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NUCLEAR ENERGY IN SOUTHEAST ASIA AND RUSSIA'S INTERESTS

The rapid economic growth which most of the developing countries in Southeast Asia are demonstrating has led to an unprecedented rise in electricity demand. These countries are therefore scrambling to identify the best way of satisfying that demand. The current trend in the global energy sector is to find more viable alternatives to expensive and finite fossil fuels. Nuclear energy is one such alternative.

At present, the Southeast Asian countries that have made the most tangible progress in developing nuclear energy are Vietnam, Indonesia, Malaysia, Burma, Thailand, and the Philippines.

Like any other regional market, the nuclear energy market in Southeast Asia has its own distinctive features, which have to do mostly with the region's geography and geology. Some of the countries here are in a seismically active zone, the so-called Ring of Fire, which is a horseshoe-shaped chain of volcanoes and tectonic fault lines in the Pacific. The Philippines and Indonesia are the worst affected.² Nevertheless, both countries are actively pursuing nuclear energy development plans. The Philippines has already built a nuclear power plant, though it has never launched it. Indonesia has ambitious nuclear energy plans, and views nuclear power plants (NPPs) as an important future source of electricity. Nuclear safety and security are therefore becoming increasingly important issues on the region's agenda.

Nuclear energy development in Southeast Asia has one distinctive feature: most of the countries here are building their nuclear infrastructure from scratch. The only exception is the Philippines, with its already built Bataan nuclear power plant. This means that whoever wins the contract to build nuclear power plants here will also land contracts for personnel training, for building nuclear safety and security infrastructure, etc. In other words, the country which wins the contract for building NPPs in the region will secure more than just economic dividends. Such a contract will also provide work for the winning nation's researchers, designers, machine-builders, and other subcontractors. In the longer time frame that nation will also receive a long-term contract for nuclear fuel supplies. Also, during the initial period the supplier country will have a role to play in operating the new NPP, which is a significant economic dividend.

Besides, the economic and technological ties between the importer and exporter countries built as part of an NPP project can also influence foreign policy.

All of these considerations explain the other distinctive feature of the Southeast Asian nuclear market, i.e. the fact that it is highly competitive. Apart from Russia's Atomstroyexport, interest in the region's nuclear energy programs has been expressed by other large industry players, such as AREVA and Westinghouse³, as well as Japanese and Korean companies.⁴

Below is a roundup of the six Southeast Asian countries' nuclear energy programs.

VIETNAM

Vietnam is Southeast Asia's fastest-growing economy. In 2006 the country's electricity output reached 56.5 billion kWh. Hydroelectric power plants accounted for 42 percent of that figure,



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natural gas-fired power plants for 37 percent, and coal-fired plants for 17 percent. The country's oil and gas resources are not large, and the output of hydroelectric power plants depends on the season.⁵ The country's rapidly growing economy needs other energy sources. Nuclear energy development therefore seems an entirely logical and predictable step.

First feasibility studies for nuclear energy were held in Vietnam back in the early 1980s.⁶ Another study was held in 1995; it became the basis of Vietnam's nuclear energy development program until 2025, which was later adjusted to encompass the 2030 time frame.

The country's existing nuclear energy development plan can be divided into three stages. The first is until 2015, during which time the government plans to conduct a technical and economic feasibility study and award contracts for building nuclear power plants. The second stage, in 2015–2020, will see the construction and launch of Vietnam's first nuclear power plant. During the third stage, between 2020 and 2030, more energy reactors will be launched. Eight sites in five provinces (Ninh Thuan, Binh Dinh, Phu Yen, Ha Tinh, and Quang Ngai) have already been identified. According to a government statement in 2006, two nuclear power plants were to be built in the country. The first one, with an output of 2,000 MW, was to be situated in Ninh Phuoc district; it was scheduled for launch by 2020.⁷ The second NPP, to be launched shortly after the first one, was to be situated in Ninh Hai district. Both districts are in Ninh Thuan province. The combined output of the two NPPs will be 4,000 MW. The existing Hoa Binh hydroelectric power plant, the country's largest, has a maximum capacity of 1,920 MW.⁸

By 2025 Vietnam expects to launch 8 GW of nuclear power capacity; by 2030 it plans to have 13 energy reactors in operation, with a combined output of 15 GW, or 10 percent of the country's total.

