A Report By

Singapore Institute of International Affairs

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Powering the Digital Future:

Renewable Energy for Businesses in ASEAN

October 2024

Contents

About the Special Report

This Special Report explores the energy needs of ASEAN in the context of the rapid development of datacentres in the region, in response to the generative Artificial Intelligence (AI), blockchain, and other innovations that are supporting future economic growth. The report is based on research conducted by the Singapore Institute of International Affairs (SIIA). This report was sponsored by Equinix.

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Established in 1962, the SIIA is a non-profit and independent think tank committed to fostering in-depth dialogues around politics, economic policy, and sustainability in ASEAN and the wider region. The SIIA has been working on sustainability issues since 1997, when we organised Singapore's first haze dialogue in partnership with the Singapore Environment Council. Following the severe transboundary haze in 2013, the SIIA established the Singapore Dialogue on Sustainable World Resources (SWR) in 2014 which has since become a leading platform for discussion about key sustainability challenges in the region.

Executive Summary

Generative AI, blockchain, e-commerce, and other digital technologies will be the world's main growth drivers in the decades to come. This is resulting in a rapid demand for data centres across the world, including in the Association of Southeast Asian Nations (ASEAN) where countries are well-placed to capitalise on this boom. But data centres have high energy demands, adding to the already increasing energy consumption in ASEAN. ASEAN is already collectively the fourth largest energy consumer in the world, and the region's energy consumption is expected to triple between 2020 and 2050.

In order to keep ASEAN competitive in the global economy, there is a need to ensure that ASEAN's data centres and other growth industries are powered by green rather than brown energy. Countries around the world are introducing carbon border adjustment measures that will impact trade in goods and services. Multinational companies (MNCs) are making decisions on where to site their operations based in part on the availability of renewable energy in order to meet their corporate net-zero commitments.

This Special Report by the Singapore Institute of International Affairs (SIIA) outlines pathways for powering future growth, based on our research and engagement with businesses, governments, and civil society.

1. Establish ASEAN as a Digital Hub for Future Growth

Strengthen ASEAN as a Digital Hub: Digital technologies are fuelling innovation, enhancing productivity, and creating new competitive advantages. ASEAN must secure its position in this digital future. Currently, some 60 per cent of data centre capacity in the region is in Singapore, but Malaysia and Indonesia are rapidly emerging as the next major locations for data centres, using the same subsea data cables going through Singapore. Singapore, Malaysia, and Indonesia should work together to strengthen ASEAN's collective position as a preferred digital hub for global businesses – a win-win outcome for all parties.

Build Green Data Centres in ASEAN: Energy consumption for heat management by data centres in ASEAN is higher than the global average, due to the hot climate. In 2023, Singapore introduced a standard with recommendations for data centre operation in tropical climates. ASEAN can explore harmonisation of national standards and certifications as well as the sharing of best practices, ensuring that the region's data centres are world leaders in PUE (Power Usage Effectiveness) and other forms of resource efficiency.

2. Accelerate R&D and Investment in Emerging Energy Sources

Accelerate Renewable Energy Development in Malaysia and Indonesia: As more data centres are built in Malaysia and Indonesia, increasing the demand for renewable energy, both countries can consider market mechanisms and other measures to reduce costs for buyers and project developers.

Develop Solar and Wind Energy: Solar and wind energy are currently the most attractive to buyers, developers, and investors. The intermittency of solar energy is being addressed by better battery technology. Geothermal and hydropower can provide large amounts of reliable baseload power, but are only possible in some locations and require more capital to develop, so there are limits to how much their deployment can be accelerated.

Increase R&D in Biogas and Hydrogen: More effort is needed to make biogas and hydrogen commercially viable. Indonesia and Malaysia have a great deal of biogas potential from their large agri sectors, but it is not clear if production and transport is cost effective. The use of hydrogen faces similar scalability and transfer pricing issues.

Create Frameworks for Nuclear Safety, Security, and Safeguards: Nuclear energy is still seen as high-risk by investors, even with the advent of small modular reactors (SMRs) using newer technology. Several ASEAN countries are aiming to have operating nuclear power plants by the 2030s, and as such the region needs to develop a high standard of regulatory frameworks that are aligned with international best practices.

3. Develop Cross-Border Energy Infrastructure and Smart Grids

Promote Renewable Energy Imports into Singapore: Much like how data centres in Malaysia and Indonesia are making use of the subsea data cables going through Singapore, Singapore will in turn need to access more renewable energy by connecting to power grids in the region. Singapore's neighbours will receive increased investment into energy projects as well as their renewable energy industries such as solar photovoltaic panel and battery manufacturing.

Build Connectivity and Smart Grids in ASEAN: More effort is needed to build electricity transmission and fuel transport infrastructure, not only within ASEAN countries but between borders. The ASEAN Power Grid (APG) needs to be fully realised, and ASEAN must prioritise the signing of the new APG Framework Agreement by 2025. Alongside grid development, more can be done to strengthen interoperability of REC markets. Digital technology should also be used to ensure grids are smarter and more resilient, allowing more effective energy trading across borders.

Explore New Investment Models and Blended Finance: Financing cross-border energy infrastructure will require large amounts of capital. The International Energy Agency (IEA) estimates ASEAN will require US$21 billion (S$27 bn) in investment annually between 2026 to 2030 to connect and upgrade its electricity grids. ASEAN countries must explore new investment models and options for blended finance.

Enhance Regional and International Partnerships: Platforms such as the Indo-Pacific Economic Framework (IPEF), Just Energy Transition Partnership (JET-P), and Belt and Road Initiative (BRI) could help mobilise capital for infrastructure development in ASEAN.

