

# ON 'SAFETY' AND 'SECURITY' TERMS AND THEIR RELATIONSHIP

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## Abstract

*The paper deals with such notions as object safety, subject security, production safety, environmental safety, energy security, and national security. Issues of ensuring the subject security are not limited by problems to be investigated in conjunction with the issues of ensuring the object safety. Considered are the relations between object safety, subject security, production safety, environmental safety, energy security, and national security issues. National security problem includes all the listed above safety/security issues.*

**Key words:** object safety; subject security; production safety; environmental safety; energy security; national security; electric power systems safety

## I. Introduction

'Security' and 'safety' are known to be different terms. They refer both to objects (e.g., facilities of energy systems) and to subjects (individuals, state, society). Diversity of safety/security meanings is due to different mix of threats taken into account when safety/security is considered. There is an objective demand to differentiate such notions as object safety, subject security, production safety, environmental safety, energy security, and national security.

## II. Object safety and subject security

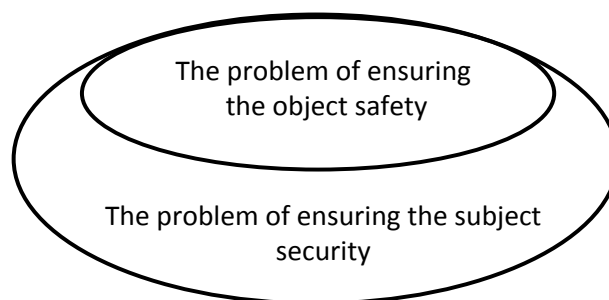
The object under study includes such energy facilities as power, gas, oil, heat and coal supply systems, as well as nuclear power systems. Safety of the object implies its ability to eliminate circumstances hazardous for people and environment. Object safety is a unique feature of complex nature, namely, reliability [3]. Studies on the object safety, as a rule, consider the so-called 'safety in emergency' when circumstances hazardous for people and environment may be caused by different internal (equipment failures, mistakes of personnel, etc.) and external (hurricanes, earthquakes, military actions, sabotage, etc.) disturbances that lead to the object destruction.

Subject security implies protection of vital and personal interests of an individual, interests of the society and the state from internal and external threats [4]. The issue of ensuring the subject

security includes issues to be investigated in conjunction with the issues of ensuring the object security (Fig. 1). Subject security cannot be ensured without ensuring the object security. An example can be the largest (in terms of victims) man-induced catastrophe in the modern history that happened early morning on December, 3, 1984. It was caused by a severe emergency at a chemical plant owned by the American chemical company in India, in the City of Bhopal. A cloud of toxic gas covered the nearby houses and a railway. Minimum 18 thousand people perished, 3000 of which perished on the day of emergency, and 15 thousand died in the subsequent years.

Subject security assurance is not limited by issues to be investigated in conjunction with the object security assurance issues. This problem is much more diverse. First, incomplete safety can demonstrate itself in normal operating conditions of the energy system. For example, negative impact of hydro power plants (HPP) may show up in constant or temporary flooding of fertile lands. Occurrence of stagnation zones in the water reservoirs due to low water flowage and turbulence may cause changes in the hydrochemical water composition and, as a result, water may become inadequate for vital human needs. Higher air humidity, higher cloudiness, wind force and rate in the water reservoir area result in the higher morbidity rate due to changed climatic conditions.

Second, means for ensuring the subject security are not limited by capabilities for ensuring the object safety. Therefore, the problem of ensuring the subject security differs from the problem of ensuring the object safety. Fig. 1 shows relations between those problems.

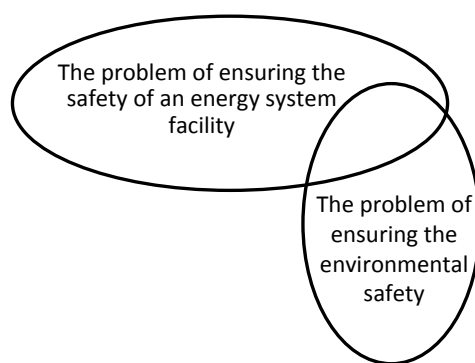


**Figure 1.** Relations between the energy facility safety and the subject security

### III. Object safety, environmental safety, and energy security issues

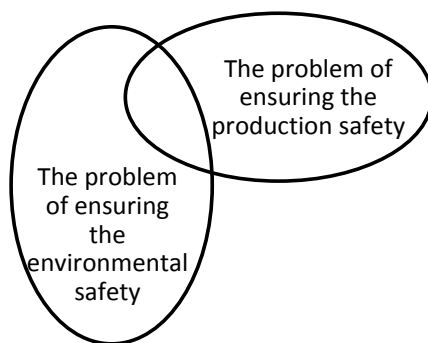
Environmental safety implies protection of an individual, society and the state from the consequences of technological and natural impacts on the environment. For example, electromagnetic pollution of habitat became so considerable that World Healthcare Organization called it a top priority challenge for a human being. Energy equipment, power lines, power transformers, high-voltage switchgears in particular make their contribution into total electromagnetic pollution of the environment. The problem of ensuring the ecological safety (unlike the object safety assurance problem) takes into account all the man-induced impacts rather than those caused by emergencies at different energy facilities.