A preliminary technical and economic feasibility study for the country's first NPP was completed in November 2009. The full study should be completed by 2012. According to the existing plans, construction is due to begin in 2014, with the launch of the first NPP scheduled for 2020.

Several international companies have submitted their bids for the project to develop nuclear energy in Vietnam. At one point the country saw Westinghouse, the world's largest maker of nuclear reactors, as a likely partner for the first NPP. Hanoi also received offers of cooperation in developing nuclear energy from several other countries, including Japan, China, India, South Korea, and Germany.¹⁰ Starting from 2006 Vietnam has signed nuclear energy cooperation agreements with France, China, South Korea, Japan, Russia, the United States, and Canada.

Russia has repeatedly expressed interest in Vietnam's project to build NPPs. During Russian Foreign Minister Sergey Lavrov's visit to Hanoi in July 2009 representatives of the Russian Rosatom State Corporation for Atomic Energy and the Vietnamese Science and Technology Ministry signed a memorandum of cooperation in nuclear energy development in Vietnam.¹¹ Shortly afterwards Rosatom deputy director-general Petr Shchedrovistky said that the corporation was considering the possibility of bidding for the Vietnamese contract to build the country's first NPP.¹²

In December 2009 another Russian–Vietnamese memorandum of understanding on cooperation in building the first Vietnamese NPP was signed by Rosatom head Sergey Kirienko and the director-general of the Electricity of Vietnam state energy company, Pham Le Thanh. Shortly afterwards, in February 2010, Rosatom won the contract to conduct a technical and economic feasibility study for the project, beating a Japanese consortium (International Nuclear Energy Development of Japan Co.) consisting of such industry giants as Toshiba, Mitsubishi Heavy Industries, Hitachi, and others.¹³

On March 17, 2010, during a meeting between senior Rosatom executives and the Vietnamese Deputy Prime Minister and Education Minister, Nguyen Thien Nhan, the Vietnamese side confirmed the decision to involve Russian specialists in the project to build the country's first NPP.¹⁴ The two sides signed a memorandum of intentions regarding cooperation in nuclear training and research, including the training of specialists for Vietnam's national nuclear energy sector. According to Sergey Kirienko, Russian–Vietnamese cooperation “includes the construction of a nuclear power plant and a research center, the training of specialists and help in the development of national legislation in this area.”¹⁵

According to forecasts for nuclear energy development, the Vietnamese project should become the first in a string of such projects in Southeast Asia.¹⁶ The contract with Vietnam is therefore

very important for Russia. Winning the contract and then delivering on schedule and on budget would send a positive signal to other regional customers. It would give the Russian company a competitive advantage over the traditional players on the Southeast Asian markets, including Japanese and Korean corporations.¹⁷

Rosatom's success in the negotiations with the Vietnamese side is based on several underlying factors. First, Russia and Vietnam have many years of cooperation experience in such a strategic area as the fuel and energy sector, where joint Russian–Vietnamese oil ventures have worked successfully for several years now,¹⁸ and also in the area of military and technical cooperation. Neither should we forget the cooperation experience dating back to Soviet times, when Soviet specialists played an important role in rebuilding Vietnamese industry. In other words, Russia is not a new player in Vietnam. Second, Russia has an excellent record in the area of training and education projects. This will enable Vietnam not only to build the NPPs but also to train its nuclear specialists.¹⁹

