are those who defend that clean energy is only that which, in addition to coming from renewable sources, does not generate pollution, not only atmospheric pollution but of any other type (water, soil, etc.) and that in its generation and transport processes, ecosystems and human rights are respected to a large extent.



From our point of view, we will only be aware of the seriousness of the problem if we assess the problem in its entirety. In other words, the **environmental impact must be assessed:**

- By producing and consuming energy,
- In the extractive activities that certain energy sources require,
- In transport prior to use,
- In the treatment processes to which the different energy resources must be subjected before being used,
- In the waste they generate.
- Respect for human rights.

In the same way, we believe that it is necessary to study not only the sources of pollutant emissions into the atmosphere, hydrosphere and soil, but also to follow them and analyze them up to their final destination in the ecosystems and in mankind.

5.2. Effects on the environment.

In the atmosphere.

The atmosphere is made up of a mixture of gases: nitrogen (78%), oxygen (21%), carbon dioxide (0.04%) and other gases in small proportions, such as methane, helium, neon, etc. Fossil fuels emit a large number of greenhouse gases (carbon monoxide and dioxide, sulphur dioxide, etc.) which, by altering the composition of the atmosphere, alter the climate and cause acid rain and smog.

This is the most serious of the consequences, from which all the others that follow are derived:

In the hydrosphere.

The hydrosphere consists of oceans and seas, saltwater and freshwater lakes, rivers, marshes and wetlands, groundwater, glaciers and ice caps, making up 74% of the Earth's surface.

The main polluting effects of energy production on the hydrosphere derive from:

- The effects of acid rain on inland waters.
- The effects of mining and other extractive activities.
- Thermal pollution of inland waters by power plants (atomic and thermal).

- Dumping of nuclear waste into the oceans.
- Spills (accidental or otherwise) of oil occurring during transport in:
    - Maritime disasters.
    - Pipeline failures.
    - Intentional discharges from tank cleaning, etc.

On the ground.

Soil degradation processes induced by activities related to energy production include:

- Acidification.
- Contamination by heavy metals and organic compounds (hydrocarbons).
- The extraction of minerals such as coal (fossil energy), uranium (nuclear energy), quartz (solar energy), which entails the total destruction of entire ecosystems.

In the biosphere.

The effects on the biosphere can be classified as follows:

- On vegetation cover. Desertification, disappearance of plant species
- On animals and especially humans that makes them more vulnerable to other environmental factors such as diseases (bronchitis, asthma, allergies, cancer) and parasites.

5.3 Other forms of environmental impact.

In addition to the above, there are other environmental impacts of energy production. They are perhaps less important globally, but they often have a great effect at the local level.

Not even those known as renewable, green or clean energies are exempt from certain environmental costs. Among them we can highlight:

- Those resulting from the construction of large hydroelectric power stations, which sometimes entails the disappearance of villages and the diversion of rivers.
- The impact on the landscape and birdlife that wind farms can create.
- The problems of deforestation that uncontrolled use of biomass can generate.
- Problems caused by power lines.
- The conversion of natural areas into landfill sites for electrical components, radioactive waste, accumulator batteries, etc.
- Those resulting from nuclear accidents or warlike use of energy.

Against this backdrop, we should not be discouraged but rather the opposite. Take action and make responsible energy consumption based on the following principles:

- It reduces the amount of energy consumed.
- Use energy efficiently, i.e. use energy that has less impact on the environment and improves the quality of life for everyone.

Of course there are many small gestures we can make in our daily lives and we invite you to reflect on them.

We hope that after reading this didactic unit, you have understood where the energy that we use every day comes from and that it has helped you to remember that with simple gestures and actions we can consume less energy. However, we know that you will still be asking yourself many questions as a hairdresser who needs electrical energy for your profession. We invite you to further explore this topic in the level 2 didactic unit: "Energy in the Hairdressing Salon".

Sources:

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