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Accelerating nuclear energy developments towards a net-zero ASEAN

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POLICY BRIEF

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Highlights

1. ASEAN needs to include nuclear energy in the green energy taxonomy.
2. Nuclear energy should be developed in an ecosystem approach.
3. ASEAN should embrace a renewable-nuclear co-development strategy.
4. An independent advisory panel can accelerate nuclear energy development in ASEAN.

Summary

The 6th ASEAN Energy Outlook pointed to the use of fossil fuels, especially coal, to address the region's growing energy demand. Renewables are relevant but insufficient to support the region's net-zero agenda. A clean energy ecosystem enabled by nuclear energy needs to be prioritised in long-term national energy planning.

What's the issue?

Post-COP26, several ASEAN (Association of South-East Asian Nations) Member States (AMS) have announced plans to become carbon neutral by 2050. The reality pointed out by the 6th ASEAN Energy Outlook published by the ASEAN Centre for Energy suggested fossil fuels, especially coal, will very likely remain the dominant energy source till 2040, mainly driven by the need for industrialisation, urbanisation, and economic development. Today, the region remains a net-energy exporter with relatively affordable fossil fuel prices. However, the abundance of fossil fuels has failed to shield the region from the recent fossil price hikes due to the Ukraine War.

ASEAN also have abundant renewable energy resources, but with highly uneven distribution across the ASEAN Member States (AMS)[1]. As such, the LTMS (Lao-Thailand-Malaysia-Singapore) interconnection is part of the ASEAN Power Grid initiative to share clean hydropower from the Mekong River with the connected AMS. However, there is a multitude of technical, financial, regulatory, and geopolitical challenges that remain to be appropriately addressed. Another ambitious project announced in 2018, the AUD30 billion project, dubbed the Australia Asia Power Link[2] , has planned to bring 2.2 GWp of solar electricity via subsea power cable through Indonesia to Singapore.

Due to the geopolitical uncertainties and environmental pledges, Indonesia and Malaysia[3] have made announcements to

[1] Victor Nian, S.K. Chou, The state of nuclear power two years after Fukushima – The ASEAN perspective, Applied Energy, Volume 136, 2014, Pages 838-848, https://doi.org/10.1016/j.apenergy.2014.04.030.
[2] See https://www.aseanbriefing.com/news/the-australia-asian-powerlink-encouraging-investments-in-asean-renewable-energy/
[3] See https://www.theedgemarkets.com/article/malaysia-not-exporting-renewable-energy-says-takiyuddin

suspend or limit renewable energy exports, which are likely to become an irreversible policy decision due to concern over insufficient domestic renewable supply and strategic consideration over attracting foreign investments. As the AMS continues to face challenges in their decarbonisation journey, there is a growing concern that others will soon follow suit with the renewable export ban focus on choosing the most appropriate technology for industrial and/or power applications in a vendor-neutral approach.

Driven by the need to address energy independence, net-zero emission targets, and economic development, several AMS, including the Philippines, Indonesia, Singapore and Vietnam, have announced plans to include nuclear energy in their strategic long-term energy planning. In particular, the Philippines, then President Rodrigo Duterte signed Executive Order No.164 on 28 February 2022, following the recommendation of the Nuclear Energy Programme Inter-Agency Committee to establish a national position in adopting nuclear energy in the Philippines in the long term[4]. Vietnam's Ministry of Industry and Trade (MoIT) announced plans to explore small modular reactors (SMRs) in the Vietnam Power Development Plan 2021 – 2030[5]. Singapore's Energy 2050 Committee report, commissioned and published by the Energy Market Authority of Singapore, included SMRs as one of the main future scenarios in addressing the country's net-zero and energy security goals in the long term[6].

Therefore, it seems that ASEAN is finally moving toward embracing nuclear energy, especially with the upcoming SMR technologies.

Why is this important?

SMRs are disrupting the traditional concepts and approaches of nuclear power plant planning, project management, and financing. SMRs, with smaller and standardised designs, mostly based on prefabricated modules, create opportunities for scaling project development whereby demand growth can be matched more directly through deploying additional units. SMRs are also suited for the small or dedicated grid and potentially beyond electricity production.

SMRs can enable applications-oriented for multi-utility facilities, such as hydrogen and ammonia production, desalination, and industrial-grade high-temperature heat supply. This could further enable a clean energy ecosystem from upstream natural resource harvesting, conversion and transportation to downstream use cases. Some of the Generation IV SMRs, such as high-temperature reactors, are already at an advanced stage of development with the goal of commercial deployment by 2030. Some SMRs could also be placed on a ship or a barge to form a floating nuclear power plant (FNPP).

