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Article

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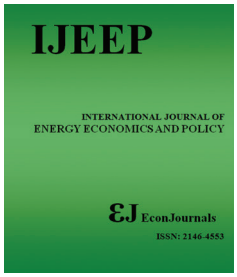

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Prospects of Nuclear Energy Development in Asia: Comparison with "Green Energy"

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ABSTRACT

Nuclear energy is an important part of energy balance of Asian countries. But at the same time, concerns about the safety of nuclear energy production are high, and the future of nuclear energy in Asia is unclear. New trends in the development of "green energy" production, especially in the most dynamically developing countries of Asia, create a high competition with nuclear energy in the region. The authors aim at a general analysis of the energy markets of leading Asian countries, which have a significant share of nuclear energy production in their energy balance – China, Japan, Korea and India. The second tool that the authors use is an econometric analysis of energy production in the studied countries. These two aspects of the energy sector analysis allow the authors to comprise the results and to form a vision of a more promising sector of the energy industry. Based on these results, the authors give a number of recommendations on the development of nuclear energy production in the studied countries. One of the main conclusions is that nuclear energy should be used as a reserve source of energy in Asian economies until they reach a high share of "green energy" in energy balance.

Keywords: Nuclear Energy, "Green Energy", Asia, Policy, Energy Market
JEL Classifications: Q40; Q47; P18; P28; P48

1. INTRODUCTION

Nuclear energy has long been one of the major hopes of the industry in the field of clean energy promotion. It has been considered a relatively clean, very effective source of energy with low quantity of waste after production. The two general models of nuclear reactors were constructed in the USA and in the USSR, the second model was less sophisticated, therefore, cheaper, while the first was more efficient due to technological solutions. The spread of nuclear energy production in the world was relatively fast; this ensured energy security of a country and created the image of a high-tech energy industry. The situation around nuclear energy seemed very bright until the Chernobyl accident in 1986. It cast the first doubts on the possibility of nuclear energy generation on a global scale and on the safety of nuclear fusion technology. But the humankind needed new sustainable sources of energy due to growing demand and pessimistic forecasts for oil and gas reserves. After the introduction of new safety measures at nuclear power plants, the whole situation became positive again until the Fukushima accident in 2011, after which the situation in the nuclear industry turned catastrophic.

At the same time, the technologies, which lie in the basis of the "green energy" production, namely, the production of solar panels and biofuels, became cheaper, the same goes for wind energy production. European and advanced economies have made significant efforts to introduce "green energy" as a new sustainable source of energy. Although some countries (such as Germany)

succeeded, most developing economies consider such technologies too expensive and unreliable to implement.

The article compares the production of nuclear and "green" energy in Asia, as one of the most dynamically developing regions in the world. The authors aim at forming the vision of the nuclear energy future in the region, taking into account competition with "green energy." Based on the results obtained, the authors propose a strategy for nuclear energy development.

2. LITERATURE REVIEW

Nuclear energy has always been a topic for significant discussion because of the high risks it bears. Even before Fukushima, several authors expressed concerns about the future of nuclear energy in Asia (Bunn et al., 2010). They focused on environmental aspects and potential military risks, but the economic aspect of the study was not developed. Wheatley et al. (2016) assessed the risks caused by the intensive use of nuclear energy and concluded that the next significant nuclear accident is highly likely (50% probability) to happen in the next 60 years. This conclusion and the research of risk factors are extremely important for the conclusions on Japan, where risks are higher (Almela, 2019).

Renewable energy, on the other hand, has its limitations, demonstrated in (Dulal et al., 2013), where authors concluded that there is no sustainable way to develop the sphere without significant financial support from the state. In addition, they point to the problem of energy transition, the difficulties of which were discussed in (Blazquez et al., 2019). The current situation on the "grid energy" market, namely the need for the electric grid creation and financial support for the sphere, was highlighted in (Erdiwansyah et al., 2019).

3. METHODOLOGY

The authors propose to study the situation with nuclear energy in the main Asian players in the energy market – China, Japan, Republic of Korea and India. Two countries are developed economies (Japan and Korea), and the other two are developing. This choice will allow to compare not only the prospects of nuclear energy in these countries, but also the attitude to it in developed and developing economies.

1. What is the situation in the field of nuclear energy?
2. What is the situation with "green energy"?
3. What is more promising for the country?

