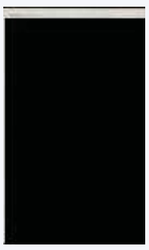
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Nuclear power as option to strengthen energy security

The Malaysian Reserve, Malaysia

by AUFA MARDHIAH

MALAYSIA'S nuclear energy preparations are moving into a more detailed phase as the country assesses how the technology could fit into a power system facing coal plant retirements, rising electricity demand and greater renewable energy (RE) penetration.

Universiti Tenaga Nasional (Uniten) Institute of Energy Policy and Research director Assoc Prof Dr Nora Yusma Mohamed Yusoff said nuclear should not be viewed as a replacement for RE, but as one of several options that could provide firm low-carbon electricity as Malaysia changes its generation mix.

"Nuclear should be viewed as part of the overall energy portfolio, not as a replacement for RE. Renewables are an important part of the electricity mix.

"The question is whether nuclear can complement them by providing firm low-carbon electricity when solar, storage, hydro or interconnection alone may not be sufficient," she told *The Malaysian Reserve (TMR)*.

For clarity, Nora Yusma's views were provided from an energy-system research and policy perspective and do not represent any utility, client or institution or findings from confidential projects.

Her comments follow an earlier interview with Arthur D Little (ADL) South-East Asia partner and head of Energy and Utilities Practice Trung Ghi, published by *TMR* on Sept 28 under the headline "Build nuclear capabilities before investment decision".

Malaysia is already undertaking preparatory work on nuclear energy, including the development of technology, talent and its regulatory framework, although the government has yet to make a final decision on developing nuclear power for electricity generation.

The country is currently in Phase 1 of the International Atomic Energy Agency's (IAEA) Milestones Approach, assessing its needs, readiness and capabilities across 19 nuclear infrastructure issues.

Meanwhile, MyPower Corp has been designated as the Nuclear Energy Programme Implementing Organisation (NEPIO) to coordinate the preparatory work, while Malaysia is also preparing for an Integrated Nuclear Infrastructure Review (INIR) Phase 1 mission.

Nora Yusma said Malaysia would not be starting from zero, having accumulated decades of experience in nuclear research while developing its national nuclear power infrastructure in line with the IAEA's Milestones Approach.

However, moving towards nuclear power would require additional capabilities in regulation, safety and security, safeguards, site and grid assessments, emergency preparedness, radioactive-waste management, financing, supply chains and workforce development.

Malaysia's established electricity sector provides experience in managing large generation and grid assets, although nuclear-specific expertise would still need to be developed and demonstrated.

"Importantly, preparing these capabilities does not in itself mean that a nuclear power plant must be built. It enables Malaysia to assess the technical, economic, safety and system requirements carefully and make decisions based on evidence and readiness," she said.

Coal Exit is More Than Replacing Megawatts

The question of where nuclear could eventually fit becomes more important as Malaysia's power system undergoes two changes at once — ageing coal plants moving towards retirement and a growing share of variable RE entering the grid.

But retiring coal is not simply a matter of replacing the electricity generated by an old plant with an equivalent amount of new capacity.

"Coal plants also provide dependable capacity and services that help keep the electricity system stable, including frequency and voltage support and the ability to respond to changes in demand," Nora Yusma said.

A reliable transition would therefore require replacement electricity and dependable capacity, supported by sufficient storage, flexible generation, transmission infrastructure and the ability to manage demand.

Solar has significant potential in Malaysia, although output varies according to weather and the time of day. Rooftop solar can also reduce daytime demand from households and businesses, particularly when combined with storage, demand response and smart energy management.

Still, these technologies change the pattern of demand on the grid rather than eliminate the need for balancing and reliable supply.

For that reason, power-system planning needs to look beyond annual generation figures or installed-capacity targets.

"We therefore need to assess the electricity system hour by hour across the full 8,760 hours of the year, rather than looking only at annual totals or installed-capacity targets," she said.

Reliability could eventually come from a combination of hydroelectricity, storage, flexible generation, demand response, regional interconnection and potentially nuclear power.

