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# POLLUTING MATERIALS, THE EFFECTS OF INDUSTRIAL POLLUTION AND DIRECTIONS/SOLUTIONS TO ELIMINATE THESE EFFECTS

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***Abstract:*** *The paper presents an overview of (i) the different polluting materials, classified according to their (bio)degradability, (ii) the sources of pollution (iii) the general effects of pollution on natural resources and on the economy and people's health. The paper also summarizes directions/solutions to eliminate these effects, including "eco" technologies, and their effectiveness on environmental conservation and regional and global ecosystem protection, in the context of a clean and sustainable environment, in accordance with the 2030 Agenda for Sustainable Development.*

## 1. Introduction

Starting from the definition "Environmental sustainability is the responsibility to conserve natural resources and protect global ecosystems to support health and well-being, now and in the future" and taking into consideration that "because so many decisions that impact the environment are not felt immediately", the community of scientists in close contact with decision-makers from all sectors of industry, must Develop Sustainable Strategies according to 2030 Agenda for Sustainable Development[1,2].

Pollution is the contamination of the Earth's environment with materials or substances that interfere with human health, quality of life or the natural functioning of ecosystems (living organisms and their physical surroundings) and has a dramatic effect on natural resources. It is known that the sources of environmental pollution are the result of both natural causes and human activities [3].

But, for the most part, pollution is caused by economic activities that generate polluting materials or substances (atmospheric pollutants, water and/or soil pollutants resulting from industrial technological processes (industrial pollutants) [4] .

As is known, the types of pollutants are of several kinds, three large categories being distinguished, such as physical, chemical or biological pollutants, pollutants that lead to water, air and soil pollution.
Although some sources of environmental pollution are the result of natural causes, such as volcanic eruptions, most pollution is caused by human activities, especially economic activities that generate air pollutants or industrial producers of polluting materials/substances.

But it must also be taken into account that in addition to industrialization and excessive urbanization, mining there is also population growth and cross-border movement of pollutants from developed countries to developing countries and vice vers [5] The main polluting sources for the environment is presented in Figure 1.

From the point of view of degradability, there are two main categories of polluting materials or pollutants: biodegradable pollutants (Figure 2) and non-degradable ones (Figure 3). Among the biodegradable ones, there are products from the agronomic field (fruits, vegetables), materials or substances of animal origin, paper or other solid or liquid substances, such as sludge and sewage [6] waste water, which decompose quickly through natural processes.

The latter mainly pollute the soil and water and these pollutants become a problem when they are produced and discharged into nature (the environment) faster than they can decompose naturally. On the other hand, non-degradable pollutants are materials/substances that do not decompose or decompose slowly in the natural environment (such as for example plastic products, toxic heavy metals, bottles, etc.).

Once contamination occurs, it is difficult or impossible to remove these pollutants from the environment.

Air pollution is also extremely harmful for living beings, with different noxes (Figure 4) resulting from (a) industrial processes like metallurgical, chemical, petrochemical, industry ,(b) through the incineration of organic or inorganic waste[7] , (c) resulting from the transport of air vehicles, terrestrial road/railways, ships [8,9] , or (d) resulting from indoor/outdoor environments of toxic gases [10] .