In order to answer the last question, the authors rely on the forecast for the production of nuclear and "green energy" in each country and give recommendations based on the current energy policy of the country and the results of the forecast.

The forecast is based on regression models with exogenous variables t, t^2, t^3, log(t), and constant, where *t* is an index variable. The general view of the model is represented below (1).

$$y \sim t+t^2+t^3+\log(t)+const \quad (1)$$

The model is estimated using the R2 criterion and the p-criterion for variables, the data acquired from modelling must be positive, since energy production cannot be negative in nature, therefore, the forecast is used with absolute values.

Based on the data acquired from forecasts and empirical analysis, the authors conduct a rating analysis, which demonstrates the answer to the question of the suitability of nuclear or "green energy" for the country's economy. The more points a country receives in a category, the more it fits in its economic model and structure of the energy sector. Dominance of a sector in the analysis indicates the best sector for investment for future development. Comparison of the results of the analysis and the current situation gives the basis for recommendations on nuclear policy for the studied countries.

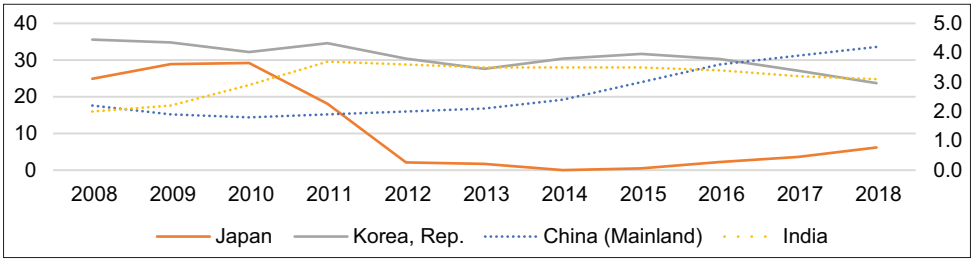
4. RESULTS

The situation in the nuclear energy industry today is rather pessimistic – the revival of nuclear energy production is far from its peak speed, as well as the development of new power plants (Horvath and Rachlew, 2016). Figure 1 demonstrates the dynamics of nuclear energy production in the studied countries.

As can be seen from Figure 1, Fukushima was much more influential in the developed economies of Asia, namely in Japan and Korea. Although the reaction of the first country is clear (the incident caused a huge panic regarding the further nuclear energy generation, the attitude of Korea is unclear: It seems that the country is not decisive in its energy policy. The crisis affected the developing countries to a lesser extent; this is confirmed by the dispersion analysis of the data rows presented in Table 1 (the lower the dispersion, the smoother the reaction).

Although the situation in the field of nuclear energy in the studied countries is unstable, the development of alternative energy seems

Figure 1: Nuclear energy in total energy production, % (dotted lines on the right axis)



Source: Created by the authors, based on (World Nuclear Association, 2019)

very promising. The dynamics of "green energy" production is presented in Figure 2.

All the countries except India have a constantly growing share of alternative energy in their energy production.

An analysis of the presented data is impossible without an analysis of the total energy production by the studied countries. As follows from the data (IEA, 2019a; 2019b; 2019c; 2019d), only Japan hits a relative plateau in energy production, while all the other countries face a rapid growth in energy production. It is noteworthy that in India, there is no rapid growth in either nuclear or "green energy" production. For all the other countries, the growth or fall trend presented in Figures 1 and 2 means the same dynamics in energy production in GWh.

4.1. China: Nuclear and "green" Energy as Primary Sources of Coal Substitution

Today, China is one of the major energy consumers in Asia (McManus, 2017). Due to the fact that the country's energy industry at the beginning of the 20th century relied mostly on coal as a source of energy and heat, the environmental situation in large cities was terrible. To change it, in 2014, China adopted a policy for clean air (World Nuclear Association, 2020a), which defines the main goals for the change in energy balance. One of the leading roles was given to nuclear energy; China planned to operate 58 GW in 2020, while another 30 GW were planned to be constructed. Nevertheless, this number is overestimated, and the construction of several new nuclear power plants is postponed (Reuters, 2018); another source states that the current situation around COVID-2019 will not have a further impact on the construction of the reactor (Reuters, 2020).

Let us discuss the main problems, which cause a slowdown in the development of the nuclear energy industry in China.