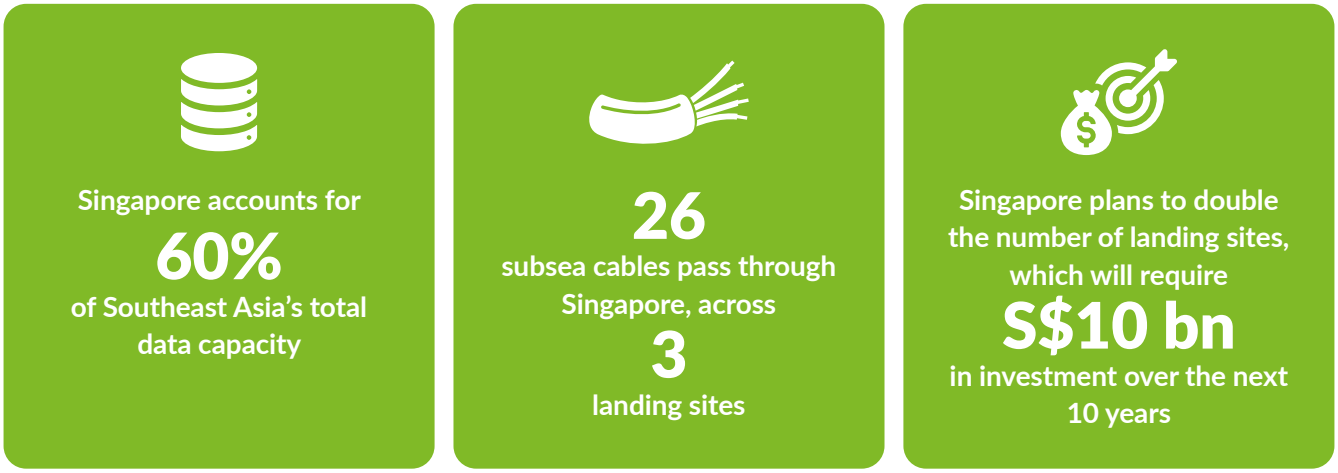
1. Establish ASEAN as a Digital Hub for Future Growth

Digital technologies, such as generative artificial intelligence (AI), blockchain, e-commerce, and cloud computing, are emerging as the chief drivers of economic growth – fuelling innovation, enhancing productivity, and creating opportunities. The digital boom has created a corresponding demand for computing capacity, necessitating a rapid buildup of data centres worldwide.

The global data centre market is expected to show a compound annual growth rate of 8.45 per cent over the next five years between 2024 and 2029, with annual revenue going from US$416.1 billion (S$535.2 bn) in 2024 to US$624.1 bn (S$802.7 bn) in 2029.[1] Currently, the majority of data centres in the world are located in the United States, but the Association of Southeast Asian Nations (ASEAN) is emerging as an attractive destination for data centres in tandem with its economic growth. The opening chapter of this report examines ASEAN's rise as a digital hub and what can be done to promote the region as a preferred location for data centres.

Digital technologies are emerging as the chief drivers of economic growth – fuelling innovation, enhancing productivity, and creating opportunities

Figure 1: Singapore's Role in Digital Connectivity



Sources: Federation of Business Information Services and Infocomm Media Development Authority (Singapore) (2024)

Strengthen ASEAN as a Digital Hub

Singapore is currently the preferred location for data centres in the region, and will remain a major hub for the foreseeable future. Singapore is a nexus for the subsea cables that carry the world's internet traffic and possesses a skilled workforce alongside a robust tech and finance company ecosystem.

However, Singapore's nature as an island city-state places constraints on the amount of available green energy and space for new data centres. As the global appetite for digital services expands, much of this demand will need to be met by data centres in Singapore's neighbours. Malaysia, Indonesia, and Singapore can collaborate in establishing themselves as a competitive and efficient location for data centres, via sharing best practices for data centre construction and operation, strengthening ASEAN's collective position as a digital hub.

Malaysia, Indonesia, and Singapore can collaborate to strengthen ASEAN's collective position as a digital hub

Across all of ASEAN, investments in the data centre market are forecasted to grow 9.59 per cent annually from 2024 to 2029.[2] Malaysia and Indonesia are the two leading contenders for new data centre development, as data centres located in Johor, the Riau Islands, and Sumatra can tap on the subsea cable connections located near Singapore. Data centre development in other ASEAN economies such as the Philippines, Thailand, and Vietnam is also picking up speed, though not as quickly.

Figure 2: Recent Data Centre Development Policies in Singapore

2019	Singapore introduces a moratorium on new data centre development
2022	Economic Development Board (EDB) and Infocomm Media Development Authority (IMDA) allow companies to submit bids for new data centres
2023	Ministry of Communications and Information (MCI) and IMDA launch Digital Connectivity Blueprint targeting between S$10 bn and S$12 bn in investment for green data centres
2024	IMDA launches Green Data Centre Roadmap to provide at least 300 MW of power capacity for green data centres in near term

Source: IMDA (2024)

Build Green Data Centres in ASEAN

Although the boom in data centre development is beneficial for ASEAN economies, data centres are energy-intensive facilities. Around half the energy consumed by a typical data centre is for cooling, and ASEAN's hot climate means that this ratio will likely be higher for data centres located in the region. Data centres account for 7 per cent of Singapore's energy use, and this could increase to 12 per cent by 2030.[3]

ASEAN's energy consumption is currently expected to quadruple between 2020 and 2050, according to the grouping's own projections, due to the increasing demand for digital capabilities coming together with the region's continued urbanisation and industralisation.[4] Seven out of the ten ASEAN member states have committed to achieving net zero greenhouse gas emissions by 2050 in their Nationally Determined Contributions (NDCs) under the global Paris Agreement. The ASEAN region will need to ensure that its energy use is managed and that there is sufficient low-carbon energy to meet its needs.

Data centre operators are working to find solutions for enhancing energy efficiency, including the use of modular and streamlined server designs, use of AI and automation, and use of new building materials in data centre construction. National regulators are likewise increasingly requiring that new data centres achieve better power utilisation effectiveness (PUE), or are introducing certifications to encourage this.

There is presently no ASEAN-wide regional framework on energy, water, and carbon standards for data centres. ASEAN could potentially explore harmonisation of existing national standards and certifications, working with the private sector to share best practices and ensure that the region's data centres are world leaders in efficiency.