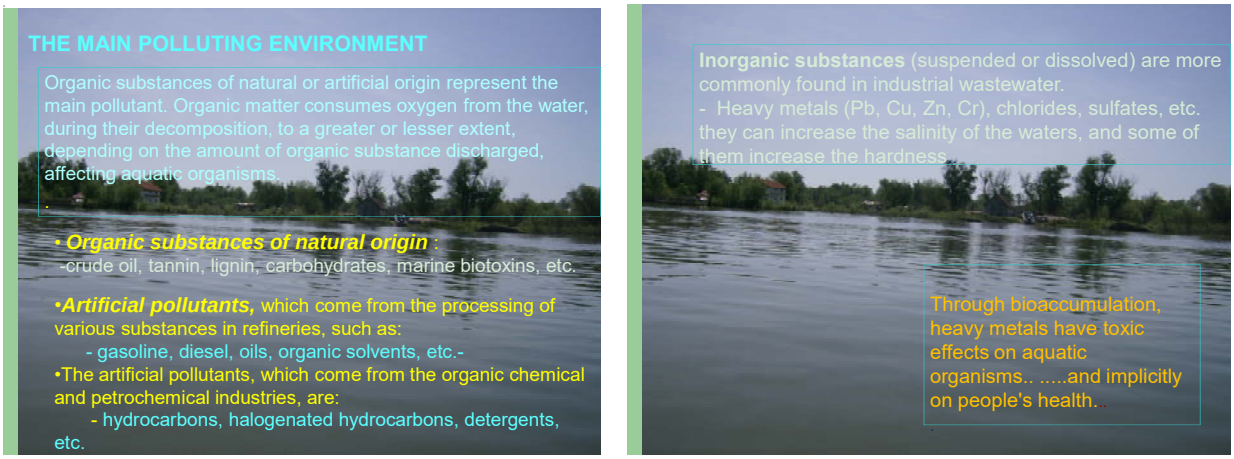



**Figure 1. The main polluting sources for the environment**




**Figure 2 The most common biodegradable pollutants that polluted the environment**



**Figure 3 Examples of non-degradable pollutants (plastic, glass, metals and harzardus waste)**

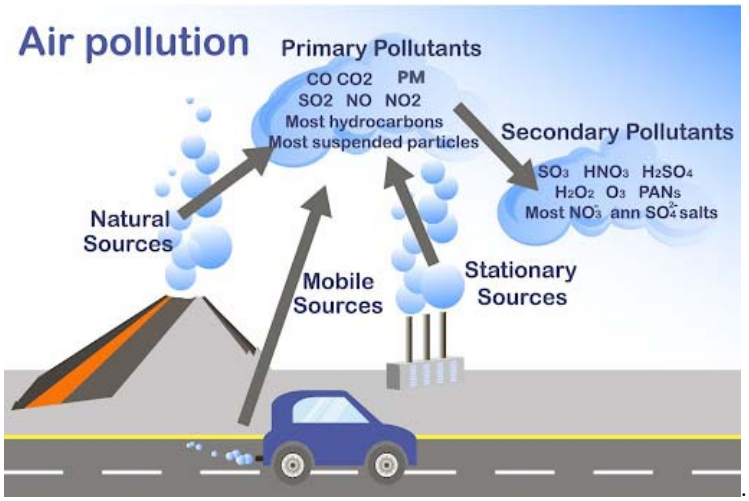



**Figure 4. Primary and secondary air polluants resulting from different sources**

## 2. Effects of pollution on the environment

### 2.1 Effects of pollution on natural resources and health

Ecosystems such as forests, wetlands, coral reefs and rivers make an important contribution (are beneficial) to the Earth's environment. They enhance water and air quality, provide habitats for plants and animals, and provide food and resources. Any or all of these ecosystem functions can be affected or destroyed by pollution [11].

Moreover, because of the complex relationships between many types of organisms and ecosystems, environmental contamination can have far-reaching consequences that are not immediately obvious or difficult to predict. For example, scientists can only speculate about the potential effects of depletion of the ozone layer, the protective layer in the atmosphere that protects the Earth from the Sun's harmful ultraviolet rays.

### 2.2. . Effects of pollution on the economy

Another major effect of pollution is the tremendous cost of cleanup and pollution prevention. The global effort to control emissions of carbon dioxide, the gas produced by burning fossil fuels such as coal or oil, or other organic materials such as wood, is one such example.
The cost of keeping annual carbon dioxide emissions at 1990 levels is estimated at 2% of gross domestic product for developed countries. The main sources of industrial pollution are the metallurgical industry, the petrochemical and chemical industry, the mining industry , the energy industry and transports and also the coonstruction materials industry. The characterisitcs of above mentioned sources of industrial pollution are summarized in the Figure 5.

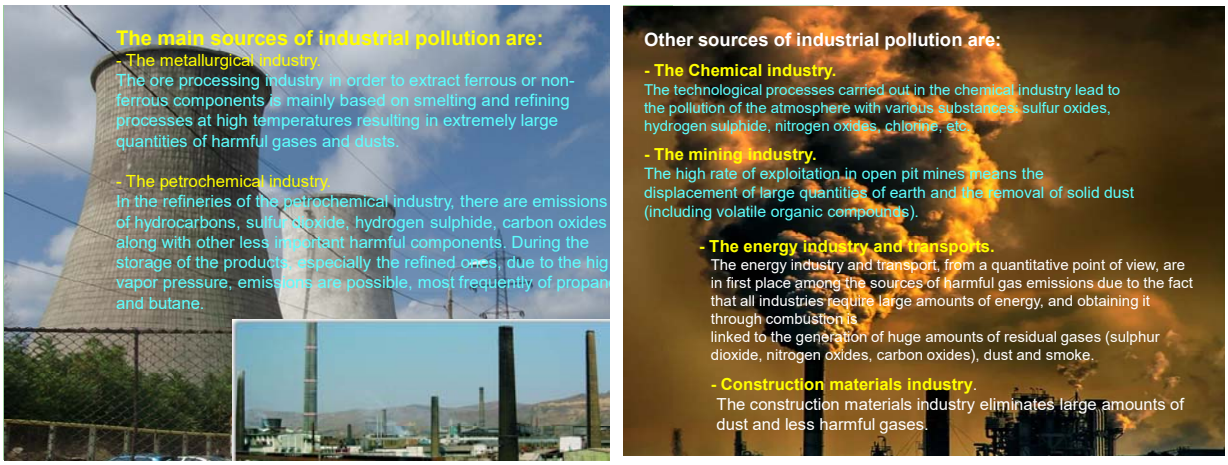



**Figure 5. The main sources of industrial pollutions and some characteristics of them**

## 3. Some solutions to eliminate the effects of pollution

The classic solution to control gas emissions in the case of industrial installations was that of diluting the emissions by injecting them at height (stacks of tens and hundreds of meters). Depending on the height of the stacks and the atmospheric conditions, polluting gases from industrial processes propagate locally or at medium/long distances. In the case of large thermal power plants, for example, the propagation of polluting gases is over large distances (cross-border), the effects being extended on a regional scale (continental areas - the air pollution induced by thermal power plants in Germany spreads throughout Central Europe) [12, 13] .

