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Is Southeast Asia's Nuclear Power Ambition Within Reach?

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SYNOPSIS

As governments in Southeast Asia find ways to achieve clean and secure energy systems, there is growing interest in the possibility that nuclear power, through advanced small reactors, will be the region's source of clean energy in the future. However, they would first need to enhance their existing nuclear governance frameworks and mechanisms.

COMMENTARY

The recent announcement that Singapore and the United States signed a 123 Agreement – also known as the peaceful nuclear cooperation agreement – reignited questions about whether Southeast Asian countries are ready to use nuclear power plants to address the twin problems of climate change and energy security.

Before Singapore, other countries in Southeast Asia, namely Indonesia, the Philippines and Vietnam, had signed and ratified their respective 123 Agreements with the US. The 123 Agreement allows for transferring information, nuclear material, equipment, and components directly between the partner country and the US. Significantly, the agreement requires partners to adhere to US non-proliferation requirements.

While Singapore has yet to decide whether to harness nuclear energy, its policy has been to study all options to decarbonise its power sector and meet its net-zero emission target by 2050. Besides the 123 Agreement, Singapore will join the US State Department's Foundational Infrastructure for Responsible Use of Small Modular Reactor Technology (FIRST) programme.

The Philippines and Indonesia were the first two countries in Southeast Asia to join the US FIRST programme. A key feature of this programme is the capacity-building support the US will provide to partner countries to help them better understand how small modular reactors (SMRs) or other advanced nuclear reactors can be built safely to meet their clean energy goals while protecting the global climate.

Clean Energy and Energy Security from SMRs

Several Southeast Asian countries are actively exploring SMRs as a clean energy source. The International Atomic Energy Agency (IAEA) classifies SMRs as advanced reactors that produce electricity of up to 300MW. An SMR is a fraction of the size of a conventional nuclear power reactor and will produce carbon-free electricity. Prefabricated units of SMRs can be built, shipped, and installed on-site, making them more affordable to build than large power reactors.

These advanced reactors are expected to play an increasingly important role in ensuring energy security and the global energy transition to net zero carbon. They may also play a pivotal role in meeting countries' climate goals and even facilitate hybrid synergies between nuclear technology and renewables.

SMRs offer an alternative source of clean energy for Southeast Asian countries where the demand continues to grow rapidly. The region is expected to have a GDP of US$20 trillion by 2040. As a net importer of fossil fuels, it is projected that the coal contribution to installed power capacity will almost double to 163GW by 2040. Not only will the rise in the use of imported coal heighten energy security risks, but it will also exacerbate greenhouse gas emissions in the region.

Since fossil fuels currently generate 80 per cent of Southeast Asia's electricity, drastic action is needed to increase the share of zero-carbon sources. Supplementing renewables with nuclear energy is a viable solution.

The Philippines currently has the region's most advanced nuclear power development plan. Its government is keen on importing SMRs, and among the potential suppliers being considered are American nuclear SMR companies NuScale and Ultra Safe Nuclear Corporation. It aims to get a 1,200MW installed power capacity from nuclear resources using SMR technologies by 2032.

Indonesia's government has included nuclear energy in its plans to attain net zero emissions by 2060 and to strengthen its energy security. Its National Research and Innovation Agency (BRIN) has said that the country plans to construct nuclear power plants, mainly SMRs, with a 1,000 to 2,000 MW capacity in the 2030s. The state-owned power utility, *Perusahaan Listrik Negara* (PLN), has also proposed building an SMR to be supplied by America's NuScale in West Kalimantan.

Thailand is open to exploring SMR technology to diversify its energy mix amid dwindling gas reserves and make its vibrant domestic manufacturing sector less carbon-intensive.

Addressing Nuclear Safety, Security and Safeguards

While proliferation associated with nuclear technology will always be a risk, it should not be much of a concern in Southeast Asia, given that the region has adopted or signed on to measures providing for safeguards.

All countries in the region have resilient norms against nuclear weapons, as institutionalised in the Southeast Asian Nuclear-Weapon-Free Zone Treaty (SEANWFZ). Most Southeast Asian countries have also signed or ratified the Treaty on the Prohibition of Nuclear Weapons.

All countries in the region are State Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and have good track records in adhering to its provisions.

They have also concluded the Comprehensive Safeguards Agreement with the IAEA, which facilitates verification that nuclear activities are not diverted to non-peaceful uses.

There is also the ASEAN Network of Regulatory Bodies on Atomic Energy (ASEANTOM), which has been a productive regional cooperation platform for nuclear regulatory agencies in the region for more than a decade. It has allowed nuclear regulators to share good practices in enhancing nuclear safety and security. Among its useful contributions is developing the ASEAN Protocol for Preparedness and Response to a Nuclear or Radiological Emergency, which would strengthen the region's response to any nuclear accident.

Actions to Take in Moving Forward on Nuclear Energy

Southeast Asian countries' decisions about using nuclear power and SMRs will always be independent national positions, not regional ones, as they all depend on their respective energy security needs, assessments of safety and security, carbon emission reduction calculations, and their degree of commitment to undertake the Milestone Approach to the 19 nuclear infrastructure requirements set by the IAEA. The Milestone Approach has three progressive phases: i) being ready to make a knowledgeable commitment to a nuclear power programme; ii) being ready to invite bids/negotiate a contract for the first nuclear plant; and iii) being ready to commission and operate the first nuclear plant. It would be crucial how countries in the region will meet each milestone as they develop their respective nuclear infrastructure.

It is, therefore, crucial for the interested countries to examine whether existing domestic and global nuclear governance regimes encompassing nuclear safety, security and safeguards, particularly, would need revision to take in unique specifications of SMRs. For instance, given that certain SMRs might produce new types of radioactive waste, the IAEA has recommended that interested countries prepare for the management of these new waste forms. New safeguards approaches may also need to be explored to address specific innovative design features of SMRs, ensuring that strong nuclear material accountancy and control measures remain effective.

States considering acquiring advanced reactor technologies would be well-advised to

continue with comprehensive preparations, which involve revising national nuclear frameworks and assessing technical and human resources capacity. Countries with 123 Agreements with the US and who have joined the FIRST programme can forge collaborations among their civil nuclear entities on the safe and secure use of nuclear energy technologies of US origin, with assistance from US nuclear bodies.

Southeast Asian countries should also seriously consider joining the SMR Regulators' Forum. This forum is a key international platform for nuclear regulatory bodies to jointly identify and resolve nuclear safety and security issues that may undermine regulatory oversight of advanced reactor technologies such as SMRs.

Conclusion

The appeal of SMRs has undoubtedly altered the discussion about the feasibility of introducing nuclear power for civilian use in Southeast Asia. However, the unique features of SMRs may entail new requirements and revisions of nuclear governance frameworks to ensure their safe and secure management. Southeast Asian countries interested in SMRs should take a proactive role in reviewing and reshaping nuclear governance.

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