ASEAN could explore harmonisation of national standards and certifications to ensure that the region's data centres are world leaders in efficiency

Figure 3: ASEAN's Growing Data Centre Industry

ASEAN is
70%
underpenetrated in data centre supply per capita compared to more evolved markets like the US, China, South Korea, and Japan

AI will drive
30%
of incremental data centre demand growth between 2023 and 2028

Geopolitics and US-China trade tensions favour ASEAN as a destination for data centres

Cost to build a data centre in ASEAN is
20%
below the global average (excluding Singapore)

ASEAN countries have announced around
6 GW
of theoretical new data centre capacity, a 3.5x increase in supply - 40% of this is financed

Source: Maybank, "ASEAN Data Centre: Ride The Multi-Year Data Centre Wave" (2024)[5]

Figure 4: National Standards to Promote Energy Efficiency in Data Centres

Singapore Standards for Sustainable Data Centres (SS 564) (2011, updated 2020)
- Modelled after ISO 50001 standard, covering energy and water usage, and other best practices

Green Mark for Data Centres (2012, updated 2019)
- Recognises data centres that meet energy, water, construction, and management criteria

Singapore Standard for Deployment and Operation of Data Centre IT Equipment under Tropical Climate (SS 697) (2023)
- Recommendations for optimising energy efficiency in data centres in hot tropical climates

Specification for Green Data Centres (2024)
- Certification system based on energy, cooling, and space management

Green Lane Pathway (2023)
- Streamlines power approvals for data centres and reduces implementation duration

Greenship Data Centre (2022)
- Assessment tool and certification system covering multiple stages from design to deployment

Sources: Infocomm Media Development Authority (IMDA), Economic Development Board (EDB), Malaysian Technical Standards Forum Berhad (MTSFB), Tenaga National Berhad (TNB), Ministry of National Development Planning of the Republic of Indonesia (Bappenas)

2. Accelerate R&D and Investment in Emerging Energy Sources

At present, around 75 per cent to more than 85 per cent of ASEAN's energy supply is derived from fossil fuels, depending on estimates, with coal accounting for over half this amount.[6] In theory, most ASEAN countries have sufficient energy supply to support their economic growth based on fossil fuel sources. The issue is ensuring that this growth is sustainable, which means shifting the region's energy mix from brown to green. The second chapter of this report takes a look at the possible pathways to accelerate renewable energy deployment in ASEAN, including discussion of the potential of different renewable energy sources and what is needed to bring them online in the coming years.

Over 75 per cent of ASEAN's energy supply is from fossil fuels – the region must shift its energy mix from brown to green

Accelerate Renewable Energy Development in Malaysia and Indonesia

Coal plants in ASEAN have an average age of less than 15 years old, making it costly for ASEAN countries to retire these plants early and to phase down the use of coal, especially when there are still power purchase agreements (PPAs) with power generation companies in place. This is particularly problematic for countries with large domestic coal reserves, such as Indonesia, where there is strong pressure from the coal-fired power industry and mining interests to keep coal power plants in service.

However, the expected increase in data centre construction in Malaysia and Indonesia means that there is a particular need to further accelerate the deployment of renewable energy in both countries to ensure that data centres are green, and that data centre operators can meet their corporate net zero targets.

Both Malaysia and Indonesia have large government-owned companies, *Tenaga Nasional Berhad (TNB)* and *Perusahaan Listrik Negara (PLN)* respectively, that have an effective monopoly on the transmission and distribution of electricity. Critics argue that liberalisation is needed to reduce costs for electricity buyers and to make renewable energy projects more attractive to both developers and investors.

Complete electricity market liberalisation for Malaysia and Indonesia is likely not practically or politically feasible in the near term. But policymakers and regulators can consider implementing reforms where possible. In September 2024, Malaysia launched a Corporate Renewable Energy Supply Scheme (CRESS), which enables large corporate consumers to purchase renewable energy directly from independent power producers. Indonesian regulations do not currently allow for such direct purchases, but Indonesia's parliament is considering a Draft Law on New and Renewable Energy which would allow "power wheeling" where independent producers can transmit electricity directly to customers via PLN's grid.

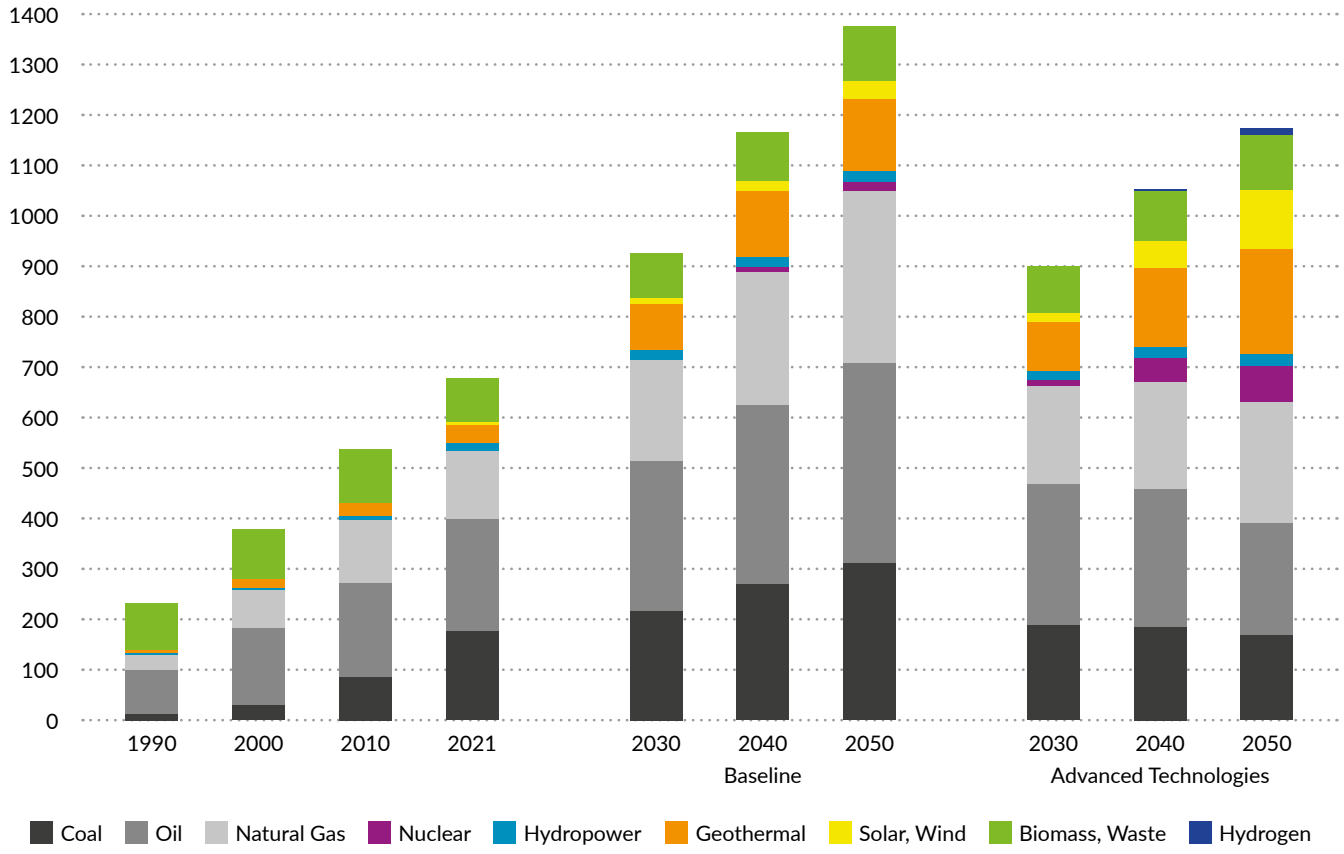
The increase in data centre construction in Malaysia and Indonesia means that there is a need to accelerate the deployment of renewable energy

