



## Topic summary:

Located in the heart of three continents, fragile from an environmental point of view, the Mediterranean basin is also a source of energy, whether it is renewable energies (wind, sun) or fossil energies present in its basement. The recent discovery of gas deposits in the eastern Mediterranean also makes it a new energy region.

### Main concepts covered:

- \* Renewable Energy
- \* Fossil Energy
- \* Greenhouse Gas
- \* Generator

### Transversal competencies acquired:

- \* Communicating orally / writing in mother/foreign language
- \* Managing information
- \* Getting organized and planning
- \* Respecting a framework and instructions.



### Definition of key notions:



#### Renewable Energy:

Any energy source that is regenerated at least at the same speed with which it is used. The following energies fall into this category: solar, wind, geothermal, marine, hydroelectric, biomass.



#### Fossil Energy:

The set of energy resources deriving from the transformation process of carbon-rich organic substances, especially plants, buried millions of years ago in an anaerobic environment. The following energies fall into this category: coal, oil, natural gas.



#### Greenhouse Gas:

The gases which are responsible for causing the greenhouse effect, that is the process by which radiation from a planet's atmosphere warms the planet's surface to a temperature above what it would be without this atmosphere. The main greenhouse gas is carbon dioxide.



#### Generator:

An electric generator is a device intended to produce electricity from a different form of energy. The different forms of energy, which are transformed into electricity, are normally mechanical energy, chemical energy, light energy or directly thermal energy.



Energy production is causing considerable harm to the environment and human well-being, although it is useful to our modern way of life and standard of living in today's society. In Europe and as in some parts of the world, fossil fuels dominate the European energy system, representing more than three quarters of the energy consumption of the 33 member countries of the European Environment Agency (EEA) in 2011 and almost 80% of greenhouse gas emissions (EEA, 2013i).

IPCC has stated in these latest reports that the increase in the concentration of greenhouse gases (Ghgs) in the atmosphere is the result of human activity, in particular energy consumption and production, resulting in increased temperatures in the coming years. United Nations Framework Convention on Climate Change Countries agree to limit increase to below 2°C compared to the pre-industrial times (the global temperature has already increased by an average of 1°C worldwide and by 1.4°C in the Mediterranean region). If the temperature rises by more than 2°C, most of the Mediterranean Basin could quickly turn into desert. Mediterranean countries accounted for 6% of global carbon dioxide (CO<sub>2</sub>) emissions in 2015. Although this share is rather low compared to the other regions, it is particularly vulnerable to the consequences of climate change and is likely to be more exposed to extreme events.

In Mediterranean, the “hot spot” of climate change, the effects will take place in agriculture and fisheries (decline in stocks and yields), tourism (heat and drought waves, floods), coastal areas and infrastructure (sea-level rise, extreme weather events), human health (heat waves) and the energy sector (power plant water supply, hydro-electricity and increased consumption).

The scarcity of water resources is likely to affect all sectors. The most vulnerable areas will be those of Southern and Eastern Mediterranean countries (PSEM) where the impacts of climate change could overlap and amplify the pressures on the already existing natural environment and related human activities. In addition, the technical and financial adaptive capabilities of PSEM are more limited. Countries on the North shore of the Mediterranean Sea (NMS) will be more vulnerable in coastal areas as well as in areas with high population growth. Adjustments should be made to avoid or minimise the resulting economic damage and loss.

The energy sector, at the heart of climate change, is the main emitter of greenhouse gases. Climate change directly influences energy production and consumption (especially electricity). In addition, CO emissions are increasing on average faster in the Mediterranean than in the world (Mediterranean Energy Observatory). For example, the region will need to adapt the current energy system and opt for low-CO solutions in order to participate in climate change mitigation efforts.



## Sustainable development issues identified in this topic:

*How to reduce harmful emissions, dependence on fossil fuels and increase energy security?*

### 1. Largely majority of non-renewable energy sources

Fossil fuels (coal, oil and natural gas) provide energy using mainly coal and oil. The oil obtained is the most widely used as petrol. Fossil fuels are problematic because they are responsible for most polluting emissions, such as sulphur oxides (SOX), nitrogen oxides (Nox) or particles, not to mention the impossibility of replacing and renewing this natural resource from a process that takes millions of years.

#### Consumption of non-renewable energy

Nearly 80% of the total energy consumed in the world has a non-renewable origin with a significant and growing consumption. While it remains a major topic of debate regarding its use and waste management, nuclear energy is one of the world's leading non-renewable energy sources.

The consumption of fossil fuels in the North shore of Mediterranean Sea is increasing. Europe is heavily dependent on imports and this makes European countries vulnerable to supply constraints and price instability. In 2011, 56% of all fossil fuels consumed in the EU were imported, compared to 45% in 1990.

To achieve its climate objectives by 2050, the EU must reduce its energy consumption and switch to alternative energy sources. This change would also bring economic, environmental and social benefits. Ensuring an economically efficient transformation of the European energy system requires a wide range of supply and demand actions.

Currently in the Mediterranean region, the primary energy demand of Northern countries exceeds South and East demand, representing 63% of the total energy demand in the Mediterranean. Energy consumption varies continuously and will certainly lead by 2040 to an increase of about 40% in the region's overall energy demand (most of the energy demand will come from the electricity and transport sectors). By 2040, the trend also shows that energy demand in the South and East will exceed the North one, reversing the current proportion. The economic growth of Eastern Mediterranean countries will continue their solid development.

