The Question of Plutonium Management (II): Protect Energy Choices—It is essential to develop fast breeder reactors (FBR)

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Key Points

- Japanese plutonium is difficult to convert into atomic bombs
- It is urgently necessary to build a system that makes full use of plutonium as fuel
- China and Russia are being proactive regarding fast breeder reactors to secure resources

There is an activity that involves collecting gold and rare metals from used mobile phones. A variety of metals and semiconductors are used for mobile phones and include a small quantity of toxic substances. They are simply rubbish if they are thrown away as they are. But if you extract gold from them in order to classify them into metals and plastics, you can reduce the quantity of rubbish. This is called urban mining. In Japan, the gold extracted will be utilized for the medals for the Tokyo Olympic and Paralympic Games in 2020.

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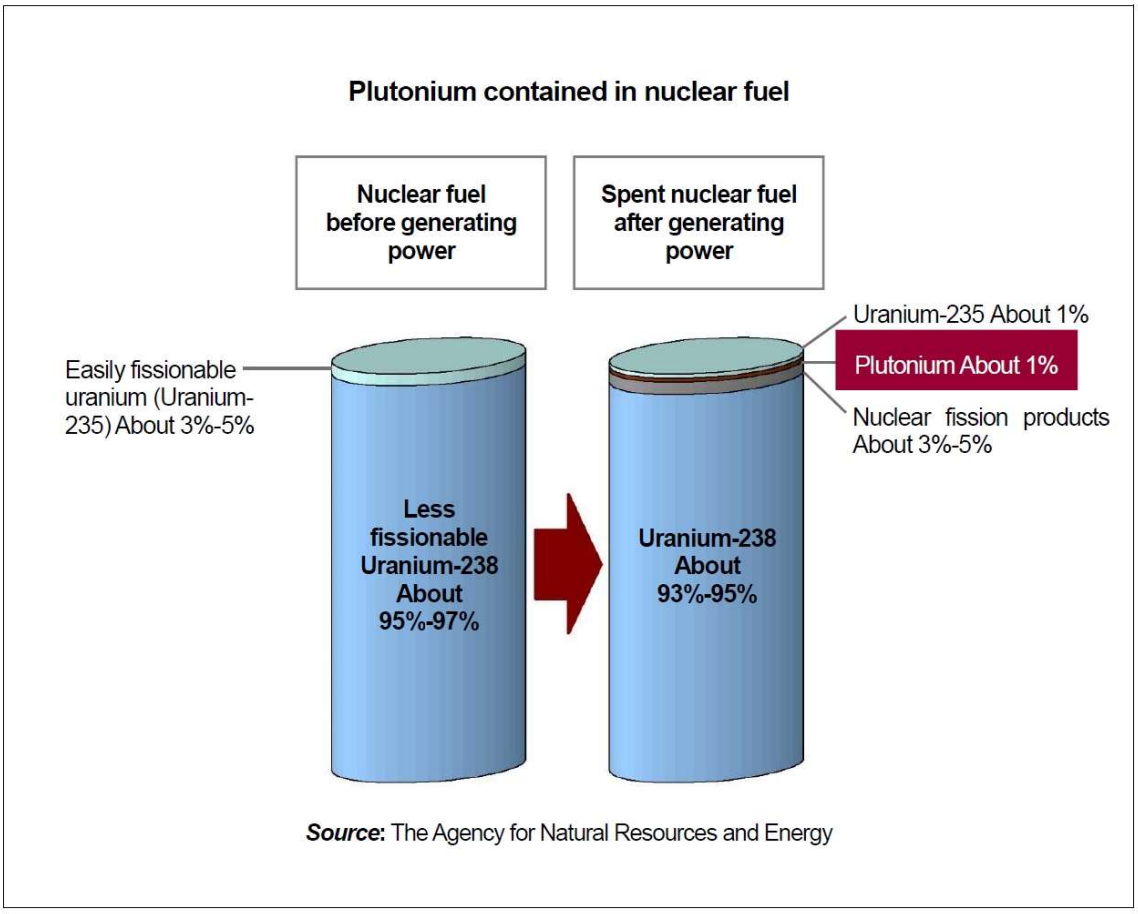
The fuel that has generated a large quantity of electricity after nuclear fission at a nuclear power plant is called spent nuclear fuel, and it is dangerous because it emits large amounts of radiation. In the United States and other countries, spent nuclear fuel is stored intact and is eventually directly disposed of by being buried underground. It is just like throwing away used mobile phones as they are.

On the other hand, spent nuclear fuel includes plutonium that is produced in the process of generating power (refer to the Illustration). Just as gold and other materials are collected from used mobile phones, this plutonium is collected from spent nuclear fuel to be processed into

mixed uranium-plutonium oxide (MOX) fuel and used again to generate power. Further classification is applied to the materials that remain after the collection of plutonium, and extremely dangerous high-level radioactive waste can be reduced to a percentage of what it was initially.



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In Japan, this plutonium is utilized solely to generate power. Plutonium that is produced at light-water nuclear power plant reactors used in Japan is difficult to use for atomic bombs. This is because nuclear fuel continues to be burned for about three years, and isotopes of Plutonium-238, which is unsuitable for atomic bombs, are produced by about 2% to 3%. North Korea is considered to have produced plutonium by using a special reactor called a graphite-moderated reactor to produce atomic bombs.

