ETHICAL IMPLICATIONS TO THE ASSESSMENT OF THE SMART GRID TECHNOLOGY IN RUSSIA

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Abstract. This paper brings up the issue of staff training for professional development of the Smart Grid technology and for use of its elements by customers in households. It was revealed that the considerable part of the respondents was not familiar with the definition of Smart Grid. That required the development of communication skills by energy engineering students and their social activity as well. The reasons mentioned make actual the following elements of engineering education: social responsibility, stress resistance, ability to forecast the future.

1 Introduction

Machines have been involved into the human life from the olden times initially intended to ease the rough labor as well as to make the environment available for living and provide the security of human life. It should be pointed out that in modern world, the new functions of machines start prevailing such as the ability to improve the human nature, change the social reality and the ways of communications, and provide the conditions for humanistic values. The authors interpret the humanistic values within the concept of the sustainable development formulated from the Brundtland Report of 1987 [1]. In modern view, the social dimension is an important part of the sustainable development which involves personality orientation, the stability of social and cultural systems, fair distribution of economic and social benefits, reducing the number of human conflicts [2]. The Smart Grid technology is no exception, it is subject to the analysis against the sustainable development background. The special aspect in adoption of the complex systems such as the Smart Grid is the uncertainty about the full range of the potential hazards when implementing such technology because the social and technological risks are revealed after a long period only. The research presents the components of the ethical evaluation which can be used to analyze the requirements considered when adopting the Smart Grid as well as the problems of the ethical competence development in training the engineering undergraduates.

2 Results and discussion

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A review of papers enables us to identify the Smart Grid concept constituents as follows: the power engineering strategy aimed at the use of alternative sources of energy, energy-efficient technology as well as at the active involvement of clients into production, consuming and distributing the energy; the development strategy of the companies which produce the equipment for power industry; the development concept for power engineering companies, which is based on innovations and the responsible participation of a consumer. In Russia and other countries, the Smart Grid concept was stimulated by the government. In 2009, the government of the Russian Federation approved the Russia's Energy Development Strategy for the period until 2030. The developed strategy is oriented towards the transition to the new generation energy, the implementation of new technology, the efficient use of conventional and new energy sources [3]. This paper provides the directions and the strategy implementation techniques. The analysis of those points suggested that the economic and technical conditions as well as the results of the strategy adoption are primarily emphasized in Russia. The human resourcing of the power industry is, above all, the main social condition: the development of professional training, corporate staff training, the creation of well-equipped and secure workplaces. However, there is a problematic issue in this paper, in our opinion. This is the poor analysis of the cultural and intellectual constituents of the Smart Grid innovation according to the sustainable development concept. The extended introduction of this technology as the Smart City [4] allows us to consider this process as the change of the social reality.

To name this process, modern authors often use the term *social experiment* [5, 6]. An experiment as a research method supposes a researcher creating the controlled conditions to test a hypothesis. In view of this, there is no difference between a man-operated experiment and an experiment which involves material systems – the experiment is artificial to some extend as a researcher plans and monitors the situation that does not exist in the real world. However, there is a possibility of the irreversible effects during the experiment, which prevents a researcher from stopping the experiment or its negative impact. This requires some extra conditions to conduct the experiment as well as to adopt new technologies in society. The modern researchers propose to forecast risks and negative effects at the early stages of the technology adoption to neutralize the unintended consequences. So, the Responsible Research and Innovation approach is being developed today [7]. Innovation is always related to planning the future because the present has not provided yet any algorithms to carry out the innovation as well as any patterns for interaction of social institutions and groups both with each other and with the adopted technology. The lack of interaction models for the new technology results in necessity of the principle that provides the framework for the evaluation of innovations. For that end, the precautionary approach based on the sustainable development concept is often used. The core value is to meet the needs of population and society to the greatest possible extend with preventing the negative effects. The similar emphasis on the expectation takes place in Europe (the Horizon 2020 program) and in the US (National Nanotechnology Initiative, NNI) as well.

The next technique to analyse the new technology adoption, which is recognized among the modern researchers, is based on bioethics principles [8] – keeping the test person informed, the positive impact on society, undiminished security of the test person, human dignity, professional and responsible behavior of the test conductor. For the first time, the principles of bioethics were set up in the Nuremberg Code after the Nuremberg trials were over in 1947 [9]. In this paper, the principle of the informed consent is analysed. The informed consent for engineering purposes was studied in the paper by Mike W. Martin, Roland Schinzinger [10]. The principle of the informed consent is proven and to some extend, obvious for a modern medical experiment. It supposes that a participant of the experiment is aware of the test purpose, methods, duration and possible negative effects. It is necessary to extrapolate the informed consent in the sphere of engineering because the

technology impacts and changes the human life to the same extend as the medicine. There is no doubt that the implementation of this principle can be complicated by following issues: the consumer awareness and the activity of the engineer. A consumer is entitled to the information provided as well as to the information which they are interested in, such as resources, the economic feasibility, the impact on environment, the production management, etc.