Despite this impressive list of advantages, until recently Russia was far from certain to win the Vietnamese NPP custom. Suffice to recall the nuclear energy cooperation agreement Vietnam signed in late March 2010 with the United States.²⁰ The agreement paves the way for American companies to participate in the construction of NPPs in Vietnam. But right now it is safe to say that Russia's efforts have achieved the desired effect. Vietnam has now chosen it as a partner in the project to build the first Vietnamese NPP. Part of the reason for such a decision by Hanoi is that Vietnam regards Russian NPP technologies as the safest in the world—this was stated by the director of Vietnam Atomic Energy Institute, Vuong Huu Tan.²¹

But, despite that relative success, Russia is still facing stiff competition from other players for the actual contract to build the NPP. The project has great strategic importance. Winning this contract will not only pave the way for broader cooperation with Vietnam but also serve as a strong competitive advantage capable of opening up for Russia the nuclear energy markets of other countries in the region.

INDONESIA

In 2006 some 44 percent of Indonesia's electricity output was generated by coal-fired power plants. Oil accounted for another 29 percent, gas for 15 percent, hydroelectric energy for 7 percent, and geothermal plants for 5 percent.

The country already operates three research reactors. They are run by the National Atomic Energy Agency, BATAN.

First plans for commercial development of nuclear energy were announced by the Indonesian government back in the late 1980s. In 1989 the government identified the Muria peninsula in Central Java province as the likely site for the future NPP. In 1996 it completed the feasibility study which identified Ujung Lemahabang, an area in a seismically stable zone, as the site of a future 7,000 MW nuclear power plant. But in 1997 it was forced to shelve the project owing to economic instability and strong rejection of nuclear energy by the Indonesian public.²² The idea was resurrected in 2002–2003, when the economy stabilized and demand for electricity started to grow again.

The existing time frame for the implementation of the Indonesian nuclear energy program was set out in several documents adopted in 2006. They include the National Electricity Planning Scheme for 2006–2026 and Presidential Decree No. 43 of 2006. The plan was to announce a contract for the Muria 1 and Muria 2 phases of the project in 2008. Construction was due to begin in 2010, with a launch date in 2017.²³ The projected capacity of the pilot NPP was set at 2,000 MW. The project is to be supervised by BATAN.²⁴ The NPP will supply electricity to Java and Bali, which account for about 75 percent of electricity consumption in the country. The second phase of the project will see the building of the Muria 3 and Muria 4 reactors. The plan was to announce the contract for these in 2016, with a launch date in 2023. As part of the same program the Indonesian government expected nuclear energy to account for at least two percent of electricity generation in the country by 2017.²⁵

The government has also said it is ready to allocate some \$8 billion for the construction of four nuclear reactors with a total output of six GW by 2025.



By mid-2010 three areas were identified as possible NPP sites, including Muria (Central Java), Banten Province (Western Java), and the island of Bangka (east of Sumatra, with two sites in the eastern and southern parts of the island).²⁶ All these sites are situated on Indonesia's northern coastline, away from the tectonic fault lines.

In July 2007, the Korea Electric Power Corporation (KEPCO), Korea Hydro & Nuclear Power Company, and Indonesia's PT Medco Energi Internasional Tbk. signed an agreement to conduct a technical and economic feasibility study for two 1,000 MW reactors worth 3 billion dollars.²⁷ In addition, BATAN conducted a preliminary feasibility study for the construction of a Korean-designed SMART reactor in Madura Province. But the project cannot go ahead until a reference reactor is built in South Korea itself.

Meanwhile, the IAEA is studying the safety situation for the future reactors on the Muria peninsula in Madura province.

In 2007 the government of Gorontalo Province in northern Sulawesi announced its interest in the Russian project to build a floating nuclear power plant.

