Technology advancements, decarbonisation drive could boost push for nuclear power in S'pore

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SINGAPORE - The global agenda to decarbonise, coupled with recent technological advancements, has tipped Singapore towards nuclear power as an energy source, something that was deemed not feasible by the Republic a decade ago.

Observers told The Straits Times that improvements in safety and better security features have made nuclear power more viable for the land-scarce city state, which has been monitoring the technology since the 1950s.

In March, a report commissioned by the industry regulator, the Energy Market Authority, to chart Singapore's path towards net-zero emissions by 2050 had anticipated that nuclear power could make up about 10 per cent of its energy mix in a geopolitically fragmented world.

A fragmented world will make it tougher for countries to band together to achieve their climate targets, the report noted, which means Singapore must resort to other means to decarbonise its energy mix, apart from relying on cooperative mechanisms such as clean energy imports.

For Singapore, a very important factor is the energy security that nuclear energy can provide, said Associate Professor Chung Keng Yeow, director of the Singapore Nuclear Research and Safety Initiative (SNRSI) at the National University of Singapore.

The ongoing war in Ukraine has exposed Europe's dependence on gas from Russia, highlighting how crucial energy independence is, said Dr Alvin Chew, a senior fellow at the S. Rajaratnam School of International Studies at Nanyang Technological University (NTU).

For Singapore, around 95 per cent of the city state's electricity supply is dependent on natural gas imports from countries such as Malaysia and Indonesia, making it vulnerable to crises in the global energy market and reliant on planet-warming fossil fuels.

The urgency of decarbonising the power sector, which accounts for about 40 per cent of carbon emissions in Singapore, with a reliable power source will be a key driver for nuclear power to be adopted here, observers said.

Said Prof Chung: "Nuclear can provide a large amount of baseload energy – the minimum level of electric power required – with very low carbon emissions. This form of electricity generation is also not reliant on external meteorological factors such as the sun or wind."

The pressure to diversify and find carbon-free energy sources is expected to mount in Singapore as solar power – the island's main source of renewable energy – is expected to meet only about 10 per cent of demand in 2050.

But as nations work towards carbon neutrality, the competition for reliable and affordable clean energy will increase, spelling more uncertainties and challenges for Singapore's ability to secure renewable energy from abroad, said Dr Victor Nian, co-founder and chief executive of independent think-tank Centre for Strategic Energy and Resources.

This enhances the attractiveness of nuclear energy as a reliable and clean source of energy, he added.

Global opinion, however, remains split about its risks and benefits, with some nations such as Germany choosing to shut its nuclear reactors while others like France and Japan have plans to restart their plants.

Nuclear plants are operational in 32 countries, making up about 10 per cent of the world's electricity, according to the World Nuclear Association.

Commercial reactors run on nuclear fission, which produces energy such as heat through the splitting of a heavy, unstable nucleus into two lighter nuclei. The heat generated can then be used to produce steam, which drives turbines for electricity production.

Meanwhile in Singapore, the authorities have eyed atomic power as a potential source since it was mooted as an evergreen source of energy in the 1950s.

In 1955, then Chief Minister David Marshall launched an unsuccessful bid for Singapore or South Johor in Malaysia to secure an atomic reactor and a nuclear research and training centre offered by the United States.

Amid the 1973 oil crisis, then Finance Minister Hon Sui Sen said in Parliament that the nation had been studying a nuclear power station to lessen the nation's dependence on oil. This was eventually put on hold due to the island's small size and high population density, which meant there was no suitable place to build the station without the danger of radioactive contamination.

Over the years, the inability to overcome the same roadblocks of land constraints, safety and security rendered nuclear power little more than a tantalising possibility for the nation as it invested in capabilities for nuclear policy, science and engineering.

In 2013, the Government approved a budget of $62.9 million to develop a Nuclear Safety Research and Education Programme, which had a 15-year implementation period, followed by the signing of a five-year planning framework with the International Atomic Energy Agency in 2021.

There have been recent signs of promise as small modular reactor (SMR) designs and floating nuclear power plants (FNPPs) are being developed that are more suitable for Singapore, observers said.

"The latest SMR designs have been very promising in terms of increased safety and require much less area around them to be of low population density. Some SMRs have even been design-certified by the US Nuclear Regulatory Commission," said Prof Chung, adding that SNRSI is actively researching the safety of advanced reactors. The commission licenses and regulates civilian use of nuclear energy to protect public health and safety and the environment.

There is now a race in developing advanced SMRs and FNPPs worldwide, said Dr Nian.

He said: "FNPP companies, such as Seaborg Technologies, ThorCon and Core Power, have shown strong interest in supporting South-east Asia's energy transition, in addition to Rolls-Royce, NuScale Power and others offering land-based SMRs.

"Everyone is looking at 2030 as the timeline for delivering the first commercial nuclear reactor to end users."

But many of these advanced nuclear technologies remain in the research and development phase, which means the Government is still evaluating their deployment, Minister of State for Trade and Industry Alvin Tan told Parliament in April.

Before embarking on a nuclear power project, Singapore will need to consider the arrangements for the entire life cycle of a nuclear power plant, ranging from fuel supply to management of the spent fuel, said Dr Chew.

To include nuclear energy in Singapore's energy mix will also require public outreach addressing concerns associated with past nuclear reactor disasters, observers said.

A comparison of attitudes towards nuclear energy among five South-east Asian nations by NTU researchers in 2021 found only one in five of 1,000 people surveyed in Singapore was in favour of nuclear energy development.

Support from respondents in other countries – Malaysia, Indonesia, Vietnam and Thailand – was similarly low, ranging from 3 per cent to 39 per cent.

Said Professor Shirley Ho, NTU's associate vice-president (humanities, social sciences and research communication), who led the study: "This sentiment towards nuclear energy in the region could be a result of a lingering effect of the 2011 Fukushima nuclear reactor meltdown, given the severity of the incident and the close geographical proximity of Japan to South-east Asia."