A macro-level study led by the Centre for Strategic Energy and Resources further suggested that SMRs could become commercially attractive to ASEAN if the region can collectively scale up nuclear energy adoption by 2050[7]. More interesting this decade is a potentially flourishing SMR

[4] See https://www.pna.gov.ph/articles/1168931
[5] See https://en.vietnamplus.vn/ministry-proposes-developing-nuclear-power-on-small-scale/223522.vnp
[6] See https://www.ema.gov.sg/energy-2050-committee-report.aspx
[7] Victor Nian, Benito Mignacca, Giorgio Locatelli, Policies toward net-zero: Benchmarking the economic competitiveness of nuclear against wind and solar energy, Applied Energy, Volume 320, 2022, 119275.

technology market with reputable new entrants such as (alphabetically) Core Power, NuScale, Rolls Royce, Seaborg, TerraPower, and ThorCon competing amongst the established nuclear enterprises. That means that SMRs with further design standardisation can now be offered as an "end-product" based on standardised designs that could require limited modification to fit in the local site. That also means that ASEAN would need to focus on choosing the most appropriate technology for industrial and/or power applications in a vendor-neutral approach.

Furthermore, SMRs can further enable additional opportunities for building up domestic capabilities in and around nuclear energy. The characteristics of SMRs being factory batch-produced with standardised modules mean that some of the AMS could play a part in the SMR supply chain. Stretching beyond the boundary of nuclear reactors, Many AMS could participate in the value chain of SMRs such as industrial supply chain (e.g. pumps and valves, tooling equipment, shipbuilding for FNPPs, etc.), supporting technologies and infrastructure (e.g. monitoring and surveillance, big data analytics and artificial intelligence, transformer substations, etc.), and professional services (e.g. financing, legal, insurance, etc.). This goes even further with an SMR-enabled carbon-free ecosystem, for example, hydrogen or ammonia production, transport, storage and downstream use.

What should the policymakers do?

1. Embrace the ecosystem approach for nuclear energy development

The first step to establishing a sustainable energy ecosystem is to define plausible use-case scenarios for clean energy options and sustainable development measures that can be enabled by nuclear energy. The goal is to map the opportunities in the industrial sector for nuclear energy beyond electricity production, such as hydrogen, ammonia, methanol, and potable water production. From the perspective of a floating nuclear power plant, the ability to produce multiple useful commodities competing in different markets can lead to the concept of a (offshore) floating multi-utility complex with potentially multiple revenue streams to ensure profitability and sustainability development. This mapping would lead to new business models, financing mechanisms, and project development concepts that can address the gaps in the present market and/or policy frameworks. This ecosystem approach would also enable new industrial strategies, including building new industrial parks, commercial districts, and other economic activities that would not have been practical for the country or city while ensuring the national clean energy and decarbonisation agenda.

2. Establish a level playing field for nuclear energy

The current high and potentially rising fossil fuel prices demonstrate a golden opportunity for countries to accelerate their energy transition journey towards using clean energy to address energy security-related issues. Political and other barriers need to be removed as quickly as possible to reveal the 'true costs and benefits' of each energy resource option. National energy policies and strategies would also need to adapt to the highly uncertain future in the aftermath of the Ukraine War. Subsidising fossil fuels might cushion the near-term impact, but it is no longer a sustainable way for future economic development. Policymakers must also recognise the need to allow market dynamics or mechanisms to drive renewable

and nuclear energy development by gradually reducing and eliminating incentives.

3. Include nuclear energy in the green energy taxonomy

On 6 July 2022, the European Union's proposal to include nuclear energy in the green energy taxonomy was approved by voting[8]. It is important to recognise the role of nuclear energy based on scientific and engineering evidence. The inclusion of nuclear energy in the green energy taxonomy would help send a clear policy signal to the financial institutions toward including nuclear energy in the sustainable financing schemes. The inclusion of nuclear energy in the taxonomy would further enable sustainable financing opportunities in a greater ecosystem, especially in hydrogen, ammonia, and potable water productions. More importantly, the endorsement of nuclear energy by the European Union means that a region with a strong renewable focus would still require synergistic development in nuclear energy to sustain the green energy agenda which is relevant and applicable in the ASEAN context.

4. Embrace a country-regional approach

In recognition of the challenges associated with a fully integrated energy market in ASEAN, the country-regional approach could offer an alternative approach to developing and expanding the use cases for nuclear energy. Instead of focusing solely on nuclear reactor market development, this country-regional approach could be designed to jointly develop other energy options, such as hydrogen and ammonia. Recognising the necessity of having nuclear energy in supporting carbon-free industrial-scale hydrogen or ammonia industry on an ASEAN regional scale, the country-regional approach could collectively expand the SMR market by aiming to become a net exporter of clean energy in the long term.

5. Leverage an independent advisory panel

The UAE has set an example of fast-tracking credible nuclear energy development even with the conventional large-sized nuclear power plants. Having access to an independent advisory panel for technology assessment, capacity building, and other necessary assistance to help the country build a nuclear power programme was among the enabling factors of a swift take-off from a short runway. The independent advisory panel would comprise a diverse range of expertise from technology, EPC (engineering, procurement and construction), project development, policy and strategy, economics, planning, regulation, and financing. This would help ensure recommendations from the panel aligned with the national energy and economic development objectives.