Russia is also studying the possibility of taking part in implementing Indonesia's nuclear energy development plan. Indonesia was one of the first countries to express interest in floating nuclear power plants (FNPP) in the late 1990s. Under the Russian proposals for FNPP export mechanisms, the actual power plant remains the property of the Russian Federation; it is operated by Russian personnel and all types of liability, including liability for so-called nuclear damage, are borne by Russia.²⁸ The FNPP can be used to generate electricity or as a desalination plant.²⁹ This makes the proposal especially attractive to Indonesia, which is one of the largest consumers of fresh water.³⁰

Russia has been working hard to strengthen its positions on the Indonesian nuclear market. In December 2006 the two countries signed a nuclear energy cooperation agreement.³¹ Later that year Rosatom head Sergey Kirienko announced the Russian nuclear company's intention to bid for the Indonesian contract for NPP construction. A year later, in September 2007, Russian President Vladimir Putin said during a visit to Indonesia that Russia was ready to assist Indonesia in the building of a nuclear power plant on Java.³²

The competition for the Indonesian NPP contract is not quite as stiff as for the Vietnamese one. Part of the reason is that Vietnam, rather than Indonesia, is expected to be the first country to actually start building an NPP in the region. Such projections shift the focus of competition. But this does not mean that winning the contract to build the first Indonesian NPP will be easy. Another important factor to take into account in Indonesia is that public opinion there is actively opposed to the construction of an NPP in the country. That could be a significant complication. Opponents of nuclear energy voice a whole range of arguments. Some say that high seismic activity in the region makes it unsuitable for building nuclear power plants. Others insist that the country has cheap and environmentally safe alternatives to nuclear energy, including its abundant geothermal energy sources.³³

MALAYSIA

In 2006 oil-fired power plants accounted for 41 percent of electricity generation in Malaysia, natural gas for 35 percent, coal 15 percent, and hydroelectric power plants two percent.³⁴

The starting point for the latest nuclear energy development plans in Malaysia was August 2006, when the Malaysian Nuclear Licensing Board said the country should build two nuclear reactors by 2020. The Ministry of Science, Technology and Innovation was tasked with implementing the program.³⁵ In 2008 the government launched a comprehensive study of the country's energy options, including nuclear energy. The study was scheduled to announce its conclusions in 2010. But even before that deadline the state-owned energy corporation, Tenaga Nasional Berhad, said that nuclear energy was one of the most promising future energy sources. In October 2009 the initial nuclear energy plan was revised. The country's Energy Minister, Peter Chin Fah Kui, said that the government saw 2025 as the earliest possible date for the launch of the first NPP.³⁶

Until recently Malaysia did not have a clear plan for nuclear energy development, and all the existing proposals looked more like declarations of intent. But in May 2010 the Energy Minister said in a public statement that the country's economic council had given the green light to the

construction of the first Malaysian NPP. The government had also set a firm deadline for the launch of that NPP for 2021.³⁷

The statement seemed to signal that the Malaysian government had finally set its NPP plans in motion—but experts were quite skeptical. Later on, however, some media outlets reported that the country's Energy Ministry was selecting the site for the first nuclear power plant and planning to spend about \$6 billion on building the first reactor.³⁸

The site will most likely be on the country's west coast, i.e. on the coast of the Strait of Malacca. There are some potentially suitable locations in Johor State (Batu Pahat District), Selangor State (Pulau Angsa Island), and Perak State (Sitiawan District) in the west of the country. Another possible site is in Pahang State.

It has to be said, however, that at this time Malaysia has yet to make a final decision on such a fundamental question as the power-output specifications of its future NPP. The existing plan therefore cannot be viewed as a clear roadmap. The Executive Secretary of Malaysia's Nuclear Licensing Board, Abdul Aziz Raja Adnan, has proposed two 500 MW reactors at the first NPP. Other specialists favor a more traditional configuration with two 1,000 MW reactors.³⁹

But despite the remaining uncertainty Russia still has a good starting position to win future Malaysian nuclear contracts. Like Indonesia, Malaysia has also expressed interest in the FNPP project. The Russian floating nuclear power plant was designed for the purpose of providing electricity to remote and inaccessible areas in the country's own Far North—but it also has an excellent export potential.