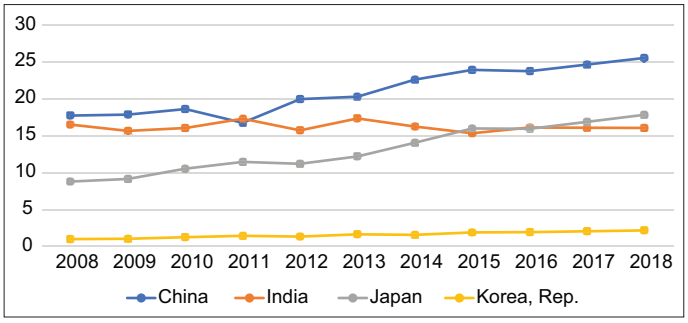
Today's Chinese economy is characterized by a "new normality," which means an inevitable slowdown in the long run. The nuclear energy development requires significant financial resources. Provided previously by the state, in the new conditions such large investments will not be possible.

Table 1: Dispersion of nuclear energy generation rows

China (Mainland)	Japan	Korea, Rep.	India
0.78	144.63	13.11	0.32

Source: Calculated by the authors

Figure 2: "Green energy" in total energy production, %



Source: created by the authors, based on (World Bank, 2019)

China's pursuit of innovation in the field of nuclear technologies requires a close partnership with Russia, France and the United States as the main contributors to the Chinese technology acquisition (Rosatom, Orano [formerly, Areva] Westinghouse) (World Nuclear Association, 2020a). Under the current conditions of a trade war with the United States, the only source left is the cooperation with Russia, which is costly.

Another important issue is the massive deployment of new projects. According to (Xu et al., 2018), China has the largest number and generating capacity of nuclear reactors under construction in the world. Such a significant number of projects built simultaneously needs additional financial support. Another important consequence is the high degree of uncertainty regarding the future of these reactors and their social and environmental impact, but what is more important – their reliability.

Despite this, China exports its nuclear technology to Asian countries and successfully competes with historically influential nuclear powers such as Russia and the United States on the global arena of nuclear energy development. All in all, the prospects of nuclear energy in China are quite positive, even if "green energy" dominates the country's energy policy agenda in the near future.

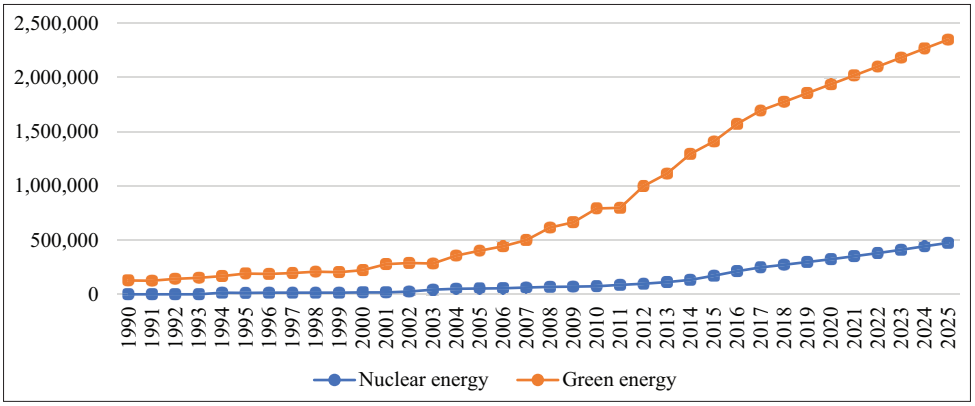
At the same time, the situation with "green energy" in China is much better (Chernysheva et al., 2019; He et al., 2018). Its share in energy production will reach 30% of total energy production, as stated in the 13th 5-year plan for electricity (Gosens et al., 2017), and investments in this field come massively from private companies and development corporations including development banks (Bai et al., 2013; Mazzucato and Semieniuk, 2018).

The main problem with the development of "green energy" in China is the industrial demand for energy. In this regard, power plants situated near the main regions of industrial production are significantly better, and the transition of electric power is cheaper (Blazquez et al., 2019).

The authors put forward a hypothesis on the Chinese energy balance: households can be supplied with "green energy" sources, helping to reduce pollution in large cities and agglomerations, while the industrial sector prefers nuclear energy and oil and gas energy, as they are more reliable and such power plants can be placed almost everywhere, except for seismically dangerous areas and areas prone to natural disasters, such as tsunamis. A comparison of nuclear and "green" energy in China is presented in Figure 3.

