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Underground Nuclear Power Plant: Why not?

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With the surge in energy demand in developing Southeast Asia, the propensity of using nuclear energy as an option is growing. Singapore needs to adapt itself and explore the benefits of a 'nuclearised' region.

THE QUEST for alternative sources of energy has become relentless. This is due to two 'depleting' factors in our environment. At the subterranean level, the depletion of our fossil fuels, often in politically-unstable regions, has led to the notion of energy security. At the stratospheric level, the depletion of our ozone layer has already evoked drastic concerns in the face of climate change and global warming. Both 'depleting' factors are attributed to the increased consumption of energy resulting from economic growth. A recourse to nuclear energy is an increasingly popular solution to address the issues of energy security and climate change.

Underground Nuclear Power Plant

Singapore now does not rule out the option of using nuclear energy as part of its energy diversification strategy. Recently, it has floated the possibility of an underground nuclear reactor, as the constraint of a 30km hazard zone by international standards could make it unviable to have its own above ground nuclear power plant. For a land scarce nation like Singapore, the trend of building underground facilities will free up considerable land space.

The concept of underground nuclear power plants is not new. Leading national laboratories in both the United States and Europe have been trying to develop underground nuclear power plants. The idea could have been mooted when a French physicist discovered a natural uranium deposit in Oklo, Gabon, which has self-sustaining nuclear fission reactions that can generate up to 100 kW of power. Although this proved to be a mere fraction of the capacities of current generation of nuclear reactors, it became a catalyst for efforts towards subterranean facilities. Research and development into building underground nuclear facilities is intensive in Russia as the industry is gearing up towards building smaller-capacity and mobile nuclear reactors based on submarine technologies.

In addition to freeing up usable land space in Singapore, the stable and solid rock formation in some

parts of the country will serve as a natural shield against an atmospheric hazard in the event of a catastrophe. The shielding offered by the solid rock formation could possibly reduce the 30km hazard radius, as its stable geological formation also eliminates threats of seismic vibrations. Also, it offers superior protection of its infrastructure against any possible attacks of a terrorist nature.

Nevertheless underground nuclear power plants also raise some issues of concern, one of them being accessibility. In the event of an accident, personnel on site could face the problem of evacuation to an area of safety. With more passive safety systems being incorporated in modern nuclear reactor design, the scenario of the core reactor melting down is remote and the need for human intervention is kept to the minimal. Advancements in nuclear engineering have led to automated features that have enhanced the operational safety of the reactors. While the core reactor has a high level of safety, recent accidents in Japan have indicated the vulnerability of auxiliary buildings in the vicinity. Stringent safety procedures are therefore still required for the management of nuclear power plants.

The cost of sub-terrain facilities is however expensive. The planning and design stages should consider only the critical elements to be placed underground, such as the core reactors. Additional considerations must be taken into account for the piping systems that draw water to facilitate the plant operation. Auxiliary buildings that house personnel should allow quick evacuation routes.

Adapting to a ‘nuclearising’ region

It is inevitable that the ‘nuclear’ nomenclature carries with it a tag of insecurity, at both the national and the international levels. Domestic concerns over high levels of radioactive toxicity have been plaguing societies equipped with nuclear power plants. It is of paramount importance that the public is made aware and is assured of the level of safety, as well as the benefits that can be derived from states having nuclear power plants. Nuclear technology will not be acquired over a short time, and the building of such competencies in this region is critical if Southeast Asia is to have its nuclear power reactors operating in the next decade.

At the international level, non-proliferation issues dominate the security agenda. The region can be made safer with cooperative mechanisms that facilitate the sharing of nuclear infrastructure and facilities. As the entire nuclear fuel cycle comprises several stages, there are opportunities for regional countries in ASEAN to work together. Forming a regional institution to regulate the safe management of the entire nuclear process will not only enhance the transfer of information and awareness within the region, but also raises the level of confidence of the international community.

The stage has been set for nuclear reactors in Southeast Asia to be operational in the coming years. The idea of operating nuclear power plants in the region is no longer exploratory. Some of Singapore’s neighbours such as Indonesia, Malaysia, the Philippines, Vietnam and Thailand are implementing plans to turn to nuclear energy to curb their dependence on conventional fossil fuels. It is time for Singapore to consider the possibility of underground nuclear power plants.

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