Previously, we saw the Korean Peninsula Energy Development Organization (KEDO) project in which the United States, Japan and other countries cooperate in building light-water reactors

in North Korea on the basis of the Agreed Framework Between the United States of America and the Democratic People's Republic of Korea in 1994. Because the United States knew that plutonium produced at light-water reactors was unsuitable for atomic bombs, it sought to provide light-water reactors to North Korea.

By the same token, the United States is also aware that the plutonium held by Japan was collected from light-water reactors, and that it is unsuitable for atomic bombs. But the Japanese government did not consider the future circumstances, and promised to place an upper limit on stockpiles of plutonium. The plutonium collected is the source of electricity in the future of resource-poor Japan; if Japan stops collecting plutonium, it will have to purchase a large amount of energy resources from abroad.

In Japan, plutonium collected from spent nuclear fuel does not exist separately and is managed by being mixed with uranium. This is intended to make plutonium that is fundamentally unsuitable for atomic bombs even less easy to be processed for atomic bombs, and to make use of it as fuel. The plutonium collected also undergoes strict inspections by the International Atomic Energy Agency (IAEA). It is managed so that it will not be used for any purposes other than as fuel, and every quantity of plutonium exists for a particular purpose.

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Because Japan is a resource-poor island country, it basically has to import most energy as resources. Tankers carrying liquefied natural gas (LNG) shuttle between Japan and other countries every day and support the Japanese economy. It is necessary for our country to have a wide range of energy options in case a major change in international affairs throws it into a situation in which resource imports stagnate. This is the basic strategy of Japan, which underwent an oil crisis about fifty years ago, and this basic strategy still remains unchanged.

The stockpiling of oil has progressed, but natural gas is difficult to stockpile. Uranium can produce such a large quantity of energy in a small amount that it is effective as an option for stockpiling. In addition, because nuclear power plants themselves produce plutonium, like mines, they are even more effective as an option for securing energy.

If 47 tons of plutonium held by Japan are all utilized as nuclear power plant fuel, it can generate electricity with an approximate value of about 200 billion kilowatt-hour, which is equal to about two months' power generation for the whole of Japan. If you wanted to generate the same quantity of power with natural gas, you would need about 300 large LNG tankers. Extracting plutonium from spent nuclear fuel and stockpiling it in the form of fuel is a significant asset for the Japanese in the future.

The restart of nuclear power plants has not progressed, and there are limited numbers of nuclear reactors that have gained permission to use MOX fuel that use plutonium as fuel. The Oma Nuclear Power Plant (Aomori), whose construction has been halted, can be operated entirely on MOX fuel. But only one-third of the fuel can be used at other nuclear power plants that have gained permission. It is necessary for the central government and electricity companies to resume the construction of the Oma Nuclear Power Plant and build a system that makes adequate use of MOX fuel, as well as to increase the number of nuclear power plants that can utilize MOX fuel.

If the global population exceeds 10 billion in the future and a global energy crisis looms, it will be an advantage to have the option of utilizing domestic "plutonium mines." To this end, it is essential to establish the technology of fast breeder reactors that enable you to make better use of plutonium and produce it effectively.

The fast breeder reactor is the nuclear reactor that can produce plutonium proactively by undertaking nuclear fission using high-energy neutrons (high-speed neutrons). Because this reactor can produce more plutonium fuel than what is burned, it is called a breeder reactor. If fast breeder reactor technology is established, nuclear power plants are certain to become mines.
A fast breeder reactor can easily use plutonium as well as uranium as fuel. In addition, it is also possible to reduce troublesome high-level radioactive waste by using high-speed neutrons.
The Japanese government has decided to decommission the Monju fast breeder reactor (Fukui) because unfortunately, it caused frequent problems. But it is essential to develop fast breeder reactors in terms of securing domestic energy resources as well.

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It will take more than twenty years to develop fast breeder reactors. Currently, the Japanese government is playing a central role in drawing up a roadmap for establishing fast breeder reactor technology, and this roadmap is scheduled to be published by the end of this year. Russia and China are being proactive about fast breeder reactors on the basis of their strategies for securing future energy resources. They have already been developing fast breeder reactors in view of the exhaustion of energy resources in the future, as well as with a focus on utilizing uranium resources effectively. The two countries are expected to establish the technology a few years from now. Resource-poor Japan should learn a lesson from these two countries.

In the current situation, it is disadvantageous in terms of cost to collect plutonium from spent nuclear fuel. But it is important to take steps as an option in preparation for a future energy crisis. In addition, it also has many other advantages, including the possibility of significantly reducing

high-level radioactive waste and its quantity, the possibility of saving energy resources worth more than 300 LNG tankers and the possibility of reducing CO_2 emissions.

How energy is secured for Japan thirty years from now and beyond is of vital importance. There is no guarantee whatsoever that because it is working now, it will be possible to import energy stably next year as well. Nuclear energy and plutonium fuel are almost established technologies, and Japan has these cards to play. Of course, Japan should utilize other options, such as solar power and storage batteries, but Japan has to draw new cards for them from now on. To give up hopeful options in the face of pressures from abroad means losing Japan's independence.

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