The next aspect to be considered when discussing the informed consent principle is the risk forecasting. A necessary basis for forecasting in the current practice is the system of values, on which a decision about the possible risks is made, and the concept of the future considered as the ground for planning the present. A conventional element of the decision making within the risk theory is an attempt to strike the possible balance between the economic benefit and the social-ethical responsibility. The economic benefit is apparent and of general importance, however, the ethical component should be analysed. The ethical issues of the technology implementation such as human security, preserving the personal and cultural identity, privacy right, development of traditional forms for preserving the sociality are the topical problems for our future. Hence, it is necessary to place greater emphasis both on individual values, which are of general importance as well, and on social values which will determine the life of humanity in the future.

The constituents of the ethical evaluation mentioned above are interrelated – the engineering inventions are adopted in the society considering the precautionary principle. The technology adoption is an experiment of a specific nature – a social experiment which is conducted to serve mankind. To determine, whether the invention is really helpful or not the informed consent is applied. In our opinion, these principles, despite some constraints, can be applied for analysing the Smart Grid technology in a social context. The sustainable development involves preserving the planet with the conditions and the amount of resources that provide the fulfilling life for our descendants. The requirement for the sustainable development is the combination of the economic development, environmental system, social development and traditional values, which are unique for every culture. Our understanding is that the Smart Grid fully complies to the sustainable development concept.

The Smart Grid provides the opportunity to use the alternative sources of energy which enhance the chances to preserve the nonrenewable sources for the next generations. While the renewable energy sources reduce the negative impact on environment, they increase the consumer responsibility. Being simultaneously a producer, a consumer has the opportunity to cut down the energy costs and to supply the rest to other consumers. The adoption of this technology positively impacts different groups, which interests are affected by the technology adoption: it meets demands of each consumer, the potential for technological risks is reduced which is the essential advantage for all nations; the smart control system provides the realtime data about the equipment status reducing the labor costs of the system operator; the need in reconstruction of the workstation provides the safe working conditions for human resources; the Smart Grid designing stimulates the interrelated fields of science and technology, so, the positive working environment and facilities for research and development are provided; the reduction of production costs due to the cutting down the energy costs provides the positive effects on business [11].

In spite of the positive aspects of the Smart Grid adoption, it should be noted that the ordinary consumers make the significant part of the mentioned groups, which can benefit from using this technology. This part, as was earlier discussed [12], is poorly aware of the Smart Grid itself as well as of possible positive and negative impacts of the technology adoption (this is the proven fact for Russia). So, the adoption requires that an engineer interacts with the society and clarifies possible impacts of the technology and supports this way the informed consent [13]. That is the aspect which strengthens the social constituent of the engineer's activity in the modern world, and this means changing the goals of the

engineering education declared in the Learning for the future concept [14]. That document noted that the education is a condition for the sustainable development as the appropriate world view, knowledge and understanding of problems and solutions are formed through the education. It is interesting that the document formulated the requirements to the academic staff who make students develop the necessary competences in the field of the sustainable development.

According to that paper, every teacher, irrespective of their specialty and training, should develop themselves four groups of competences: they should teach the principles of communication between different cultures, generations, social groups, people and environment; they should teach considering the students' life experience and solving the urgent problems; they should help to coordinate the different visions of the future, shape the view of the sustainable development; they should understand the impact of the present mechanisms on the future. These competences are obviously to be developed by students. Targeting this problem is a topical issue in Russia. Tomsk Polytechnic University currently provides the action plan aimed at the development of the competences required. This process is performed with the change of the social and humanity training the engineering students. According to the new concept, the training of social and humanity competences is to be resulted in the qualifications of a graduate who should be able to make the professional decisions with the principles of social responsibility, meet social challenges and demands, be an efficient worker both in national and international teams [15]. The concept adoption is complicated by the fact that a system of certain values should be its final goal. So, it should be noted that the modern society makes two conflicting requirements to the engineering training: it is necessary to shape the worldview on the sustainable development basis, on the one hand, but the intention and ability for the continuous production, on the other hand. The issue whether the combination of these requirements is possible in the training process as well as in the worldview of a modern person remains an urgent problem when developing the necessary competences of the perspective engineers.

3 Conclusion

The adoption of new technology in a society can be considered as a social experiment as it provides the transformation of both the material and the social realities as well as the system of values. The very nature of the social experiment is in the fact that it is hardly possible to forecast its procedure and results and to stop the experimental execution as well. Moreover, the participants of a social experiment should be large groups of people, who rarely consider themselves as the experiment parts, and the risks taken by the participating groups in case of the unfortunate occurrence. The specified characteristics focus the researchers on the ethical requirements which are to be met: the informed consent, the positive impact on social life, the safety of the test person, human dignity, professional and responsible behavior of the test conductor. The informed consent should be a condition for the adoption of the global technology such as the Smart Grid and stimulate its expansion among populations. Implementing this principle is possible on condition of the changing the goals of the engineering education according to the sustainable development. However, there is a conflict of the values in the modern society i.e. the simultaneous commitment to consumption and saving. The next research will provide the possible solutions of this conflict in the engineering education.

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