Figure 3 shows the growing gap between the development of nuclear and "green" energy in China. This gap demonstrates the growing demand of households, which can be supplied by "green" power plants and a slowdown in industrial demand (Mortazavi et al., 2019). Figure 3 proves the hypothesis, expressed previously, since the household demand of electricity in China grows rapidly due to the program of consumer demand stimulation in China (China Chamber of International Commerce, 2019; Shijia, 2019), while the growth rate of industrial demand remains relatively low.

Figure 3: Energy segments development forecast in China, GWh



Source: Calculated by the authors

4.2. Japan: Total Ban of Nuclear Energy Development

After the accident at the Fukushima nuclear power plant, the situation on the Japanese energy market changed dramatically. Japan's nuclear energy market was previously formed by Japanese companies, such as Toshiba, Mitsubishi, etc., which mainly were part of the keiretsu (Grabowiecki, 2006). As a result of the Japanese keiretsu system, when a company has a significant influence on the authorities and regulates the economic system in many fields, the previous incidents, some of which resulted in deaths, were not properly investigated, therefore, conclusions were not made (Fackler, 2007; The New York Times, 1981). Hence, the entire nuclear industry of the country had significant malfunctions, which were revealed only during the Fukushima accident and its investigation.

A mistrust in the nuclear energy safety in seismically dangerous areas resulted in a ban on nuclear energy until the producers fulfil the new requirements (World Nuclear Association, 2020c). Today, Japan's long-term goal is to generate 20% of energy through nuclear power plants. They must comply with the new strict rules and the system of licensing authorities.

The other side of the Fukushima accident is the exploitation of the fear of nuclear energy. Japan depends on energy imports, so some actors, such as pro-American forces, which are interested in selling LNG and shale gas to Japan (Clemente, 2020; Levi, 2012), try to exploit the problems of the Japanese energy production.

In this regard, it is clear that the Japanese nuclear energy industry is going through difficult times, especially in the case of another accident at nuclear power plants, which has significant chances to happen due to the country's natural conditions (high seismic activity, floods and tsunami risks, etc.).

At the same time, this situation created very strong beliefs in alternative energy sources in Japan. Clearly, the country does not want to depend on foreign resources, especially taking into account a significant potential for "green energy" production (Kaya et al., 2015). The overall impact of "green energy" on the Japanese economy is significant, especially given that the country's energy sector tends to change its priorities.

The introduction of the feed-in tariff system increased support for "green energy" by $ 22 billion in 2019 alone (Takeuchi, 2019), but the costs were placed on the society. As a result, the development of "green energy" in Japan will be quick, but rather painful for the country's economy. This is currently the main problem with "green energy" in Japan. The problem of the transition of energy is not as significant as in China; firstly, because of the smaller territory and higher density of industrial production; secondly, because of the significant geothermal potential of "green energy" production, which can be realized in almost every point of the country; and, finally, because of the lower industrial demand, since today Japan does not manufacture a significant amount of goods, its companies have outsourced production to other countries, including China (Asklund, 2011).

Figure 4 demonstrates the future of Japan's energy industry.

It is noteworthy that the development of "green energy" correlates with a fall in nuclear energy in the country's energy balance, but the value of energy production in 2010 from these two sources will be reached only in 2022. At the same time, nuclear energy production starts to grow at a high pace, so the current situation in Japan's energy industry will lead to a possible energy independence of the country from energy imports. From this point of view, the current energy policy of Japan is expensive and socially irresponsible, but leads to lower energy expenditures and, consequently, costs in the long run (at least after 2025).

4.3. Korea: The Next Generation Will Decide

Korea, like Japan, is one of the main energy importers in Asia. The country's previous energy policy implied a constant share of nuclear energy in the energy balance of the country. The Fukushima accident significantly influenced this plan, but in the case of Korea this influence was much more weighted than in Japan. The nuclear energy policy is regulated in (MOTIE, 2015), which was based on the assumption that 13 new reactors should be opened before 2029 (World Nuclear Association, 2020d).

The country's new leader stated that the next 40 years will lead to the rejection of nuclear energy generation in Korea. This is partly a political decision, but, like Japan, Korea has more hopes for "green energy."

