

TRENDS OF CONSUMPTION OF NUCLEAR ENERGY AND ITS ECONOMIC ASPECTS

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Summary

In the scientific research "Trends of Consumption of Nuclear Energy and its Economic Aspects" the importance of the use of atomic energy and related key issues are presented. Among the actual global issues of the modern era one of the largest attention is paid to the nuclear technology. Accidents and disasters are the results of the use of Atomic Energy, which cause the deadly diseases of live organisms, it significantly pollutes the environment and breaks the planet's ecosystems, in spite of the above mentioned facts the mankind cannot deny the positive features of nuclear energy, the prospect and efficiency of its usage. The fact is that it exists in our world, it belongs to the planet, and civilization cannot sidestep the thing which subordinates the physical laws.

The main directions of the research are to analyze economic aspects of the use of nuclear energy and to look for its importance, to stimulate interest in the study of nuclear energy and to support the development of researches.

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Trends of Consumption of Nuclear Energy and its Economic Aspects

The period of the use of nuclear energy is very important in Energy consumption, which is significantly less compared to others, but has a stable development dynamics. Due to the potential of Atomic Energy on modern stage it is possible to increase the annual rates, but there is still a negative attitude towards nuclear energy, which greatly damages its reputation and its further development.

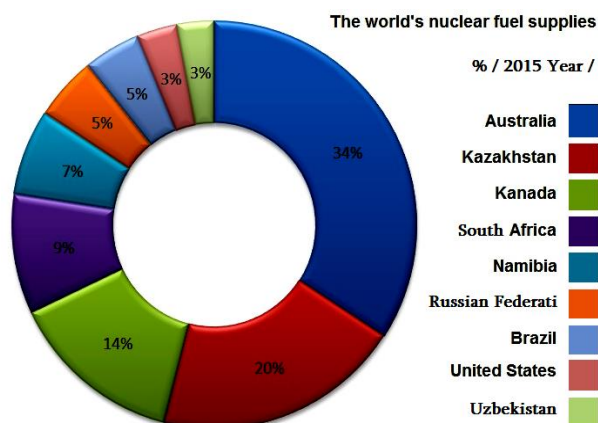


Figure 1

Number of victims of the nuclear disaster is 240000 people and got the health disease more than 300000 people, where the number of people afflicted by blast of Khirosima and Nagasaki is more than 90%, and totally 10% as a result of accidents in the Energy sector. The results of researches based on the UN and other international organizations reflects the fact (see Figure 1) that the negative effects and processes arising while using coal, gas and hydro energy resources are much more dangerous than the results of accidents at nuclear station. During the 44 years the amount of victims of nuclear energy in the energy sector is 0.3%, natural gas - 10.3%, hydro - 34.4%, coal - 55%. Production technologies of nuclear el. station allow an opportunity of more stable operation, than hydroelectric and thermal power stations, it should be noted that the main causes of accidents at nuclear power

stations are resulting from natural events and staff actions: England, - 1957; US - 1961; Switzerland -1969; France - 1969; US -1975; US -1979;

Ukraine -1986; Japan -2011; And, etc. These above mentioned accidents' results have established the fact that the major features of nuclear risk in atomic energetics are: **- Rapid development of the effects of the disaster; - a wide capacity of spread throughout; - Crash recovery period; - Fuel waste disposal.**

Nuclear energy has properpositives of development and**creates the best opportunities for energy independence of the country.** It does not have seasonality due to the fuelspecifics, it does not need an extensive transportation infrastructure and giving stable guarantees of a low cost of cheap electricity bill.