Currently, demand for energy per capita in the South and East is less than half that of the North. As people in Southern and Eastern Mediterranean improve their access to modern energy services, this average will increase significantly in 2040 according to the Reference Case. This rapid increase in the energy demand of Southern and Eastern Mediterranean countries is linked to the trend in Turkey, the second largest consumer in the Mediterranean region. Algeria and Egypt are expected to be major consumers by 2025. The share of other countries is relatively smaller as they are smaller, but some of them may well have the fastest growth rate in energy consumption (Palestine, Tunisia and Syria in particular).

#### Energy mix

The energy mix will remain based on fossil fuels, but the share of fossil fuels could range from two-thirds today to almost half by 2040. At the same time, demand for oil will continue to rise, particularly for fuels in

the transportation sector. While fossil fuels remain the dominant energy source in the Mediterranean primary energy mix in 2040, whatever the scenario, oil will remain the dominant fuel until 2040. Renewable energy is expected to show strong growth trends until 2040, encouraged by incentives, forward-looking policies and technological advances. Energy efficiency is also expected to play a decisive role in end-use sectors and electricity generation: increased renewable energy in the mix will also be essential.

Faced with this increase in energy demand, the countries bordering the Mediterranean are facing several challenges: sustainably managing scarce resources, ensuring access to electricity for populations not yet served, and encouraging users to behave economically. In addition, these tensions may be exacerbated by the effects of climate change. The increase in temperature, the decrease in expected precipitation, would lead to a reduction in resources and an increase in water demand. At the same time, they would lead to a decline in electricity production (hydroelectricity, thermal power stations) and an increase in energy demand for water production and mobilization. It is therefore essential that the Mediterranean region change its energy trajectory and implement energy efficiency measures and renewable energy deployment targets.

## 2. Renewable energies as alternatives

Today, renewable energy is an effective solution. A “renewable, alternative or soft energy” is an energy obtained through an almost inexhaustible resource, either because of the immense amount of energy it contains, or because it is able to regenerate naturally.

These sources would therefore be an alternative to traditional processes and would reduce the environmental impact. The main known energy sources have not reached the stage of “sufficient supply” of energy. Of course, others are to be discovered.

### Solar energy

It captures the energy of the sun through the use of sensor panels. Large fields of solar panels in deserts to collect enough energy to recharge power plants. More and more individuals are using small solar systems to supplement their electricity or to obtain hot water.

The major problem with this energy is the amount of sunlight required. Thus, it is effective only in certain geographical areas of the world. In addition, the lifespan of a module is about 30 years and the recycling channels are not sufficiently effective yet.

### Wind energy

It has become one of the most common forms of energy. New innovations allow to install many wind farms. Using large turbine turbines, a generator activates and generates electricity.

While wind turbines seemed to be an ideal alternative, reality is beginning to reveal an unexpected ecological impact. They are a threat to wildlife causing nuisance for birds and bats.

### Geothermal energy

It is created by the continuous high temperatures from the Earth’s crust. The underground heat warms the water and produces steam. Then the steam is captured to operate turbines, which in turn feed generators. It is clean,

sustainable and environmentally friendly. It can be used on all scales for industrial utilization, for example.

The biggest drawback is that it can only be produced at specific sites.

### The biomass

It is produced from the degradation of organic matter and is commonly used around the world. Electricity is made from the heat generated by the combustion of wood, plants, agricultural waste and household waste. Although this is an innovative solution, many environmental organizations are critical of the large European biomass power plants and their international wood supply chains.

### Hydraulic energy

It is produced thanks to the power of the water that turns the turbines supplying generators. Most of the cities in the world are powered by water. The main problem right now is the aging of dams that require significant work to ensure their functionality and security.

According to the 450 scenario of the International Energy Agency, which would allow to maintain the increase of the temperature on the surface of the world below 2°C, renewable energies will have to cover, in 2040, 58% of the electricity needs, 22 % for the production of renewable heat and cold and 20 % for transport.

Renewable energy will account for nearly 60% of the new capacity installed until 2040. Several factors can encourage this evolution: lower costs, global diffusion of technologies, economic and geopolitical tensions linked to hydrocarbons (fossil fuels), the will to respect the commitments of the Paris Agreement. Regarding the decrease in costs, the International Agency for Renewable Energies (IRENA) estimates that the costs of electricity generated from wind and solar photovoltaic could decrease by 26% and 59% respectively by 2025.

## 3. Conclusion

For a sustainable future, significant investments in renewable energy and strong efficiency and policy measures will be essential. In addition to the obvious environmental benefits, these investments could improve Mediterranean energy infrastructure while reducing energy costs and enhancing security in the region. In addition, reducing geopolitical tensions and the resulting job creation would be a well-being for the whole region and beyond.

However, the simple shift from fossil-based energy production to renewable resources is not enough to «solve» the problem of the environmental impacts of energy production which requires more space and uses some non-renewal elements in batteries. In the Mediterranean, many countries are confronted with land predation (especially on common areas and some protected natural areas) linked to the industrial production of renewable energy. Reducing energy losses, increase energy savings and promoting the decentralization of energy supply networks are also part of solution.



## Position of the topic in the school program:

	11	12	13	14	15	16	17
Mother / Foreign language / Litterature							
History		X					
Geography	X	X	X			X	X
Mathematics							
Biology / Geology		X	X	X	X	X	
Physic / Chemistry	X	X	X	X			
Social Science / Economy / Law							X
Art / Musics							
Technology / Computer science							



## Ressources:

- Agence Européenne pour l'Environnement <https://www.iea.org/>
- Agence internationale de l'Energie <https://www.eea.europa.eu/fr/themes/energy>
- Mediteranean Energy Perspectives, Executive summary, 2018
- L'environnement en Europe, État et perspectives, 2015