At the same time, Korea has a slightly different attitude to nuclear energy than Japan. It does not promote a total global ban of nuclear

energy (Yurman, 2019), further, it entered the global market of nuclear power plant builders; this was especially significant in 2011, when Kepco, the Korean leader in nuclear research, signed a deal with the United Arab Emirates for construction of four nuclear reactors. The main idea of the Kepco's competitiveness in the global market is standardization, which reduces costs (Kim, 2019). At the same time, standardization leads to growing risks of various conditions of exploitation in different countries.

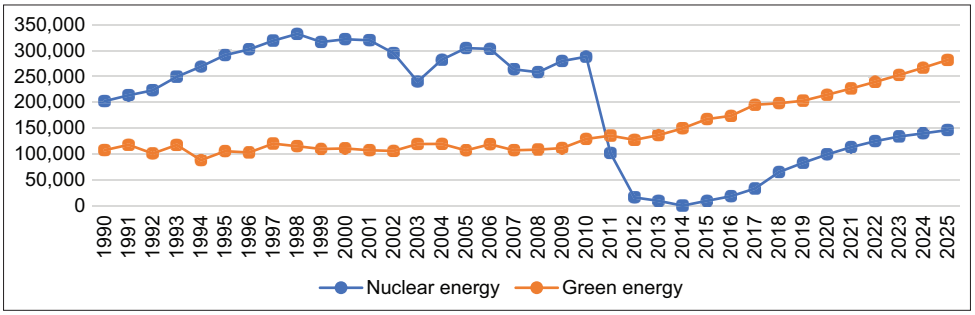
Korea is the first from the studied countries, which aims at a total ban of nuclear energy generation on its territory; this is a doubtful decision, taking into account the relatively small territory of the country and the high intensity of industrial production. Korea stands between the Chinese and Japanese economic models. The Chinese one offers mass production on the territory of the country with a low share of outsourcing (Eloot et al., 2013; Feng et al., 2018), while the Japanese model is characterized by technology production, while industrial production is outsourced to other countries. The Korean path offers outsourcing of industries with negative social and environmental impact, while high-tech industries are located in the domestic territory. The main question for Korea is whether its industry will be able to change the energy source in the next 40 years.

When speaking about "green energy" in Korea, it should be noted that the country has adopted a policy of rapid stimulation of the "green energy" development. This policy includes tax benefits, but in addition to that, regulatory quotas for large (more than 500 MW) producers, which must produce a fixed amount of energy through renewables (Yoon and Sim, 2015); for 2020 this amount equals to 7% and is expected to grow to 10% in 2023. This attitude gives a significant boost to "green energy" production, but at the same time it turned out to be inefficient for energy producers. A quota of 7%, if the facility produces more from renewables (for instance, "green energy" power plants), can be sold to other power plants, which did not achieve this value. The price of such quotas was a significant part of the return on investments, especially for those power plants, which had to invest heavily (biofuel energy is cheap to invest, as well as waste energy, while solar, tidal and geothermal energy production requires significant capital). In recent years, solar energy production in Korea has risen sharply, so quotas were exceeded to such an extent that the price of quota in the Korean market of energy producers fell more than thrice a year (Byung-wook, 2020). This example is only part of a discussion on the efficiency of the Korean "green energy" policy.

Another important issue for "green energy" in Korea is the low price of electricity and low return on investments (Byung-wook, 2020). In addition, the nuclear lobby in the country is strong too. The current dynamics of nuclear and renewable energy production is presented in Figure 5.

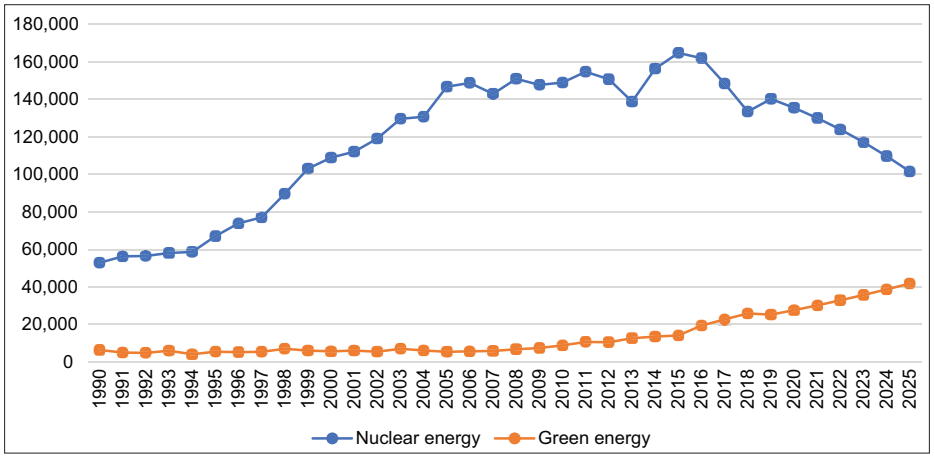
Figure 5 demonstrates the key inefficiency of the Korean energy policy: the fall in nuclear energy production is not compensated by "green energy" production, which will force the energy sector to build up the power generated from oil and gas, which, in