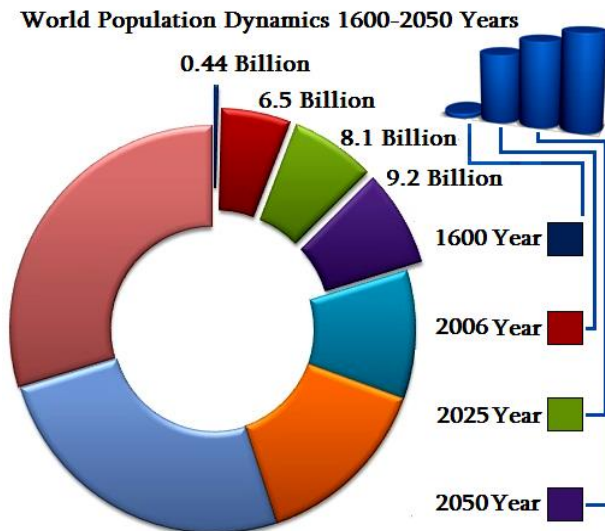


Figure 2

Recently, it is getting more and more harder an exact count of nuclear fuel in the world, but according to data of an international and local nuclear energy organizations capacity of nuclear fuel equals 5 million tons, about its usage as a result of scientific studies it is possible to determine different directions, **as this kind of fuel is smaller and is high-energy equivalence, the special priorities of its usage must be determined.** At present, it can only be used in order to get weapons, electrical and thermal energy and in the future it is possible to take place among other fields and give the mankind more economic effect, it is still a mystery and requires a deep scientific study of the unique features of uranium. The products, made by processing other energy resources, are used in the economic fields, such as: heavy, light and chemical industry, agriculture, transport, etc., **and the use of nuclear fuel diversity is still to be studied.** Among the structure of the uranium concentrate, an important exporter of nuclear materials is Canada, Australia, Nigeria, Brazil and the US, while according to the stock of deposits and in the theoretical point of view, important countries are Russia, Ukraine, France, Germany, Kazakhstan and others. According to reserves the leader is Australia, which owns 30% of the world's nuclear fuel. (See Figure 2) Due to the fuel price and energy-making potential, the price of the electricity is much cheaper than the electricity produced in other energy sectors, in the initial stage of the utilization of uranium cost only \$ 20- \$ 25 per 1 kg of raw uranium, and the price is now \$ 90- \$ 110 per 1 kg of raw uranium. Terms of economic efficiency, the following features should be highlighted about the nuclear fuel characters: **- simplicity of fuel discovery and production; - Transportation efficiency and compactness of storage; - equivalency of energy potential; - concrete and specificity of the use. (Not general raw materials); Dynamic stability of prices.**

Economic efficiency in atomic energy increases:

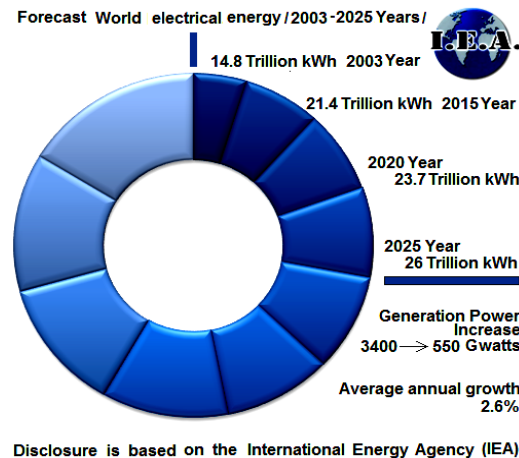


Figure 3

-systematic el. Station technologies; - el. Station compactness; - management methods of Manufacturing process; - qualification of labor

resources, which is not clearly shaped in the infrastructure of liquid fuel, gas and coal thermal power plants and hydro power stations. According to the waste hydro and fuel green energy has no alternative, but the global climate change may interfere the stability of hydro energy. Nowadays, power plants with dams still have a significant impact on the environment, which is revealed through flooding, soil rocks erosion and significant changes of climate. In the modern world, for effective use of nuclear energy, increasing research activities are focused on the creation of ultra-modern new types of reactors and in this regard in the innovative projects of the el. stations the following issues should be outlined: -station mobility; -compactness; - Increase throughput capacity of reactors; - safety quality improvement. The solution of above mentioned issues should ensure modern requirements. It is also necessary to ensure security, improvement of nuclear energy's working process measuring systems and the diagnostic technologies, which will determine real variations of forecasting and make the production process safer.

According to world population growth and the future prognosis, (See Figure 3) one of the major problems of civilization is supplying enough energy. In 2000-2015 the world demographic number increased with 1.2 billion which is bigger than the population growth rate in 1500-1900 years, or for 400 years. Unfortunately, it is not possible to provide enough electricity in proportion to population growth. Electricity consumption analysis shows that (See Figure 5) according to the example of presented countries for the world population required average of 17.4 trillion watts per year. As the share of electricity consumption of world's population, in the total power consumption is of average 50%, therefore for proper operation of the world economy and social space is required the 34 trillion kWh, which at this point is not done and there is quite important deficit. 50% of electricity from currently produced 8.48 trillion kw/h average of per 1 person is 606 kilowatt-hours, while according to given diagram, 2372 kw/h is necessary per 1 person, as a result we conclude

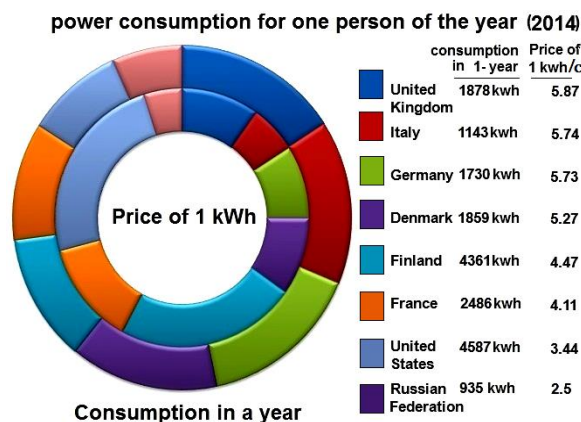


Figure 4

that the demand of world population is satisfied with 25.5% per 1 person.