Develop Solar and Wind Energy

In the International Energy Agency's (IEA) World Energy Balances scenario projections for 2030 to 2050, solar, wind, hydropower, geothermal, biomass, hydrogen, and nuclear power could make up half of the ASEAN region's energy mix by 2050 in an advanced technology scenario – assuming both advancements in energy efficiency as well as renewable energy technology (see Figure 5).

Hydropower and geothermal provide large amounts of reliable baseload power. Vietnam is the region's leader in hydropower, with over 18.5 gigawatts (GW) of capacity, while Laos, Malaysia, Indonesia, the Philippines, Thailand, Myanmar, and Cambodia are all already home to major hydropower projects.[7] Indonesia is already the world's second largest producer of geothermal energy after the United States, with around 2.3 GW of installed capacity, while the Philippines is also a major geothermal producer with 1.9 GW of capacity.

Figure 5: Energy Mix in ASEAN (1990 to 2050)



Note: Y-axis shows energy mix in million tonnes of oil equivalent (Mtoe), x-axis shows years and International Energy Agency (IEA) estimates for baseline and advanced technology scenarios for 2030-2050

Source: Authors' visualisation, based on IEA World Energy Balances (2024)

However, only a few locations are suitable for hydropower and geothermal projects, and both energy types require large amounts of capital expenditure to develop. There are also increasing concerns both internationally and within ASEAN about the environmental and social impact of any future hydropower projects in the region, as the creation of hydropower dams and reservoirs may change the landscape and displace populations. There are therefore limits to how quickly hydropower and geothermal development in the region can be accelerated beyond its current pace.

In this context, more investment is needed to accelerate the deployment of solar and wind power, which can be deployed in more locations and require less capital expenditure as well as operating expenditure. United Overseas Bank estimates that energy generation from solar and wind in ASEAN has surged almost 12 times between 2015 and 2022,[8] and this trajectory can continue. In addition to solar panels and wind turbines themselves, the development and deployment of better battery technology to address intermittency issues is crucial for ASEAN's future.

More investment is needed to accelerate the deployment of solar and wind power, which can be deployed in more locations and require less capital

Increase R&D in Biogas and Hydrogen

Southeast Asian economies are already generating electricity from biomass, in the form of burning wood pellets or chips and other forms of agricultural waste and residues such as palm kernel shells. This form of power generation still produces greenhouse gas emissions, though lower than coal-fired power plants.

There is some interest in developing even more efficient forms of electricity generation from biomass, for instance, via the production of biogas using biomass as a raw material or feedstock. This involves collecting the biogas released when agricultural waste and residues decompose, either naturally or within an industrial anaerobic digester. Biogas is a mix of various gases, though its methane content is what has value as an energy source. Biogas can be further refined into 100 per cent biomethane.

Biogas is already commonly extracted on-site at agricultural mills and used to power mill operations, and some biogas power plants are already operational in Indonesia, Malaysia, and Thailand, which have large agricultural sectors. However, current installed capacity for biogas power plants is relatively low, only amounting to an estimated 1 GW across all of ASEAN.[9]

Some government policymakers and experts are optimistic that biogas capacity in ASEAN can be scaled up, but the region's final biogas potential is unclear. Many agricultural businesses contend that their industries are already using most of their waste and residues, meaning there is not a great deal of excess feedstock to meet demand for electricity. The IEA's projections, even in the IEA's advanced technology scenario, do not foresee much increase in electricity generation from biomass by 2050.

The use of hydrogen faces similar questions of scalability, as well as challenges related to transport and transfer pricing. The IEA only expects hydrogen to be a significant part of ASEAN's energy mix by 2050 in their advanced technologies scenario and even then it is only projected to be around 1 per cent of the region's energy supply.

To date, Singapore is the only ASEAN member state to have established a comprehensive National Hydrogen Strategy, with hydrogen envisioned as possibly supplying half of Singapore's energy needs by 2050 if technology continues to advance and international efforts to build hydrogen supply chains remain strong.[10] Other ASEAN member states are actively exploring hydrogen development from the supply side. Hydrogen features in Malaysia's National Energy Transition Roadmap released in 2023, with the state of Sarawak poised to become a major hydrogen exporter.