Figure 4: Energy segments development forecast in japan, Gwh



Source: Calculated by the authors

Figure 5: Energy segments development forecast in Korea, GWh



Source: Calculated by the authors

turn, does not comply with the country's "green energy" policy development. In this regard, the current policy of the country needs to be reviewed, especially in the field of nuclear energy, as it allows to temporary substitute "green energy". In addition, one of the major renewable energy sources in Korea is biofuel and waste energy, which produce significant amounts of CO2 (Shin et al., 2018). As a result, Korea may soon face the problem of the Chinese economy before the clean air reform: increasing CO2 emissions will worsen the country's environment, while nuclear energy can solve the problem, at least temporarily.

4.4. India – A New Way of Nuclear Energy Distribution

India has a very specific history of nuclear energy production. Due to restrictions caused by the fact that India is not a party to the treaty on the non-proliferation of nuclear weapons, the import of nuclear fuel, which is scarce in India, was very complicated. This necessitated the development of technologies that would work on less uranium, for example, technologically simple reactors that use heavy water. At the same time, foreign influence on the industry was significant, the major players were Russia, the main supplier of uranium to India since 2001, China, constructing several new reactors in the country in recent years, and the United States, participating in the construction of Tarapur reactors (World Nuclear Association, 2020b).

A feature of India's nuclear energy development is the fact that the country does not possess enough financial resources to massively invest in rapidly growing energy demand (it is estimated that growth by 2040 will be 156% (BP, 2019). This means that the country needs a reliable and stable source of energy, but due to the lack of hydrocarbon resources in its territory, the country has only one relatively cheap and financially profitable option – nuclear energy, especially given the fact that alternative energy is financed by Asian development banks, while the main global powers see the potential in the country and compete for its nuclear market (Russia, China and the United States are the major competitors in nuclear energy development in India) (DiChristopher, 2019). Another important point is the Indian nuclear development strategy: the substitution of energy production from traditional sources (hydrocarbons and coal) by nuclear energy (Rajaraman, 2018). This attitude is atypical for the studied countries, which in the last decade have sought ways to enlarge the capacity of "green energy" generation.

Furthermore, India uses nuclear energy to supply households, so industry cannot dictate where and how to place nuclear power plants. As a result, the prospects of nuclear energy development in the country are not influenced by industrial development.

Another positive external effect of nuclear energy in India is its influence on the country's scientific development (Jain, 2008). India actively cooperates with Russia in the development of new nuclear technologies, and China provides its solutions for the effective electric grid development in the country. The history of this sphere offers wide opportunities for Indian export of cheap and simple nuclear energy technologies to the least developed countries, so the country's nuclear development is a very important part of its economy.

All the mentioned is true, despite the fact that nuclear energy provides about 3% of the country's energy balance. Such a low number is explained by the recent start of extensive growth of the country's economy.