Strategic direction of the deficit, takes a special place in the nuclear energy, the 7% position of nuclear energy will change in the world electricity balance. (See Figure 4) After the rehabilitation and operation of new reactors the increase is inevitable and the existing rate will increase in the future at least 15% in capacity. The relationships among the nuclear potential owned countries are specific and co-regulation creates best model, in which international organizations for nuclear safety and atomic energy make great contribution, (IAE, NAE, and act...). Currently, there operate 427 nuclear reactors in the world, 66 new reactors are being built in 15 countries, and at the functioning atomic el. Stations the total power in the beginning of the 2015 year was 364 GW / h. International Atomic Energy Organization's researches of determining economic aspects clearly show strategic development priorities, which must take into account the nuclear potential owner countries. Nuclear Engineering International scientific research organizations need to develop the priorities with nuclear countries. Due to a relatively less capacity of nuclear fuel, atomic physics' main aim is to improve the parameters of reactors, which on the one hand will optimize the use of raw materials and on the other hand will save expenses. The operating expenses of nuclear el. Stations is relatively large to others, nuclear el. station with 1000 MW requires expenses of average 9 billion dollars, but compared with the other hydro and thermal el. stations the received electricity is much cheaper and for 50 years of operation the price of 1 kw/h is 0.25 cents, while the consumer price, as a result expenses of fuel, scheduling labor resources and budgetary tax makes a change, that an average is 4.5 cents. **In the world energy market configuration the nuclear energy tariff policy is more stable, the dynamism of changes depends on the requirements of the market.** In recent years impact on price changes seems unnatural processes and manipulations. As many countries, which have the

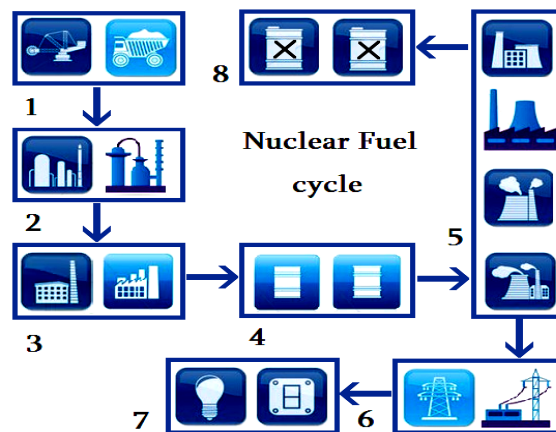


Figure 5 nuclear fuel supplies, but does not have the relevant infrastructure for electricity production, impacts and the cartel deals often have a place, moreover that the nuclear energy production cycle requires various infrastructure. (See Figure 6) 1-Uranium mining; 2-Conversion; 3-Enrichment; 4-Fuel fabrication; 5-Nuclear power station; 6-Power distribution; 7-Electricity; 8-Fuel waste utilization. There is neither precedent nor physically possible of accommodation the whole Atomic Energy infrastructure in a small territorial unit, but there are the large abstract areas of some of the countries in the world: the US., Canada, Russia, France's where there is a perfect Atomic Energy infrastructure, and

Figure 6 they are operating successfully and the electricity generated by them is cheaper than in other countries: England, Italy, and etc. Unlike the hydropower, in different countries whole trading infrastructure of nuclear energy is ambiguous, in the economic aspects of the world nuclear energetic outline the issue of electricity price-setting methodology for the improvement where it is necessary to take into account the issues of full production cycle of infrastructure complementation and to set scales, that directly impact on economic efficiency. Thus, nuclear power on this stage is not universal and does not belong to the type of business, its implementation is possible neither in any country nor any company will be involved in nuclear energetics, so despite the recent negative developments of the processes, negative events of the competition do not have a place. Based on the above mentioned fact in this direction it is possible to bring positive factors of the development of nuclear energy which may include: - **The number of competitors at the nuclear energy market;** - **Stable relationships between partners;** - **Lack of negatives of competition;**

Hence, nuclear energy trends and economic aspects show that the importance of the use of atomic energy is established as one of the global contemporary topical issues and the greatest attention is paid to nuclear technologies. Accidents and disasters are the results of the use of Atomic Energy, which causes the deadly disease of organisms; it significantly pollutes the environment and the planet's ecosystems breaks. However, mankind cannot deny the positives of nuclear energy, and the prospect of its efficiency. The fact is that it exists in our world, it belongs to the planet and the thing which subordinates physical laws civilization cannot avoid it, and it may be that the development of nuclear energy will make changes in the future in the global energy market conjuncture.

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