Green hydrogen is produced using excess energy from solar, wind, hydropower, and other renewable sources to create hydrogen gas or ammonia.[11] Arguably, hydrogen is not a source of renewable energy itself but a transport medium for green power that complements other renewables. Hydrogen is difficult to store and ship as it is the lightest element with low volumetric energy density, and compression and liquefaction of hydrogen for shipping itself requires a large amount of electricity. This is why there is also interest in ammonia, which is produced by mixing hydrogen with nitrogen, as ammonia is easier to store and transport. But the production of ammonia alone does not solve all the complexity and cost concerns that are holding back the hydrogen economy.

Hydrogen, ammonia, and biogas are therefore promising sources of renewable energy for ASEAN, but they have not yet fulfilled this promise, and there is no certainty that these two renewables will reach sufficient scale between 2030 and 2050. More research and development is required to address current technical challenges and to determine whether biogas and hydrogen are truly cost-effective and scalable.

More R&D is required to address technical challenges and to determine whether biogas and hydrogen are truly cost-effective and scalable

Figure 6: Nuclear Energy Development in ASEAN

Indonesia has been operating research reactors since 1964, and is now home to three such reactors. Indonesia aims to generate 8 GW of nuclear power by 2035 and 35 GW by 2060. Indonesia will be establishing a nuclear energy programme implementing organisation (NEPIO) by the end of 2024.

Malaysia has been operating a research reactor since 1982. Malaysia previously planned to begin constructing two nuclear power plants by 2021 with the aim of having them operational by 2030, but these plans were postponed in 2018.

Thailand has been operating a research reactor since 1977. In 2015, Thailand set the goal of building two 1 GW nuclear plants by around 2036, though this is expected to be replaced with revised plans for the deployment of SMRs by 2037.

Vietnam has been operating a research reactor since 1963. Vietnam planned to have its first nuclear power plant operational by 2024, but construction was cancelled in 2016. Vietnam is currently planning to include SMRs in the country's energy mix after 2030.

The **Philippines** has been operating a research reactor since 1963 and completed construction on a 621 MW nuclear power plant in 1984 though it was never activated. In 2023, the Philippines conducted a feasibility study with Korea on the activation of the mothballed plant. The Philippines currently plans to generate 1.2 GW of energy from nuclear power by 2032, 2.4 GW by 2035, and at least 4.5 GW by 2050.

Sources: World Nuclear Association (2024)

Create Frameworks for Nuclear Safety, Security, and Safeguards

Due to the uncertainties surrounding several forms of renewable energy, nuclear energy should still be considered as a possible element of ASEAN's energy mix because it can provide large quantities of reliable baseload power without emitting greenhouse gases. Nuclear energy is projected to contribute to ASEAN's energy mix from 2035 onwards under most scenarios in the 8th ASEAN Energy Outlook (AEO8) endorsed by the grouping's energy ministers in September 2024. The grouping has also committed to regional cooperation on civilian nuclear power generation under the ASEAN Plan of Action for Energy Cooperation (APAEC).

Prior to the Fukushima nuclear accident in 2011, several ASEAN countries were working towards the development of nuclear power projects. In the immediate aftermath of the Fukushima accident, nuclear power plans were delayed, part due to concern from both policymakers and the public about the safety of nuclear power plants, and partially due to the high financing requirements of nuclear projects and the perception among banks and investors that such projects are high risk.

The advent of a new generation of small modular reactors (SMRs) has revived interest in the deployment of nuclear power projects. SMRs are designed to deliver output of 300 MWe per unit and below, compared to a typical conventional reactor which outputs around 1 GWe. Several smaller reactors could theoretically be added to a site to achieve higher total output. Because SMRs can be built at a factory before being shipped to their destination, they are expected to reduce on-site construction costs. Newer technology should also make these reactors safer than their predecessors.[12]

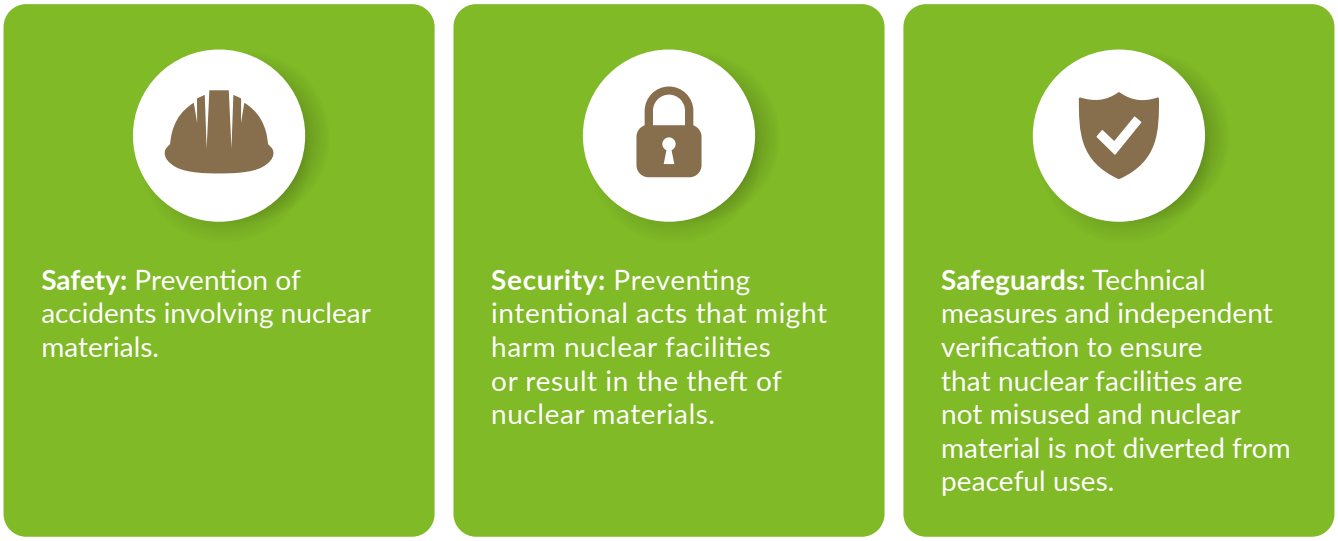
In October 2024, Google announced the purchase of six or seven SMRs built by California's Kairos Power, intended to power data centres in the United States. However, it remains to be seen if the use of SMRs by data centre operators in ASEAN, or by ASEAN's power producers, will be viable in the near term.