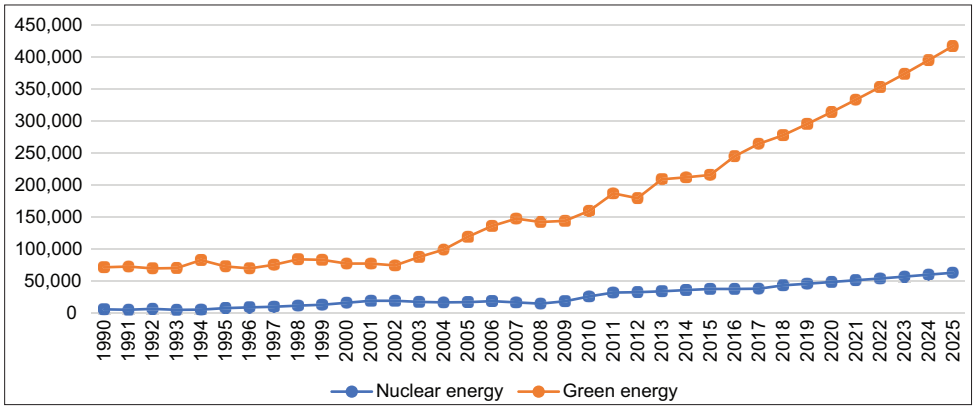
The government energy policy of India is ambivalent: it stimulates the development of nuclear energy due to numerous factors mentioned above, on the other hand, it promotes the installation of renewable energy capacities in its territory. "Green energy" has a vast potential in the country, but because of inconsistent state policy, namely the desire for cheap energy, undermined by import duties, aimed at stimulating the "Make in India" program; and its development in the country is not as fast as it was expected earlier. At the same time, India, like China, massively depends on coal. The goal set by the government to increase the performance of "green energy" is a vital part of its environmental policy.

The development of "green energy", including hydropower, is supported by the Asian Infrastructure Investment Bank and the New Development Bank of BRICS, thus providing additional financial resources for the country.

The main trends in the development of nuclear and "green" energy in India are presented in Figure 6.

Figure 6 demonstrates a situation similar to that of China: The rapid growth of "green energy" and the slow and steady growth of nuclear energy. This allows to make preliminary conclusions on the

Figure 6: Energy segments development forecast in India, GWh



Source: Calculated by the authors

similarity of the two economies in the field of energy production and consumption.

4.5. Rating the Energy Sectors

The authors have given a brief overview of the countries' policies in the field of nuclear energy and "green energy." The comparison is based on three main factors: The segment that uses energy (in the case where industries and households are able to efficiently use this type of energy, both get a plus) and the accessibility to use this energy (an assessment of the risks mentioned above – for nuclear energy, an abundance of resources and natural conditions for generation – for "green energy"). Two other factors are different: an important part of the energy security is the ability to maintain energy facilities and supply them with domestic resources (the availability of domestic uranium – for nuclear plants, financial capability to build new energy power plants – for "green energy"). At the same time, nuclear energy can be produced even if the energy prices in the country are low – it is highly competitive, while "green energy", despite the decline of costs, still performs better in countries with high energy prices. The results are presented in Table 2.

Table 2 shows that for China and India, nuclear energy suit their economies better, while the nuclear sector development in Korea is possible, but is accompanied by many difficulties. In Japan, the further development of nuclear energy is very difficult for the economy and, moreover, it will not produce positive effects for society and business.

5. DISCUSSION

The government policy of China in the field of nuclear energy is quite clear and does not require serious adjustments. China takes full advantage of cooperation with Russia and, earlier, Western companies; it has the potential to develop the industry and export nuclear technology. All in all, the key measures that should be taken by China to improve the work of nuclear energy sector are as follows:

1. To develop a program for the regular assessment of the safety and proper operation of nuclear facilities due to high social risks caused by high population density
2. To cooperate with Russia and India in the development of high nuclear technologies, create joint ventures to test the functionality of new products
3. To reduce the number of projects under construction in order to spend the budget more evenly and introduce nuclear power plants more smoothly over time in order to avoid typical malfunctions or errors and have additional time to fix them.

Japan's nuclear policy has always been risky – the question was not whether the incident would happen, but when and how destructive it was. The decision to recertify nuclear power plants was weighted and correct, but the country's new energy policy should:

1. Use nuclear energy as a temporary measure until the country's economy produces enough energy from other sources
2. Ban the construction of new nuclear reactors and limit the volume of energy production by nuclear power plants to the level, equal to the pre-Fukushima level
3. Unite the natural disasters monitoring system and the nuclear power plants production systems in order to stop the energy generation and extinguish the nuclear reaction
4. Develop a system of emergency water decontamination and radioactive decontamination in the event of a reactor failure and introduce this system at all nuclear power plants. It is clear that such a system is a necessary part of any reactor and is now constructed on any nuclear facility, but the high seismic activity and the high tsunami risk make Japan a special case – hence, this problem needs a special solution.

