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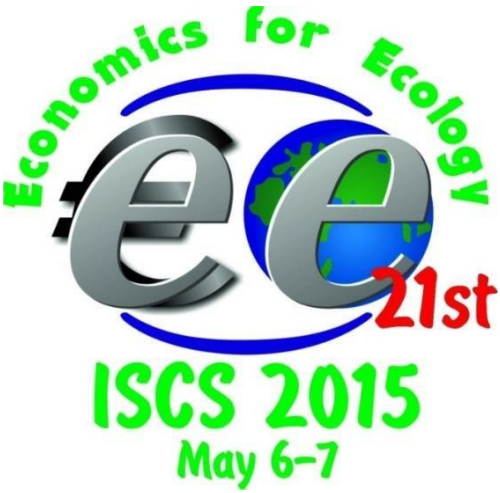

Економіка для екології

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NUCLEAR ENERGY, ECONOMY & ECOLOGY

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Modern civilization is inconceivable without electricity. Nuclear energy is one of the main sources of energy nowadays, so it requires a comprehensive research. The nuclear power sector is the most significant in France, Belgium, Finland, Sweden, Switzerland - in those industrial countries where natural energy resources are insufficient. The nuclear power has a significant advantage over the social, health and environmental costs of the fossil fuel use. Nuclear energy is the most concentrated form of energy. Nuclear power plants don't require a lot of space, they don't need a large plot like a wind farm. Nuclear power stations don't contribute to carbon emissions, so it doesn't contribute to global warming. Nuclear power is reliable. It doesn't depend on the weather. It has proven to be cost effective almost all over the world. However, nuclear power plants are potentially dangerous objects. That's why it's very important to comply with all of the safety requirements. The term "safety of the nuclear plants" is closely related to different types of damage, with possible harmful consequences of the accidents at the nuclear plants.

According to The Major Hazard Incident Data Service - MHIDAS, the major accident at the enterprises with the death of more than 25 people and wounded more than 100 take place on average every 2.5 years. As a rule, they occur mainly due to lack of knowledge and experience. As well the accidents can occur when some technologies have not been tested adequately.The accident at the nuclear power plant could kill more people than were killed in the explosion of the atomic bomb dropped on Nagasaki.

The consequences in the financial terms can also be catastrophic. The accident at the nuclear power plant can cause huge damage to the economy and the environment not only for the particular State, but also for the whole region. Nuclear accidents can spread 'radiation producing particles' over a wide area. This radiation harms the cells of the body which can make humans sick or even cause death. Illness can appear or strike people years after they were exposed to nuclear radiation and genetic problems can occur too. A possible type of reactor disaster is known as a meltdown. In the meltdown, the fission reaction of the atom goes out of control, which leads to a nuclear explosion releasing great amounts of the

radioactive particles into the environment. Here is the approximate cost calculation for the elimination of the consequences of the major accident at the nuclear power plant. As an example, consider the accident at the Hungarian nuclear power plant "Paks".The data on the estimated cost depending on the deactivation factor are listed in the table:

Table 1 - The assumption for the costs of decontamination per capita: (in $ US)

DF <3-low-level contamination area; DF>8-high-level contamination area

decontamination factor (DF)	<3	<8	>8
decontamination	19 000	42 000	0-42 000
compensation	4 800		4 800-61 800
transportation	0	3600	3600
recycling	14 000	15 000	0-15 000
Total	37 800	60 600	65 400

Economic damage is mainly focused at the distances up to 500 km from the reactor. The population density in the range of 500 km from the atomic station "Paks"is on average 110 people per km2. Consider the most likely scenario. The distance of 500 km corresponds to the distance that was covered by the bulk of the contamination in the Chernobyl accident. Area sector harboring radioactive emissions at the distance of 500 km from the station is 30 000 km^2. When making a population density of 110 persons / km2, the number of people who fell under the impact of radioactive fallout will be 3,300,300. Decontamination, transportation of people, waste management and compensation will range from $ 125 billion up to $ 216 billion, depending on the extent of contamination. This amount is close to the cost of eliminating the consequences of the accident at the nuclear power plant "Fukushima" - $ 257 billion, according to the Japanese government comission (December 2011). The accident at Fukushima was estimated by the maximum, seventh level of danger - the same as the Chernobyl tragedy. The worst circumstances mean the release of large amounts of radioactive substances, strong winds and certain of its direction - for example, if the cloud of ejection spread to France and will cover the major cities, the fallout may fall at a distance of up to 1600 km from the plant, the area of contamination will be 307 200 km^2. Under such circumstances, the proportion of victims is estimated to be 33.8 million

people. Decontamination, transportation of people, waste management and compensation in this case would amount to $ 1 277 000 000 000. To $ 2 210 billion. It is worth noting that this option is unlikely.The main causes of the accidents at the nuclear power plants are classified as follows: - wear and tear, - corrosion, - operator errors, - the use of untested alternative technologies, - other reasons. There are some examples of the negative consequences of the applying the untested alternative technologies at the nuclear power plant. It's possible to recall the accident in Finland at the NPP «Loviiza» (VVER-440), the accident in Czech Republic at the NPP Temelin (VVER-1000), the accident in Ukraine at the South-Ukrainian NPP (VVER-1000) in 2012. In all these cases the causes were similar: violations of the integrity of the spacer grids, deformations of the fuel assemblies and poor corrosion resistance. It's the fact that the fuel for the reactors of VVER is a hexagon and it's made of the zirconium-niobium alloy. The incidents began to occur with the applying of the new fuel assemblies, manufactured by the Westinghouse company. These fuel assemblies are made of stainless steel and have the square shape. The nuclear fuel assemblies can't be interchangeable due to the different manufacturing technologies. Even small deviations from the geometric dimensions or replacement materials used can lead to distortion of the temperature field, local overheating and depressurization of the containment. IAEA also recommends not infringe the existing technical regulations on safety in the construction and operation of nuclear reactors.

Major accident on the International Nuclear Event Scale (INES 7) can occur as a result of deformation of the fuel assemblies during operation. Curvature of the fuel assembly creates additional difficulties for stroke absorber rods up to their full lock. In combination with the other factors, heat-bending assembly may cause an accident similar to the consequences of the accident at the Chernobyl nuclear power plant. The most likely incidents can occur to the level from 0 to 3 (INES). Such incidents don't cause much damage to the environment and population, but they can lead to undesirable economic consequences. Summarizing, we can say with confidence, that the solution of the environmental problems of the nuclear power is vital and we can't underestimate this fact, because it would be a terrible mistake! There are a lot of countries, where it is the only opportunity to get cheap energy, and not to depend on the conditions and political preferences of other states. Thus, the prevention of the accidents at the nuclear power plants is the main problem of the further nuclear power

development. It's always easier to prevent the accident than to overcome catastrophic consequences for years and centuries, not only for the nature, but also for all the humanity. Therefore, nowadays the safety and the prevention of the global environmental catastrophe must be the one of the major concerns for the international community.