Although SMRs are expected to be cheaper than existing large nuclear power plants once SMR technology is fully commercialised, as well as safer, SMR-based projects are still currently seen as high-risk by financial institutions and will continue to be challenging to finance in the near term. As several ASEAN member states are aiming to deploy SMRs by the 2030s, policymakers will need to establish effective governance systems and ensure that the region has a competent workforce, so that nuclear energy can be deployed in a safe and secure manner that addresses the concerns of both investors and the public.

Many ASEAN countries lie on the Ring of Fire, the path along the Pacific Ocean with several active volcanos and frequent earthquakes. Coastal areas may also be prone to tsunamis. Effort will be needed to ensure that any operational nuclear power plants in the region, even those using SMRs, are properly protected. The ASEAN region will need effective regulations and mechanisms to create a resilient supply chain for nuclear technologies and fuel, as well as the capacity to respond to nuclear emergencies and manage nuclear waste safely. Nuclear energy development in ASEAN must respect the international principles of ensuring nuclear safety, security, and safeguards.

Nuclear energy development in ASEAN must respect the international principles of ensuring nuclear safety, security, and safeguards

Figure 7: Nuclear Safety, Security, and Safeguards



Source: International Atomic Energy Agency (2024)

3. Develop Cross-Border Energy Infrastructure and Smart Grids

Beyond the generation of renewable energy, ASEAN needs to ensure that electricity and fuel is able to flow across the region to where it is needed. The third chapter of this report examines the dimensions of cross-border energy connectivity across ASEAN and what can be done to enhance the region's resilience while also encouraging cross-border investment and international cooperation.

Promote Renewable Energy Imports into Singapore

Even as a new generation of data centres enter service in Malaysia and Indonesia, making use of the subsea data connections running through Singapore, green energy should ideally flow into Singapore. Singapore is currently aiming to import 6 GW of low-carbon electricity by 2035, up from the original target of 4 GW set in 2021, accounting for over a third of Singapore's projected power needs.

Currently, Singapore has granted conditional licenses for five large-scale projects to import electricity from Indonesia. Two other Indonesian projects, as well as projects in Cambodia and Vietnam, have been granted conditional approvals, the stage before a conditional license. In addition to these large-scale projects, Singapore will be importing up to 200 MW from Laos and Malaysia via the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP) on a smaller-scale trial basis. Malaysia plans to supply a total of 100 MW to Singapore via an auction on the new Energy Exchange Malaysia (ENEGEM) Platform.[13]

If all these electricity imports are fully realised, Singapore will be importing around 5.6 MW of electricity from renewable sources, only slightly short of the 6 GW goal. It is likely that Singapore will meet its low-carbon electricity import targets for 2035. The question for the long term is whether green electricity imports can scale up further beyond 2035, in response to future energy needs.

It is likely that Singapore will meet its electricity import targets for 2035 – the question is whether electricity imports can scale up further beyond 2035

Indonesia is set to be the leading source of electricity imports into Singapore in the near to medium term. Electricity trading between Indonesia and Singapore was spotlighted at the 2nd Indonesia International Sustainability Forum in September 2024. Coordinating Minister for Maritime and Investment Affairs Luhut Pandjaitan, whose ministry convened the forum, noted that the seven energy import projects going between Indonesia and Singapore will bring some US$20 bn (S$25.7 bn) in investment to Indonesia.[14] These projects are therefore win-win for both Indonesia and Singapore, while also benefiting broader efforts to build energy connectivity across the region.

Investment flows from Singapore to Indonesia are supporting the construction of solar farms and cable connections between both countries, while also boosting Indonesia's manufacturing of solar panels, batteries for energy storage, and other technology. It is logical for projects in the Riau Islands and Sumatra to supply Singapore in exchange for partnerships and investment, as Singapore is the closest node of major energy consumption – far closer than Java, where the majority of Indonesia's population is based.

Indonesia is set to be the leading source of electricity imports into Singapore in the near to medium term

Malaysia is also close to Singapore, and there is interest in exporting low-carbon electricity to Singapore as the creation of ENEGEM indicates. Sarawak's state's energy company Sarawak Energy Berhad (SEB) has proposed the export of 1 GW of electricity, mostly from hydropower, to Singapore by 2032.[15] This will require the construction of a new 720 kilometre (km) undersea power cable to link Sarawak with Singapore and potentially also peninsular Malaysia. This is technologically feasible as a longer power cable has already recently been constructed between Denmark and the United Kingdom. The project is still in a preliminary study stage involving SEB and TNB, with surveys being done of the proposed cable route.

Australian company SunCable is developing the Australia-Asia PowerLink (AAPowerLink), transmitting approximately 2 GW of green electricity from a solar farm in the Northern Territory of Australia to Singapore's grid, via an undersea cable running through Indonesian waters. The Australian government has given major environmental approvals to the project, and SunCable is presently engaging with Singapore's EMA to secure a conditional approval. It is also working with the Indonesian government regarding regulatory and permit matters for the proposed subsea route, including knowledge and hydrographic data-sharing.[16] Sun Cable's project is a more ambitious undertaking than SEB's, as the undersea connection will span 4,300 km, making it the longest such cable in the world. The project is expected to cost some A$35 billion (S$31 billion) and a final investment decision is expected in 2027.