BURMA

In Burma hydroelectric power plants accounted for 53 percent of the country's electricity output in 2007, natural gas-fired power plants for 41 percent, and oil-fired plants for 4.5 percent.⁴⁰

Unlike the other countries in the region, Burma has already chosen Russia as its sole partner in nuclear energy development. Burmese nuclear energy plans were discussed by the country's Science and Technology Minister, U Thaung, during a visit to Russia in late 2000.⁴¹ In February 2001 Burma received an official offer from Russia to build a research reactor. On May 15, 2002 the Russian government passed a resolution to approve the Nuclear Industry Ministry's draft of an agreement between the two governments on building a nuclear research center in Burma.

In the early stages of the project the exact site of the future research reactor was not disclosed, giving rise to a wave of rumors and speculation. Rangoon was named as one possible site. But according to information published in several sources, the ceremony to lay the foundations of the future reactor was to take place in January 2003 in a location not far from the town of Magwe in central Burma.⁴² It was expected that later that year Russia and Burma would conduct a series of talks and sign an official agreement. But those plans were postponed because the IAEA had expressed doubts about Burma's ability to ensure adequate levels of security and safety for the future reactor,⁴³ and also because Russia doubted Rangoon's ability to pay for the project.⁴⁴

Talks resumed in 2005, and on May 15, 2007 at a special ceremony in Moscow the two countries signed an agreement on cooperation in building a nuclear research center in Burma.⁴⁵ The next round of talks on the future of Russian–Burmese cooperation in building a research reactor was held on May 16, 2007. The two sides discussed preparations for the signing of the actual contract for the reactor. Another round was tentatively scheduled for the second half of 2007 in Burma.

But the situation was complicated by the Saffron Revolution in September 2007, which led to serious destabilization in Burma. Further talks and practical steps to implement the project had to be postponed. Then came another calamity; in May 2008 Burma was devastated by Cyclone Nargis. The country was put on the brink of a humanitarian catastrophe, and resuming work on the expensive nuclear project became quite impossible.

The current situation is that the project has been postponed indefinitely. This does not mean, however, that cooperation between Russia and Burma has ceased in all areas. Military and technical cooperation continues to develop, and there is real hope that the implementation of the agreement to build a nuclear research center in Burma will resume shortly. As for Russian–Bur–Burmese ties in strategic areas, including nuclear energy, it must be said that cooperation between the two countries has come under serious criticism from the international community.⁴⁶



Nevertheless, Russia has not abrogated its commitments under the agreement with Burma, thereby bolstering its own reputation as a reliable partner.

THAILAND

Most of Thailand's electricity is produced by oil-fired power plants (50.3 percent in 2007). In 2009, the share of natural gas was 37.2 percent, coal 10.4 percent, and hydroelectric energy 2.2 percent.⁴⁷

The country's demand for electricity is projected to grow to 30 GW by 2020. For the supply to keep up, the Electricity Generating Authority of Thailand (EGAT) said the country will aim to launch four GW of nuclear power generation capacity by 2020.⁴⁸ In a statement made in June 2007 the country's Energy Minister, Piyavasti Amranand, spoke of nuclear energy "as the best way to keep electricity prices under control." The Minister stressed that Thailand needed to end its dependence on natural gas supplies from the Gulf of Siam countries because the gas fields there would soon be depleted. He added that coal was a cheap alternative, but the cost of this to the environment was incalculable.⁴⁹

In 2007 Thailand's national committee for energy policy approved the national energy plan to 2021, which included the launch of a 4,000 MW nuclear power plant. In the new version of the plan approved in 2010 and covering the period until 2030 the output specifications of the future NPP were increased to 5,000 MW. Work at the site was due to begin in 2015, with a launch date some time in 2020. Over the period from 2020 to 2028 the government wants to launch another five 1,000 MW reactors. The project will be led by the state-owned energy company. The output of the future NPP has been set at 5,000 MW. An agency tasked with ensuring safe operation of the NPP is due to be set up by 2014.⁵⁰ The first stage of the NPP project is to be financed by Thailand itself.