[8] See https://www.reuters.com/business/sustainable-business/eu-parliament-vote-green-gas-nuclear-rules-2022-07-06/

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Biography

Dr Victor Nian is a Co-Founder and Chief Executive Officer of the Centre for Strategic Energy and Resources. Dr Nian advises public and private organisations on energy strategy, industrial and climate policy, technology management, digital transformation, and other energy transition and sustainable development related issues. He is recognised as one of the go-to-persons on nuclear energy and hydrogen economy in Southeast Asia. He holds a PhD in Mechanical Engineering and BEng (Hons) in Electrical Engineering with Minor in Management of Technology, all from the National University of Singapore.

Dr Benito Mignacca is a Postdoctoral Research Fellow and Lecturer in Engineering Economics at the University of Cassino and Southern Lazio (Italy). He is an affiliated expert of the Centre for Strategic Energy and Resources. He obtained his PhD at the University of Leeds (UK) in 2021, receiving the 2021 and 2022 Postgraduate Awards in recognition of his academic performance and working as a Research Fellow in 2021. His main areas of expertise and research include energy economics and finance, circular economy, modularity in complex systems, innovation management, and project management. He is keen to collaborate and cooperate with public and private organisations in these areas.

Dr Giorgio Locatelli is Full Professor of Complex Projects Business at Politecnico di Milano – School of Management. His research is about project management of complex infrastructure. He also works as a consultant and visiting academic for several public and private organisations, including the UK government. He authored more than 100 international peer-reviewed publications and he is listed in the world top 2% of scientists.

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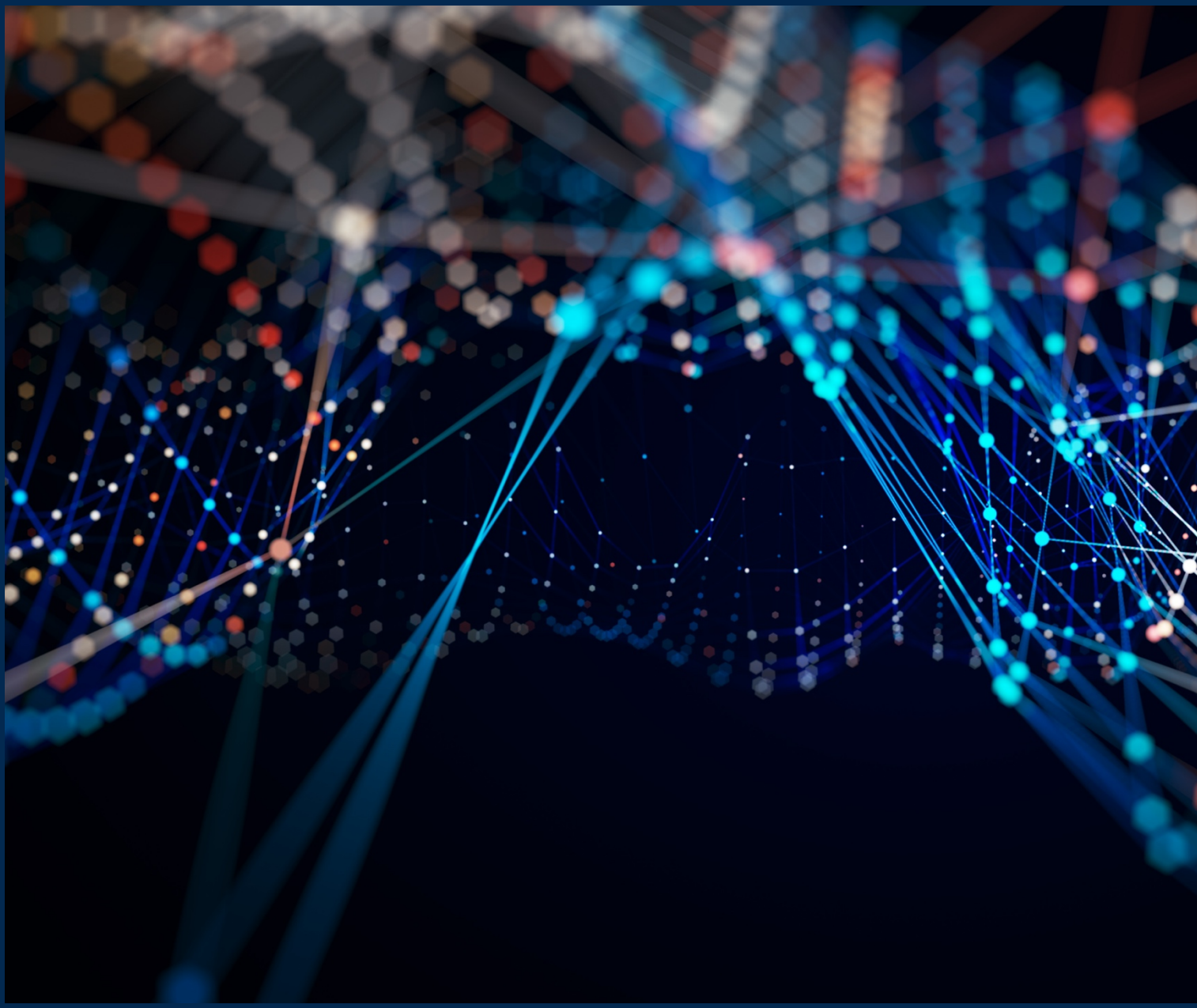

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