Other technologies, including hydrogen, ammonia co-firing, carbon capture and storage (CCS), sustainable bioenergy and longer-duration storage, could also form part of that assessment.

Each technology provides different services to the electricity system, making it important to assess how they can work together to maintain reliability and affordability while reducing emissions.

Nuclear could strengthen energy security and diversify Malaysia's generation mix, although its scale would have to suit the country's grid and reserve.

Any assessment would also need to account for financing, construction, safety, waste management, operations and institutional readiness.

Meanwhile, greater reliance on imported liquefied natural gas (LNG) as coal-fired generation declines could expose Malaysia to fuel-price volatility, foreign-exchange movements and geopolitical supply risks.

Against this backdrop, Nora Yusma said nuclear power should be compared transparently with other generation portfolios based on hourly demand, renewable variability, reserve margins, storage operations, fuel use, emissions and total system costs.



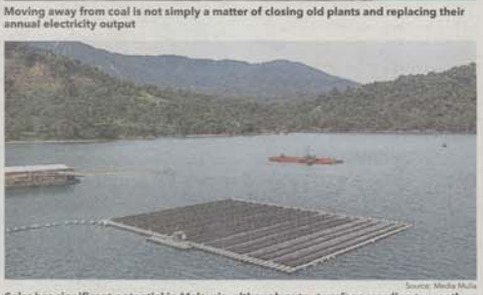
Nuclear energy is a long-term commitment, with implications that can span generations, says Nora Yusma



Beyond technology and infrastructure, public confidence is also crucial if Malaysia eventually proceeds with nuclear power



Moving away from coal is not simply a matter of closing old plants and replacing their annual electricity output



Source: Media Mulia

Solar has significant potential in Malaysia, although output varies according to weather and the time of day

Data Centres Could Reshape Where Power is Needed

Adding another layer to the equation is the rapid expansion of data centres, which can create large and concentrated electricity demand with high reliability requirements.

Nora Yusma said small modular reactors (SMRs) could potentially be considered for data centres over the longer term, subject to regulatory requirements, site suitability, grid considerations and commercial viability.

However, she cautioned against choosing a reactor type before assessing the needs of the power system.

"Reactor size should follow the needs of the power system, not a preference for a particular technology. We need to look at the size and strength of the grid, demand growth, reserve margins, system stability and when the capacity will be needed," she said.

Large conventional reactors could provide substantial firm generating capacity but would require significant upfront investment, longer development periods and a strong grid capable of integrating a large unit.

SMRs, by contrast, could allow generating capacity to be added in stages, potentially providing greater flexibility in matching future electricity demand.

Beyond electricity generation, SMRs may also have applications in hydrogen production, industrial heat and desalination.

However, their operating experience remains relatively limited compared to conventional reactors, with questions over costs, construction performance and reliability at commercial scale yet to be fully resolved.

As more projects are deployed, the evidence could help Malaysia assess both large reactors and SMRs based on technology maturity, system requirements, safety, economics and overall readiness.

Public Confidence Remains Central to Nuclear Plans

Beyond technology and infrastructure, public confidence is also crucial if Malaysia eventually proceeds with nuclear power.

Nora Yusma acknowledged concerns over nuclear accidents and the country's ability to respond to a serious emergency. Safety depends on effective regulation, proper planning, trained personnel and emergency preparedness.

"These are legitimate concerns, and the public needs clear, credible information about the benefits and risks of nuclear energy," she said.

She pointed to Singapore's emphasis on public education as part of its nuclear energy assessment, including the benefits, risks and capabilities required for responsible decision-making.

In Malaysia, the Malaysia Energy Literacy Programme (MELP) could provide a platform for broader public understanding of nuclear safety, radioactive-waste management, emergency preparedness and long-term responsibilities.

"Nuclear energy is a long-term commitment, with implications that can span generations. Its potential development involves responsibilities to our children, grandchildren and future generations, including safety, cost and environmental considerations.

"Ultimately, public confidence depends on transparency, accountability, public understanding and demonstrable preparedness," she said.

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