A general recommendation for Japan is to develop "green energy" and limit the use of nuclear energy up to its total ban. The current trends in the development of the country's energy sector, presented in Figure 4, do not give a clear answer to the future plans of the country, therefore, the authors pay special attention to the fact that nuclear energy does not suit either the economic model or the natural conditions of Japan, so the rejection of nuclear energy generation is the most correct way of the country's energy sector development.

Speaking about the Republic of Korea, the authors consider nuclear energy an important part of the country's energy balance and make the following recommendations:

1. The policy of a 40-year nuclear energy use reduction in the country is preliminary, the construction of the "green energy" facilities in Korea and a suitable electric grid infrastructure, especially energy reserve facilities, will take a longer time
2. Nuclear power can be used in the country as a source of stable energy, independent on natural conditions, and as a reserve in case "green energy" power plants cannot satisfy the energy demand at a certain moment
3. Nuclear power should not play a significant role in the country's energy balance because of doubtful natural conditions and military threats from North Korea, which could result in an attack on nuclear power plants and cause severe damage to the country's economy, population and nature
4. The government should develop a clear vision and a concrete technical plan for the power grid of the country, which will

Table 2: Scoring of energy sectors efficiency in the studied countries

Nuclear energy					"Green energy"				
Factor	China	Japan	Korea, Rep.	India	Factor	China	Japan	Korea, Rep.	India
Industry	+	+	+	+	Industry	-	+	+	+
Households	–	–	–	+	Households	+	+	+	+
Natural conditions	+	–	±	+	Natural conditions	±	+	+	+
Availability of domestic nuclear fuel	+	–	–	–	Availability of extensive finances	+	+	+	–
Low energy price	+	–	+	+	High energy price	–	+	–	–
Final score	4	1	2.5	4	Final score	2.5	5	4	3

Source: Created by the authors

include nuclear power plants, playing the role described above.

Korea has a significant potential for "green energy" production, but should have a reserve option – nuclear energy.

India has a significant potential in the development of nuclear energy production. The major problem is the lack of domestic reserves of uranium. The main recommendations for the Indian energy system:

1. Cooperate with China and Russia in order to stimulate foreign direct investment in the construction of nuclear power plants in the country, as well as with Russia and Western companies in the field of technology transfer
2. Inclusion of nuclear technology solutions in "Make in India" initiative that promotes domestic production; this will contribute to the growth of India's overall exports and boost India's trade with less developed countries, especially in the energy and high-tech fields
3. Creation of reserves of uranium through trade with Russia and China
4. Development of a model of nuclear energy for everybody, thus stimulating the growth of local businesses by providing them with cheap energy generated by nuclear power plants.

The authors made an important observation on the nuclear energy production in the studied countries: the less financially developed the country is, the less financial resources it has, the more profitable nuclear energy is for its energy sector. This leads to another conclusion: nuclear energy is much cheaper than "green energy" and provides vast potential for the economy.

6. CONCLUSION

The current situation in the energy market puts significant pressure on nuclear energy. The future of this source of energy in Asia is unclear – the analysis of the countries demonstrates that developing economies tend to maintain a share of nuclear energy in their energy balance, while developed economies prefer "green energy."

China and India have a significant potential in both energy sectors. India tends to reduce the costs of developing its energy market and use nuclear energy as a new emerging source of energy. China has a combined strategy, where both nuclear energy and "green energy" have the same priority in the future development. Korea pursues a total ban of nuclear energy production in the country, this decision is preliminary due to the lower than expected successes of "green energy" caused by a controversial policy. Japan, despite the negative experience, tries to revive nuclear energy, while the country is least adapted to the nuclear energy production among all the studied countries. Systematization of the results leads to the conclusion that nuclear energy today depends on the political course of the country and the leading energy market lobby. As a result, the efficiency and safety of nuclear energy production in Japan and Korea are doubtful, in China and India, the efficiency is ensured, safety is subject to risks, but they are lower than in Japan and Korea.

The main recommendation for all the countries is to preserve the role of nuclear energy in the economy, but for Japan and Korea its role should complement "green energy." A new course in the development of nuclear energy in Asia requires a very cautious approach and greater control in this field. In addition, the unification of nuclear facilities in the countries, which start the process of the energy market transformation, is needed. This will reduce the costs risks of nuclear energy development.

Another important direction of nuclear energy development is the focus on the economic assessment of nuclear energy production in the country. The more effective the sector is for the country's economy, the higher should be the share of nuclear energy in energy production of the country.

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