In addition, the Thai state energy company has conducted a study to identify the best site for the future NPP. Five sites were shortlisted. Three of them were in the south of the country in Surat Thani and Nakhon Si Thammarat provinces—but later they were dropped from the list due to opposition from the local communities. Other sites are in Ubon Ratchathani province in the east of the country, close to the border with Laos, and in Nakhon Sawan province 200km north of Bangkok. The final choice will be made between these two sites.

In December 2009 EGAT, in partnership with Hong Kong's largest energy company, signed an agreement on nuclear energy cooperation with China Guangdong Nuclear Power Corp. In 2010 EGAT signed an agreement on cooperation in building a nuclear power plant with Japan Atomic Power Co.

No information is available concerning any Russian–Thai cooperation on nuclear energy. But the area has been named as one of the priorities during bilateral discussions on future cooperation programs.

THE PHILIPPINES

The Philippines' electricity output reached 56.7 billion kWh in 2006. Coal-fired power plants accounted for 27 percent of that figure, natural gas 29 percent, oil eight percent, hydroelectric energy 17.5 percent, and geothermal energy 18.5 percent.

The Philippines is the only country in Southeast Asia which already has a nuclear power plant. But whether or not that NPP should be launched has been the subject of heated debate for many years. The decision to build the Bataan Nuclear Power Plant (BNPP), with two reactors and a total output of 621 MW, was made by the government during the 1973 oil crisis. Building work at the Bataan 1 site began in 1976 and was completed in 1984, at a cost of \$460 million.⁵¹ The Marcos regime supported the project, but after it fell the project was frozen.⁵² The NPP was never launched because of financial problems and unresolved safety issues.

In April 2007 the government made the last payment for the NPP. It has considered the option of converting the plant to use natural gas as fuel,⁵³ but the project was found to be uneconomic. The government then decided simply to maintain the NPP in a working state without actually operating it, which costs \$800,000 every year. In 2007 the energy department launched a feasibility study

for nuclear energy as part of the overall national energy plan. Nuclear energy is seen in the country as a way of reducing dependence on coal and oil imports.

According to information published in the country's 2008 national energy plan, the government aims to launch two 600 MW reactors by 2025, then add three more 600 MW reactors in 2027, 2030, and 2034, for a total nuclear generation capacity of 2,400 MW by 2034. The project is based on findings of the nuclear energy feasibility studies produced by the country's energy department as part of the overall national energy plan.⁵⁴

In 2008 the Philippines applied to the IAEA for assistance in resolving the situation with the Bataan NPP. It also sought the agency's recommendations regarding nuclear energy development in the country.⁵⁵ In the opinion of the IAEA the Bataan 1 NPP can be rebuilt, giving it at least 30 years of economical and safe operation. But the project will cost from \$800 million to \$1 billion. A number of Korean companies have already expressed keen interest in the proposed project to revive the Bataan NPP.⁵⁶

Also, according to the Filipino ambassador to Moscow, the country is interested in pursuing nuclear energy cooperation with Russia. A visit to Moscow by a delegation of the Filipino Energy Ministry has been scheduled for a date shortly after the May 2012 presidential election in Russia to discuss the prospects for such cooperation. According to an embassy official, the Philippines views Russia as a potential partner because the two countries already have positive experience of cooperation in other areas.⁵⁷

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Rapid economic growth in Southeast Asian countries is raising a number of problems related to growing demand for electricity. Given the volatility of the prices for oil, gas, and coal, and the fact that sooner or later the existing reserves will run out, these countries are increasingly opting for alternative energy sources, including nuclear energy. For Russia, which is one of the world's leading exporters of nuclear technologies, such a situation offers a unique opportunity to tap into a promising new market. This objective should be near the top of Russia's list of priorities, but achieving it will not be easy. The country will face fierce competition from other players; it will also have to take into account the specifics of the region as a whole and of each individual country in particular. Whether or not Rosatom succeeds in this venture will determine the company's direction for many years to come. Russia already has extensive experience of cooperation in building nuclear power plants⁵⁸ in India and China.⁵⁹ That experience, and the reputation Russia has earned as a reliable partner, is the trump card Russian companies will rely on in their efforts to win Southeast Asian markets. Besides, Russia can offer not only excellent value for money to the region's countries pursuing nuclear energy development but also some unique solutions that take into account their geographic situation.