The difference lies in the fact that the problem of ensuring the energy facility safety takes into account situations risky for people but not risky for environment, e.g., power supply (as a target product) interruption due to emergencies in the power systems. Fig. 2 shows relations between the object safety and environmental safety assurance problems.



**Figure 2.** Relations between the energy object safety and the environmental safety assurance problems

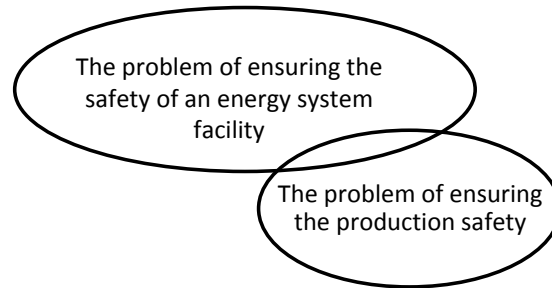
The problem of ensuring the labor safety implies protection of operating personnel from hazardous impact of technological processes, power, working environment, equipment items and labor conditions at a production facility. The problem of ensuring the production safety suggests the ability to control production-related hazardous factors impacting the operating personnel. Improper production safety contributes to the increased number of incidents, higher rate of occupational diseases and even death of people during emergencies at energy facilities. Chernobyl catastrophe on April 26, 1986 is a sorrowful example. Personnel of the plant and rescuers got lethal doses of radiation. Emergency at Sayano-Shushenskaya HPP on August 17, 2009 is the largest man-induced catastrophe in the Russian history. 75 people of the plant personnel perished. The emergency had a negative impact on the adjacent aquifer environment. Fig. 3 shows relations between environmental and production safety assurance problems.



**Figure 3.** Relations between the environmental and production safety assurance problems

Analysis of incidents and fatalities shows that the major share of emergencies is caused by the so-called 'human factor', i.e., incorrect actions of personnel, responsible persons and officials, violation of technological procedures (about 80-85% of incidents), as well as by drawbacks in the legislative control and safety standards. According to United Nations Organization data, every eight (8) violations of safety rules result in an incident, and one out of 228 violations result in fatality [1].

Unlike the production safety the object safety assurance problem includes only impacts that may result in emergencies at different energy facilities that are hazardous for people and environment. Fig. 4 shows relations between the object safety and production safety assurance problems.

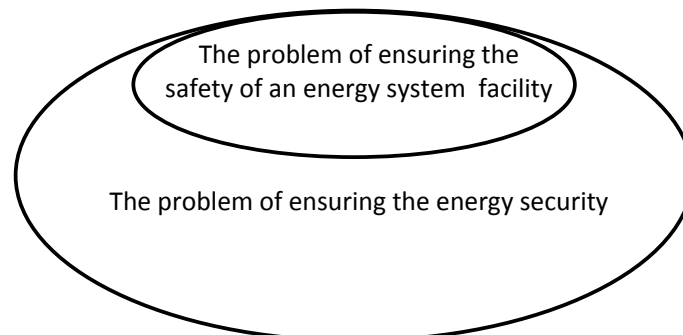


**Figure 4.** Relations between the energy object safety and production safety assurance problems.

#### IV. Object safety, environmental safety, and energy security

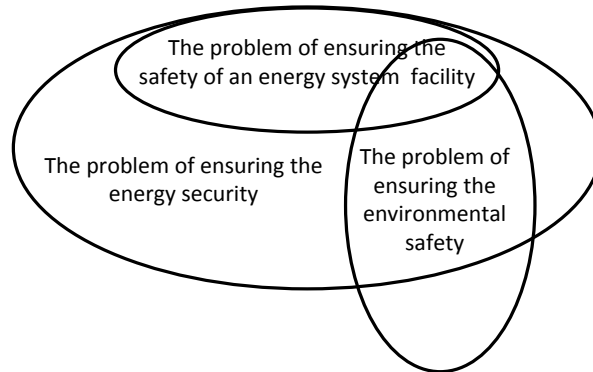
The problem of ensuring the energy security (with account of recommendations given in [4]) implies protection of citizens, society, state and economy from the threat of the shortage of power supply from economically efficient energy sources of acceptable quality, from the threat of power supply interruption and occurrence of circumstances risky for people and environment [2]. The problem of ensuring the energy security is of more general nature than the problems of ensuring the energy facilities safety as it takes into account a large range of threats, namely, economic, social, foreign economic and political relations, technological, natural and managerial threats [4]. For example, to ensure energy security one should take into account risks of possible power supply interruption due to putting the nuclear power plant out of operation following people's protests, equipment aging and impossibility of its timely replacement. There are cases of successive disconnections of power consumers, for example, at Ukraine in winter 2014 due to lack of finances to pay against the fuel supply contracts.