Build Connectivity and Smart Grids in ASEAN

ASEAN has been working towards the establishment of an ASEAN Power Grid (APG) since 1997, when the concept was first included in the ASEAN Vision 2020. ASEAN could save up to US$800 bn (S$1.03 tn) in decarbonisation costs if a fully interconnected grid is established across the region.[17] However, connecting electricity grids in ASEAN will require significant investment. The IEA estimates that an overall grid investment of US$21 bn (S$27 bn) annually will be needed in ASEAN from 2026 to 2030.[18]

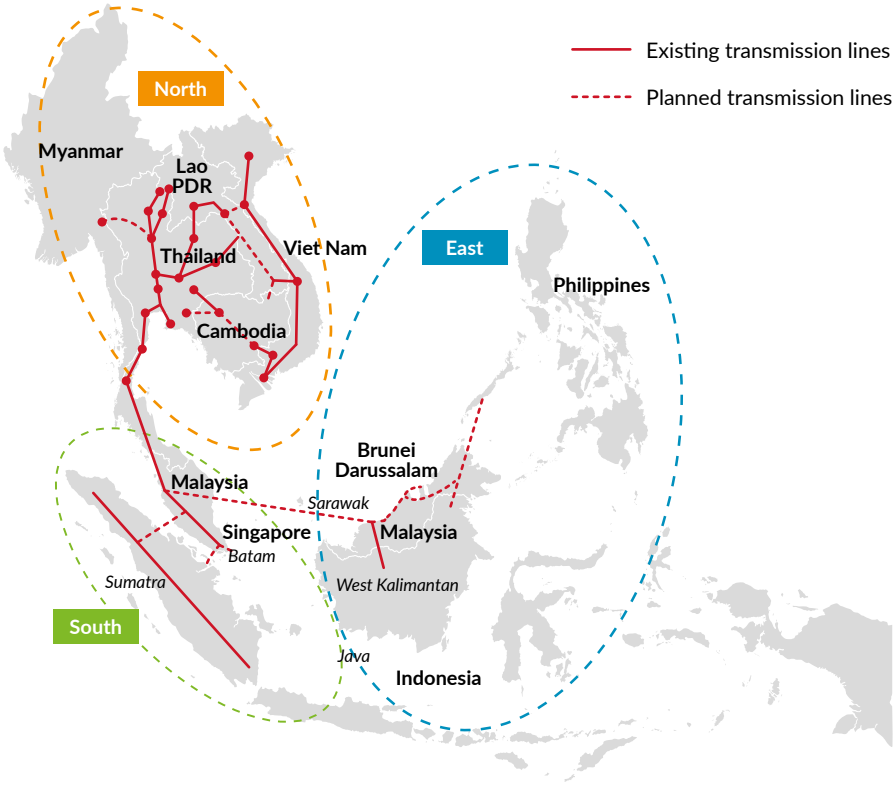
Some progress has been made in connecting grids on a subregional basis, for instance with the LTMS-PIP. But only nine out of the 18 key connections needed to properly achieve the APG have been completed.[19] Though efforts are needed to strengthen connectivity among mainland ASEAN countries along the Mekong, the largest remaining gaps in the region are between the mainland and ASEAN's island nations. ASEAN is paying increasing attention on how to facilitate the development and passage of subsea power cables in the region.

ASEAN must address roadblocks standing in the way of grid connectivity and cross-border electricity trading, including political, regulatory, and technical issues. ASEAN currently has a memorandum of understanding (MOU) on the development of the APG, which is set to be replaced by a stronger APG Framework Agreement in 2025. Notably, the new agreement under discussion includes possible provisions for the creation of a permanent coordinating body or secretariat for the APG, as well as market mechanisms to govern the sale and payment of electricity transfers.

ASEAN must address roadblocks standing in the way of the ASEAN Power Grid

In conjunction with the creation of regional mechanisms to govern electricity transfers, the ASEAN region can strengthen cross-border and international recognition of RECs, by coordinating between different registries and developing common frameworks to make markets interoperable. Most ASEAN countries are engaging with the global International Renewable Energy Certificate (I-REC) standard, which is commonly used by multinational companies to report their energy consumption and emissions reduction. However, the RE100 initiative does not recognise cross-border procurement of RECs in ASEAN – only cross-border purchases in Europe and North America are recognised by RE100, which limits the ability of businesses in ASEAN to claim purchases towards their RE100 commitments. More can therefore be done to strengthen the REC market in ASEAN, making the region a more attractive location for businesses.[20]

Figure 8: Existing and Proposed Connections for the ASEAN Power Grid



Sources: Asian Development Bank (2024), based on data from the government of Lao PDR, ASEAN Centre for Energy, IEA, and other sources

Electricity grids within ASEAN countries and cross-border grid connections must be as smart as possible

While renewable energy is needed to power ASEAN's green data centres, digital technology can in turn make electricity generation and grid management smarter, improving resilience and efficiency. Smart grid systems can monitor power consumption and control power flow across electricity grids in real time. Digital technologies can be used to manage the battery storage systems that are being deployed to address the intermittency of solar energy generation. ASEAN can devise incentives to help smart grid systems create returns and make them more bankable for investors, alongside establishing policy frameworks to make smart grids interoperable across the region.[21]

Beyond electricity trading, ASEAN countries should cooperate further on the cross-border trading of sustainable fuels that could be part of the region's future energy mix, such as biogas, hydrogen, and ammonia. The ASEAN Strategy for Carbon Neutrality adopted in 2023 includes calls to create an ASEAN feedstocks pathway for biofuels and to enable hydrogen infrastructure interoperability, but these recommendations are focused on fuel for vehicles rather than electricity generation.[22]

Explore New Investment Models and Blended Finance

It is estimated that ASEAN requires approximately US$1.5 trillion (S$1.9 tn) in investment to support its green transition through to 2030.[23] It is often argued that there is no shortage of capital globally to finance the green transition, and that the green economy is the largest investment opportunity the world has seen in decades. This may be true, but investors and financial institutions have limits on their liquidity at any one time. There are bottlenecks in how fast the pace of renewable energy deployment can be sped up. Policymakers will need to work with private investors and banks to free up balance sheets in order to accelerate the green transition., and to mitigate the perceived or real risks faced by investors.