The solutions are:

1. Rethinking the product and its functions;

2. Reduction of material and energy consumption throughout the entire life cycle;

3. Replacing hazardous substances with less hazardous or non-hazardous alternatives for the environment;

4. Recycling (choosing materials that can be recycled and designing a product so that it can be easily disassembled for recycling);

5. Reuse (designing the product so that its component parts can be reused);

6. Repair (designing a product that is easy to repair, so that it does not have to be replaced too quickly).

7. The use of "eco" technologies.

8. Conservation of resources.

### 3. 1. The using of "eco" technologies

The „eco" technologies or green technologies included renewable energies sources presented in Table 1 [14] and Schemattically in Figure. 6.

**Table 1.** Potential of Romania for renewable energy sources.

| Renewable Energy Source | Technical Potential [GWh] | Technical Potential [thousand toe] |
|---|---|---|
| Wind | 409,731 | 35,231 |
| Solar thermal | 14,932 | 1284 |
| Solar photovoltaic | 161,929 | 13,923 |
| Biodiesel | 6084 | 523 |
| Bioethanol | 45,461 | 3909 |
| Solid fuel | 71,966 | 6188 |
| Micro hydro | 14,724 | 1266 |
| Geothermal | 279 | 24 |
| Total | 710,103 | 61,058 |

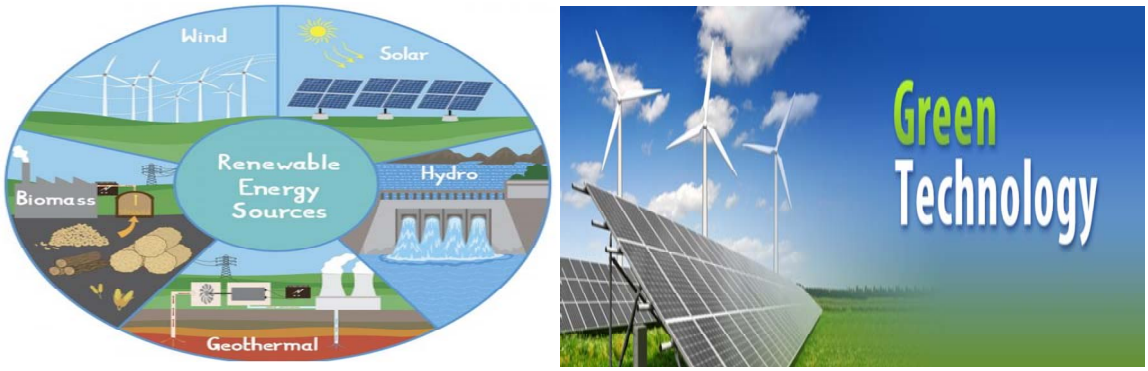



**Figure 6. Renewable energies sources for green technology**

Solar panels have become increasingly affordable eco technologies, with prices falling in the US since 2000 even by 70%, Planet Save shows. In addition to helping to save electricity, investing in these panels has beneficial effects on the environment [15, 16] .

Economical light bulbs are also an investment that helps save electricity. Recently, the Phillips company has developed a prototype light bulb that saves half of the electricity used by regular light bulbs.

They will be available on the market in about two years, and the prices will not be significantly higher than those of ordinary light bulbs[17, 18, 19].

Environmentally friendly plastic is already a reality, thanks to researchers at KAIST University in Seoul, eHow reports [20, 21].

This type of "friendly" plastic with nature is not produced from petroleum, is biodegradable and contains a low level of toxic substances.

## 4. Conclusions and perspectives

The paper presented an overview of pollution, its causes and effects, the main sources of industrial pollution and some solutions to eliminate or reduction of pollution.

In the future, the use of eco-technologies, "green" inventions for the health of the planet will not be a distant dream. For instance, an invention that could materialize on a large scale is the plane powered by solar energy [22] (Figure 7), the same source says.




**Figure 7. The electric airplanes with diverse utility and applications [22]**

Although still in the prototype stage, the Swiss Solar Impulse plane has made flights of more than 20 hours, using only solar energy, both during the day and at night.

The ingenious idea of turning air into water, by extracting hydrogen particles, is already being applied in various areas of the world. In addition to the fact that, in the future, this could solve the problems in the regions affected by the lack of drinking water resources, it could also save many human lives in case of natural calamities.

Electric cars could help reduce toxic emissions from car exhaust fumes. In addition to reducing air pollution, this alternative also helps to save financial resources. Nissan, Ford or Toyota have, until now, developed such electric cars [23, 24, 25].

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