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## ***ПЕРШИЙ КРОК У НАУКУ***

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## **ECONOMIC ASPECTS OF PROCESSES FOR PROTECTION THE ENVIRONMENT WITH NANOTECHNOLOGIES USAGE**

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Time goes, so science and progress are not standing in place. After just several years, humanity has been receiving new devices, technologies and new opportunities for improving their lives. One of the main areas in such progress is nanotechnology usage. Father of nanotechnology is one of the most famous physicists in our time, Nobel Prize winner Richard Feynman. Nanotechnology is an area of applied science that deals with objects smaller than 100 nm (1 nm = 10<sup>-9</sup> m). Nanobjects are created by manipulating with individual atoms. From the twentieth century to the present day, research on nanotechnologies and nanoobjects and their implementation in almost all branches of science are constantly being conducted: medicine, energy, mechanical engineering, biotechnology, military industry.

Nanotechnology is constantly entering in all spheres of life and activity. The nanotechnology usage in the long perspective will help eliminate a large number of environmental problems. The most important problem in this sphere is increasing the average temperature of the Earth's atmosphere, which were caused by increasing in the amount of fuel burned by industry, transport, etc. (the so-called greenhouse effect). A separate example of the fight against such an effect is the nanotubes usage for the solar energy converters manufacture. In addition, carbon nanotubes can effectively filter a large amount of hydrogen, which can improve the processes of manufacturing heating systems and batteries. This, in particular, will enable the creation of environmentally friendly transport.

Another major environmental problem that the future mankind can overcome with the help of nanotechnology is the ozone layer destruction under the influence of chemical products used in everyday life and industry. In particular, the so-called freons – artificial chemical reagents, which are made in the form of aerosol and often used in refrigeration. Reducing the ozone layer by only 1% increases the risk of skin cancer and leukemia few times. Scientists are studying the creation of nanostructured material that can replace Freon in a future.

Of course, such perspectives are quite tempting, but if we come up to using such technologies from economic point, a logical question often arises: is it rational to implement of such nanotechnologies for environmental protection nowadays?

Today, such technologies are already in use, in particular, it concerns alternative energy sources. Solar energy is actively being implemented even in Ukraine and the Sumy region. The roofs of buildings in Sumy are increasingly covered with solar panels. Photocells in them turn light into electricity. In addition, in Trostyanets, Sumy Oblast, it is planned to build a solar power station with an area of 9 hectares.

However, we should note that the performance coefficient of modern panels is about 20%. But even today, Japanese scientists have developed a semiconductor in the size of 100 nm, which increased the panels' efficiency up to 40%. Of course, their value will be significantly higher, but their usage is more cost-effective in terms of perspective.

Obviously, the economic feasibility of using the newest nanotechnologies in environmental protection processes is rather low today, since such use requires considerable financial costs. But with the rapid scientific and technological progress, the latest technology is gradually included even in the sphere of everyday life. In particular, by analyzing the technological process of manufacturing the smartphones' central processors, which are vivid examples of modern nanotechnology, we can notice that:

1. Samsung Galaxy S5: CPU made with 28 nm process, release year – 2014;
2. Samsung Galaxy S6: CPU made with 14 nm, release year – 2015;
3. Samsung Galaxy S7: CPU made with 14 nm, release year – 2016;
4. Samsung Galaxy S8: CPU made with 10nm, release year – 2017.

This means that just in 4 years, the characteristics of the processors have increased almost three times, and therefore, every next step in improving nanotechnologies means reducing the cost of the previous ones.

Therefore, we can hope that the latest developments in the field of nanotechnology will gradually become available to enterprises, cities and states, and they will be a powerful tool in the struggle for the purity of our planet.

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