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Shutting Down Of Japan's Monju Reactor: Prevailing Nuclear Energy Uncertainties

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Japan's ambition in expanding its nuclear programme was somewhat arrested by the Fukushima-Daiichi meltdown in March 2011. Currently, Japan is looking at restarting a number of its nuclear reactors post the accident. However, it is becoming clear that nuclear energy will no longer be as major a contributor to Japan's energy mix as it was in the pre-Fukushima era.

Over the past twenty years, the Monju Fast Breeder Reactor (FBR) was considered an important cog in Japan's nuclear power programme. Once touted as a "dream reactor", the facility was designed to generate more fuel than it consumes by using high energy, or fast neutrons to enable nuclear fission. Being one of the first FBRs, it was not expected to carry out large energy-production but to be a prototype for more such reactors. In the post-Fukushima scenario, with multiplying expenses and growing safety concerns, Japan has shut down the Monju reactor.

In December 2016, Japanese officials finally decided to pull the plug on the Monju reactor. The Monju reactor is located at Tsuruga city in the Fukui Prefecture and owned by the Japan Atomic Energy Agency (JAEA), a government affiliated company. It was constructed by the Japanese Nuclear Fuel Cycle Development Institute and attained criticality in April 1994. This prototype reactor was built to conduct research that would be beneficial for gathering information for the establishment of commercial technology. However, Japan has not achieved the success it had hoped for with this Monju reactor. While it generated electricity for the first time in August 1995, a sodium leak occurred towards the end of the commissioning test in December 1995. The Japanese government claims that "a thorough investigation of the cause of the accident [had] been carried out, and the safety of all aspects of the Monju design and operation has been revised."[1] Since the sodium-leak accident, the Monju reactor invited a degree of controversies, plagued by cost overruns, alleged

cover-ups and more accidents. It has often been accused of mismanagement. While the Nuclear Regulation Agency (NRA) suggested that control over the reactor could be given to another agency, it was reported that only the JAEA was qualified to undertake the complexities involved in the project.

It was perhaps the sodium-leak accident that first sounded the death knell for the Monju FBR. In 2012, it was discovered that the JAEA did not follow proper safety regulations and failed to check up to 10,000 parts.[2] The JAEA's failure to win the public with convincing explanations was another setback. While Japanese Prime Minister Shinzo Abe has been pushing to reignite Japan's nuclear power programme, such failures continue to create negative perceptions on nuclear energy. Since the setting up of the Monju reactor, Japan has invested a considerable amount of funds. The most recent figure stands at more than 1 trillion Yen (9.7 billion USD) on a reactor that has operated for only 250 days.[3]Furthermore, it has been mentioned that it would cost Japan a whopping 540 billion Yen (5.2 billion USD) if it were to resume its plans with the reactor.[4]

Decommissioning the Monju reactor will further pose a new set of challenges. One such problem is on how to dispose Japan's stockpile of plutonium. Since FBRs are designed to use spent fuel from other nuclear reactors after reprocessing, the shutting down of the Monju reactor means stockpiling of plutonium stored for use by the FBR. In anticipation of use in Monju, Japan had stockpiled 48 tons of plutonium. This material can also be used to build 1000 nuclear weapons and thus poses a proliferation risk. Considering Monju's price-tag, experts also are of the belief that there is little meaning for a costly exercise to extract more plutonium from spent fuel and raise concerns about compliance with international non-proliferation agreements.[5] Furthermore, Japan had already also begun building the Rokkasho reprocessing plant, designed to produce separated plutonium. Policy-makers have affirmed that this will continue to be built – But for what purpose? Although the plutonium that has been stockpiled could perhaps be used in Japan's Joyo nuclear reactor, also a test sodium-cooled FBR, this is only if the Joyo reactor does not face a fate similar to that of the Monju reactor. It is also worth mentioning that Japan is designing another FBR with France referred to as the Astrid reactor.

Many nuclear energy observers have opined that the array of failures and controversy that the Monju reactor has undergone is a blow to the global nuclear industry. The National Nuclear Laboratory's chief technologist Richard Stainsby comments, "Overall and looking globally, nuclear power has a safety record at least as good as any other form of large-scale electricity generation." The Monju reactor is not exemplary of that. Yet, other countries that have

included FBRs in their Nuclear Fuel Cycles (NFCs), such as Russia, India, and China, will continue to push for this technology. Currently, there are 8 FBRs in the world (including the Monju reactor), of which two are in India. The closing of the Monju reactor could perhaps provide informative takeaways for other countries pursuing the FBR technology. The nuclear industry is one that continues to grow and such learning curves are beneficial for Japan and others. The steps which the Japanese officials will lay out to further carry out the decommissioning of the Monju reactor will also be beneficial upon analysis.

The global nuclear industry will continue to push for nuclear energy as an answer to catastrophic results of global warming and climate change with its clean-energy bid. Japan's nuclear industry, in particular, could catch the attention of many researchers this year. After shutting down a fleet of reactors since the Fukushima-Daiichi meltdown, the country's energy-derived CO2 emissions increased for four consecutive years, reaching 1235 million tonnes in Fiscal Year 2013.[6] Yet, Japan is seen to be undergoing a "low-restart" process, due to the tedious and complex process of restarting nuclear power plants. Japan has a total of 45 reactors. However, only 5 of the total number reactors have been restarted. These are Sendai 1 and 2, Takahama 3 and 4, and Ikata 3. However, Takahama 3, 4 are placed on provisional injunction. Therefore, Takahama 3 and 4 will not be operationalised unless the local court clears its judicial stand on the two nuclear reactors. Hence, currently, only three reactors are operational in Japan. Attempts in trying to enhance public perception towards nuclear energy also seem to be dwindling. With the victory of anti-nuclear gubernatorial candidates in Kagoshima and Niigata districts in 2016, the efforts of the ruling Liberal Democratic Party to revive Japan's reactors is tangling. The upcoming elections will therefore be watched carefully in light of further tracing the development of Japan's nuclear power programme in the near future.

(Disclaimer: The views and opinions expressed in this article are those of the author and do not necessarily reflect the position of the Centre for Air Power Studies [CAPS])

Notes

[1] 'Fast Breeder Reactor', JAEA website, see https://www.jaea.go.jp/jnc/jncweb/02r-d/fast.html. Accessed on 12 January 2017.

[2] 'Scrapping Monju: the curtain falls on Japan's experimental fast breeder reactor', Molly Lempriere, *Power-Technology* website, 3 January 2017, see http://www.power-technology.com/features/featurescrapping-monju-the-curtain-falls-on-japans-experimental-fast-breeder-reactor-5708445/. Accessed on 12 January 2017.

[3] 'Resuming Monju reactor operations may cost over ¥540 billion', *The Japan Times*, 8 October 2016, see http://www.japantimes.co.jp/news/2016/10/08/national/resuming-monju-reactor-operations-may-cost-%C2%A5540-billion/#.WHhmNvl94dU. Accessed on 12 January 2017.

[4] n. 2

[5] 'Japan Moves Closer to Shutting Reactor After Spending Nearly $10 Billion', *The Wall Street Journal*, 21 September, 2016, see http://www.wsj.com/articles/japan-moves-closer-to-shutting-reactor-after-spending-nearly-10-billion-147446277. Accessed on 19 January 2017.

[6] '2017 an important year for Japanese reactor restarts, World Nuclear News, 11 January 2017, see http://www.world-nuclear-news.org/NP-2017-an-important-year-for-Japanese-reactor-restarts-1101174.html. Accessed on 13 January 2017.