Apart from the financial benefits of winning Southeast Asian nuclear contracts, the technological solutions designed for projects in the region can also be used in Russia itself. For example, building NPPs in earthquake-prone countries like Indonesia or the Philippines will require the utmost attention to safety issues. Later on the solutions developed for projects in these two countries could be used in Russia's own Far East, an area with high seismic activity and a shortage of electricity.

Table 1. Southeast Asian Nuclear Energy Projects.

Country	Project launch	Completion deadline	Number of reactors	Planned capacity	Cooperation with Russia
Vietnam	1995	2030	13	15 GW	Yes
Indonesia	2002–2003	2025	4	6 GW	Yes
Burma	2001	—	1*	10 MW	Yes
The Philippines	2007	2034	4	2,4 GW	No
Thailand	2007	2028	5	5 GW	No
Malaysia	2006	2025	2	1 GW or 2 GW	No

Notes: *Research reactor.



Russia's floating nuclear power plant (FNPP) project has very good chances of winning export contracts. Russia is the sole player in this market niche, and it already has a lot of experience in building and operating nuclear-powered civilian ships. The reactor design chosen for the FNPP project is the tried and tested KLT-40S, normally used on nuclear-powered ice-breakers. But before they sign actual contracts, potential foreign customers want to see at least one reference unit launched and operated. The first such unit, the *Mikhail Lomonosov*, is now on the ways at the Baltiysky shipyards in St Petersburg; its launch has been scheduled for 2013.

The main advantage of the FNPP project in the Southeast Asian context is that it would be economical in remote areas and small island countries, where demand for electricity is not large enough to justify building a nuclear power plant of traditional design.

Nuclear energy cooperation is a research-intensive and high-tech area in which Russia already has a lot of experience, making it a reliable supplier of advanced technologies. But there is still a lot of work to be done if Russia is to strengthen its presence in the region's market.

As of late 2010–early 2011, countries in Southeast Asia could be divided into two groups, depending on the progress they have made in implementing their nuclear energy plans and on the seriousness of their intentions. The first group includes Vietnam, Indonesia, and Thailand, where nuclear energy programs are clearly structured, with firm deadlines already set and decisions made regarding the sites of the future NPPs, as well as the number and power output specifications of the nuclear reactors to be built. The second group includes Malaysia, the Philippines, and Burma. These countries have announced their interest in nuclear energy, but for a variety of reasons any major practical steps are still a long way off.

Another thing to consider is the serious impact of the Fukushima crisis in March 2011 on nuclear energy programs all over the world, including Southeast Asia. The accident at the Fukushima plant, which has often been compared in the media to the Chernobyl disaster, has forced the international community to think again about the future of nuclear energy. There is no doubt that the Fukushima crisis has also prompted the Southeast Asian countries to review their own plans regarding nuclear energy development. At present, five of the six Southeast Asian countries studied in this paper (i.e. all but Vietnam) have decided that the implementation of their nuclear energy programs needs to be put on hold⁶⁰ for the time being, until additional studies have been conducted and the necessary nuclear safety mechanisms have been put in place. Indonesia, the Philippines, Malaysia, and Thailand are all facing growing domestic opposition to nuclear energy.⁶¹ Nevertheless, demand for electricity in these countries continues to grow; very soon nuclear energy will come to be seen once again as the only viable and economical alternative to traditional energy sources. The pause will probably last one or two years. That time will be used by the countries concerned to address any problems with the existing projects and to set more realistic deadlines for all the stages of their nuclear plans. 

NOTES

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