

## THE HARMONY INITIATIVE: WHAT'S PROS AND CONS?

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The World Nuclear Association (WNA) announced the Harmony Initiative, on the intensive development of nuclear energy in the world. The purpose of this program - the creation of up to 1,000 GW of new nuclear capacity by 2050. Implementation of the declared goal will allow the nuclear power plant to take about 25% of the world's energy balance. How will this affect market participants? What are the advantages and disadvantages?

The main thesis of the program is humanistic, not commercial. Electricity should appear where it is needed. According to the UN, today more than 1 billion people in the world do not have access at all to electricity. These are, for example, many residents of Tanzania and Mozambique, Angola and Nigeria, Cambodia and Ghana. The lack of electricity, in turn, significantly hinders the economic development of these countries.

The International Energy Agency predicts growth of energy consumption by about 17% in the world until 2050. Even the satisfaction of this additional demand will require the creation of a significant amount of capacity, and the role of nuclear power in ensuring the growing demand should be quite significant, according to WNA. Many experts of the nuclear industry are confident that the missing part of the energy needs to be produced at nuclear power plants.

Firstly, this is due to the high efficiency of existing plants (it is about 30-34 %). Secondly, the energy generated at nuclear power plants is cheaper than the energy received at thermal power plants. And the most important advantage of the NPP (Nuclear Power Plants) is the environmental friendliness of the energy received.

The importance of the last point is emphasized by the existence of the Paris climate agreement, which was ratified by 96 UN member states in 2015. Its main goal is to keep an increase in the average temperatures on the planet at the level of more than 20°C, and ideally - to fix at the level of 1.50°C (old-mark – indicators temperature on the Earth in preindustrial epoch of the 19 century). Most scientists believe that such a level would allow to avoid development on the planet uncontrolled natural cataclysms that will lead to the death of a significant part of the humanity. It is believed that today the average temperature increased by about 1 °C. Within the framework of the document, each country assumed commitment to contribute to reducing emissions of CO<sup>2</sup>. A fund is also created in the amount of up to \$ 100 billion for assistance to the less well-off States. The developed countries are required to support the fund's financing in the amount of amount annually.

The security paradigm remains an important barrier to the development of nuclear energy. It is necessary to maintain high standards of nuclear safety, constantly drawing public attention to the role of nuclear power plants in reducing emissions - today it is obviously underestimated. Despite the environmental friendliness of the electricity produced at the nuclear power plant, these power plants are subject to the

highest requirements for ensuring the safety of production. The whole world remembers the accident at the Fukushima-1 nuclear power plant, which occurred in 2011. This led to radioactive contamination of the adjacent territories, as well as water and air in the whole of Japan.

Undoubtedly, the possibility of implementing the announced development program is still controversial. In the world, there are two opposite trends in the development of the nuclear industry. While the developed countries are trying to reduce the number of nuclear power plants and power units, switching to alternative energy sources, developing countries, on the contrary, are launching the construction of new plants.

So, perhaps, if the program "Harmony" did not exist, it would be worthwhile to come up with. After all, often a clearly marked goal, flavored with a humanistic message, even if it seems too ambitious, is capable of leading oneself.

#### RESOURCES:

1. Zhurnal «Atomnyj jekspert», №5 2017
2. Infografika MIA «Rossija segodnja» - «Razvitie i perspektivy atomnoj jenergetiki v mire», 2015
3. «Harmony brochure» - Vsemirnaja jadernaja asociacija, 2017
4. Dannye RIA Interfaks ot 2016
5. Obshhestvennaja priemlost' atomnoj jenergetiki: sociologicheskij analiz i strategija formirovaniya – Plankina N. A., 2003

### **PENETRATION OF RENEWABLE SOURCES IN MICROGRIDS: EFFECTS OF MILP BASED CONTROL STRATEGIES**

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**Abstract:** The rapid growth of the Distributed Generation (DG) concept has given technical issues regarding the integration and control within the grid nodes. A predictive control strategy integrating renewable and non-renewable sources as well as energy storage within the grid, is a potential solution to face with the mentioned issues. The behavior of a smart building of 30 apartments has been considered in this work. The Hybrid Renewable System has been controlled by a Model Predictive Control (MPC) strategy. The HRS includes sub-systems for the conversion of renewable energy sources as well as non-renewable ones connected to the main grid. Several scenarios have been tested under different weather conditions and in terms of renewable sources penetration. Results obtained with the MPC control strategy have been compared with a Rule Based Control (RBC). Results show that the use of MPC improves the integration of the residential microgrid with the renewable sources connected to the grid thanks to the predictive system smoothing out the energy demand