Figure 9: Policies in ASEAN Member States to Encourage Renewable Energy Development

Regulatory Policies

	Feed-in tariffs, auctions, and premiums	Net metering, billing, direct consumption	Biofuel targets	Renewable quotas and standards	Tradable RECs
Brunei	✓				✓
Cambodia	✓				✓
Indonesia		✓	✓	✓	✓
Lao PDR	✓				✓
Malaysia		✓	✓	✓	✓
Myanmar	✓				
Philippines		✓	✓	✓	✓
Singapore	✓	✓			✓
Thailand	✓		✓		✓
Viet Nam	✓	✓	✓	✓	✓

Fiscal Policies

	Tax incentives	Production tax credits	Public investments, loans, and grants	Tenders	Energy production payments
Brunei					
Cambodia	✓				
Indonesia	✓	✓	✓	✓	
Lao PDR	✓		✓		
Malaysia	✓		✓	✓	
Myanmar			✓	✓	
Philippines	✓	✓	✓	✓	✓
Singapore			✓	✓	
Thailand	✓		✓		✓
Viet Nam	✓	✓	✓		

Sources: EU-ASEAN Business Council (2023) and official government information

At the inaugural Indo-Pacific Economic Framework for Prosperity (IPEF) Clean Economy Investor Forum held in Singapore in June 2024, Singapore's President Tharman Shanmugaratnam noted in an in-conversation session with SIIA Chairman Simon Tay that there is a need to utilise all forms of capital to support the energy transition. "We have to bring every source of investment capital together, from early stage, growth capital, venture capital, commercial banks, public sector money, philanthropic money, each with their different risk and return preferences."[24]

Risk-tolerant capital in the form of public, multilateral development bank, and philanthropic funding is needed to nurture green energy pilots and startups, so they can demonstrate that their technologies are scalable. Other sources of investments can come in once better risk-return ratios and volume guarantees have been achieved. For cross-border electricity transmission and grid infrastructure, projects require large upfront capital expenditure with a long tail. Private financing can lead the way, but there is still a role for sovereign support.

"We have to bring every source of investment capital together… each with their different risk and return preferences."

Mr Tharman Shanmugaratnam
President of the Republic of Singapore,
at the inaugural IPEF Clean Economy Investor Forum

ASEAN member states have deployed a range of regulatory and fiscal measures to promote the adoption of renewable energy (see Figure 9). However, these are not as extensive or cohesive as the Inflation Reduction Act (IRA) in the United States and the policies China has implemented for green technologies. ASEAN countries must find ways to incentivise renewable energy investment and projects, while at the same time ensuring that these measures are not inavertently protectionist.

Enhance Regional and International Partnerships

This report has focused on renewable energy development and financing within ASEAN, but the grouping will need to work together with countries beyond the region to achieve its green economy ambitions. In the wake of the 2021 United Nations Climate Change Conference (COP26) in Glasgow, new multilateral sustainable financing platforms have been launched to support the world's energy transition.

ASEAN countries should leverage international platforms to secure financing and technical assistance for their energy transitions. The ASEAN grouping as a whole can explore how cooperation with international platforms and multilateral development banks can be used to enhance the grouping's own initiatives such as the APG. The establishment of the IEA Regional Cooperation Centre in Singapore, the IEA's first office outside of Paris, will help ASEAN and Asia access green financing. The Centre will also serve as a hub for the IEA's policy guidance, technical assistance, and capacity building activities.

Figure 10: Recent International Partnerships for Energy Transition Financing

Just Energy Transition Partnership (JETP) (2021)
- Supported by the International Partners Group (IPG) of developed economies co-led by the US and Japan
- JETP agreements for climate financing are signed between the IPG and countries outside the grouping
- Indonesia, Senegal, South Africa, and Vietnam have signed JETP agreements

Indo-Pacific Economic Framework for Prosperity (IPEF) Clean Economy Agreement (2024)
- Part of the IPEF initiative that was initially launched in 2022
- IPEF now includes 14 countries, including 7 ASEAN member states
- Supports the green transition in IPEF countries via innovation partnerships, matching investors with projects, and a capital fund to pool resources for climate project financing

Sources: Ministry of Energy and Mineral Resources (Indonesia) and Ministry of Trade and Industry (Singapore) (2024)

4. Conclusion and Recommendations

ASEAN economies must ensure that their growth is sustainable not only for environmental reasons, but also to ensure that their digital economy remains competitive globally. In order to attract global businesses and consumers of high-value digital services to the region, ASEAN countries must ensure that the region's data centres are green and that operators are able to meet both their own net-zero targets as well as those of their downstream clients.

To grow and thrive as a digital hub, ASEAN needs to accelerate renewable energy deployment, especially in Malaysia and Indonesia as both countries emerge as leading destinations for new data centre construction. At the same time, efforts must continue to ensure a sufficient supply of low-carbon electricity imports into Singapore, which will continue to be a major node for data centres and subsea cable connections.

Government and industry action to accelerate renewable energy deployment must be combined with action to upgrade and connect electricity grids across the region. It is crucial for ASEAN to fully realise the ASEAN Power Grid, along with the market mechanisms needed to support electricity trading across the region. ASEAN must also build transport infrastructure for fuels such as hydrogen and ammonia. Blended finance will be needed, drawing on all sources of capital, in order for ASEAN to achieve its potential.

Recommendations:

1. Establish ASEAN as a Digital Hub for Future Growth

- Strengthen ASEAN as a Digital Hub
- Build Green Data Centres in ASEAN

2. Accelerate R&D and Investment in Emerging Energy Sources

- Accelerate Renewable Energy Development in Malaysia and Indonesia
- Develop Solar and Wind Energy
- Increase R&D in Biogas and Hydrogen
- Create Frameworks for Nuclear Safety, Security, and Safeguards

3. Develop Cross-Border Energy Infrastructure and Smart Grids

- Promote Renewable Energy Imports into Singapore
- Build Connectivity and Smart Grids in ASEAN
- Explore New Investment Models and Blended Finance
- Enhance Regional and International Partnerships

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