Energy facilities safety assurance problems are an inherent component of the energy security assurance problem as a whole. Methods for ensuring the energy systems safety (unlike energy security) are limited by capabilities of the systems themselves and do not allow offsetting the consequences of all the listed threats. Fig. 5 shows relations between the energy system safety assurance problem and the problem of energy security assurance as a whole.



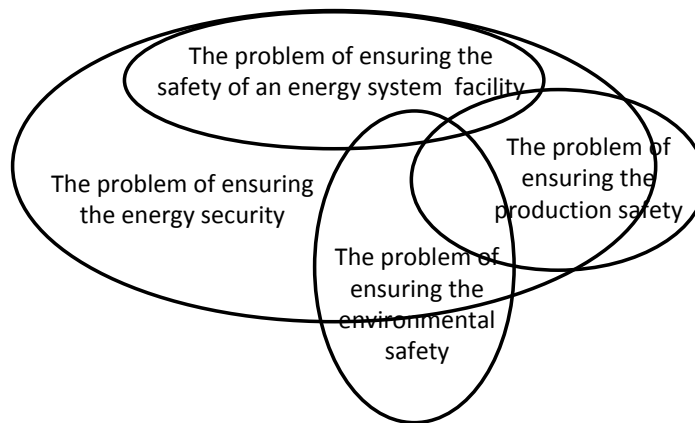
**Figure 5.** Relations between the problems of ensuring the energy facility safety and energy security as a whole

The issue of energy security assurance does not cover all the challenges related to environmental safety as technological impact on the environment is not caused by the energy facilities only. Motor and railway transport, chemical and other industries have an adverse impact on the environment as well. Fig. 6 shows relations between problems of ensuring the energy security, environmental safety and energy facilities safety.



**Figure 6.** Relations between the energy facilities safety, environmental safety and energy security assurance problems

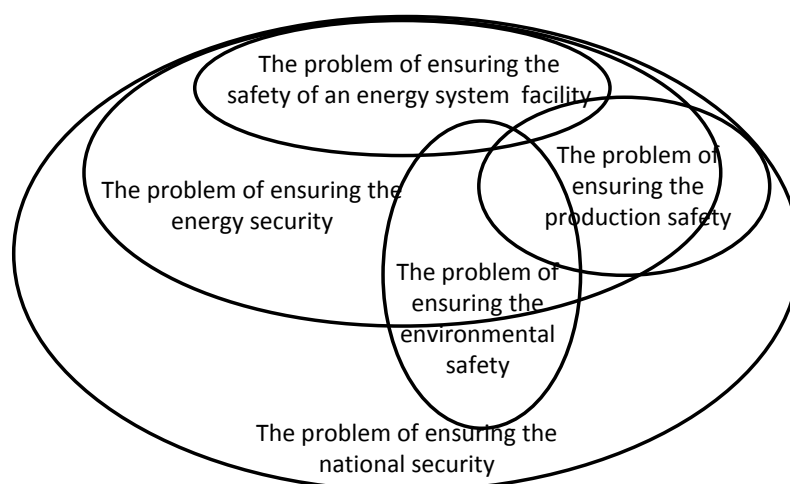
The problem of ensuring the energy security does not cover all the issues related to production safety assurance. For example, the problem of ensuring the energy security does not take into account labor conditions and modes. Fig. 7 shows relations between the energy security, environmental and production safety, and energy facilities safety assurance problems.



**Figure 7.** Relations between energy facilities safety, environmental safety, and production safety assurance problems

## V. Object safety, environmental safety, and national security problems

National security implies protection of vital interests of the country, society, and its citizens, as well as protection of national interests in the economic, social, international, defense, cultural, religious and other spheres [4]. It is the most general notion of security. The problem of ensuring the national security includes all the above listed safety/security problems. Fig. 8 shows relations between the problems of ensuring the safety of objects, environmental safety, production safety, energy and national security.



**Figure 8.** Relations between the problems of ensuring the security/safety

## CONCLUSIONS

1. The problem of ensuring the subject security is not limited by issues to be investigated in conjunction with the object security assurance. This problem is much more diverse.

2. Unlike the problem of ensuring the production safety the problem of ensuring the object safety includes only impacts that may result in emergencies at different energy facilities that are hazardous for people and environment.

3. The problem of ensuring the ecological safety takes into account all the technological impacts rather than those caused by emergencies at different energy facilities.

4. The problem of ensuring the energy security is of more general nature than the problem of ensuring the energy facility safety, but at the same time it does not cover all the issues related to environmental safety assurance.

5. The problem of ensuring the national security includes all the above listed safety/security issues.

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