Cabinet B - The Environment

Topic 1: Should Singapore adopt Nuclear Energy?

Written By: N Remila, Celeste Chee, Zelia, Raaj, Rahish

[18th March 2026-20th March 2026]

Table of Contents

Introduction to Cabinet B

Dear Representative,

Welcome to Cabinet B! The presidents warmly welcome you as we engage in 3 days of rigorous study. We would like to stipulate the purpose of the council, our mandate, our principles, and our goals. The cabinet convenes on pressing matters that substantially affect Singaporeans. Its composition consists of relevant ministries and statutory boards. Its members are imperative to the enactment of inclusive and targeted policies. Furthermore, the cabinet aims to reflect real-world governance, where trade-offs are unavoidable, introducing representatives to the realities of policymaking. An effective government must first understand its role and its mandates. Besides sometimes competing interests, ministries and statutory boards have respective powers that cannot be overruled. While legislative power lies with the cabinet, its members control aspects of our society. Representatives should first familiarise themselves with our government's principles and objectives. Some overarching objectives would be economic competitiveness (gov.sg, 2025), social cohesion (gov.sg, 2025), and abiding sustainability (SG Green Plan, 2025). The objective of the Cabinet remains addressing pressing concerns while managing trade-offs. As representatives, the onus of representing competing priorities and engaging in diplomacy falls upon you. The president is excited to see substantive debate during the conference, but also wishes to see you grow as representatives and as people. So speak, write, and argue to garner as much as possible from the Singapore Model Cabinet 2026!

Background

The idea of nuclear energy has been part of Singapore's energy discourse for some time. Over a decade ago, Singapore conducted a Nuclear Energy Pre-Feasibility Study (2010-2012) (Ministry of Trade and Industry, 2012) with the conclusion that although conventional large-scale nuclear technology was unsuitable due to the population density and land scarcity, Singapore should continue building expertise in nuclear science, radiation safety, and emergency preparedness (National Environment Agency, 2024). This led to the establishment of the Nuclear Safety Research and Education Programme (NSREP) in 2014 (Singapore Nuclear Research and Safety Institute, 2024) and later the Singapore Nuclear Research and Safety Initiative (SNRSI), signalling the government's recognition that nuclear literacy for Singapore's citizens would be essential in the coming decades.

Since the initial discussion of the feasibility of nuclear energy, the global nuclear landscape has changed significantly. Traditional first-generation and second-generation reactors (e.g. pressurised water reactors) are larger, more land-intensive, require wider buffer zones, and carry catastrophic risk in a densely populated city-state (Goldberg & Rosner, 2026). In comparison, Small Modular Reactors (SMRs), which are compact reactors designed with passive cooling, underground siting, and smaller land footprints are emerging as potentially safer and more suitable alternatives for land-scarce cities like Singapore (Liou, 2023; National Environment Agency, 2024; Samsung C&T Global PR Manager, 2024). Countries like the United States, the United Kingdom, Canada, Japan, and the Republic of Korea are actively developing SMR

prototypes, which are likely to be developed commercially by the 2030s-2040s (European Commission, 2024). Across Southeast Asia, interest in nuclear energy has also been growing. ASEAN neighbours, including the Philippines, Indonesia, and Vietnam, have repeatedly signalled interest in nuclear power to strengthen energy security, reduce dependence on fossil fuels, and commit to decarbonisation (Southeast Asia Public Policy Institute, 2025). This means that Singapore should consider nuclear energy not only as a domestic option but also as a strategic issue affecting regional safety preparedness, the exposure to cross-border risks, and keeping up with ASEAN energy transitions (Lim, 2025).

Current Situation

Recognising that informed deliberation requires domestic expertise, Singapore established the Singapore Nuclear Research and Safety Initiative (SNRSI) in 2014. This initiative was created to build up Singapore's capabilities in nuclear safety, science, and engineering (Energy Market Authority, 2014). In 2025, SNRSI was upgraded to a full research institute with a purpose-built facility at the National University of Singapore, supported by a substantial funding grant. The expanded institute conducts research into nuclear safety, reactor simulation, radiochemistry, radiobiology, and nuclear policy. Its mission includes growing a community of nuclear specialists and enhancing understanding of nuclear technologies to support long-term assessments (National Environment Agency, 2025). The government's capability building also includes ongoing studies on the safety and technical feasibility of advanced nuclear technologies. In late 2024 and 2025, the Energy Market Authority (EMA) issued tenders and appointed

technical consultants (such as Mott MacDonald) to evaluate aspects such as safety performance, technology maturity, and commercial readiness of advanced nuclear technologies, including SMRs (Energy Market Authority, 2024; Energy Market Authority, 2025).

Although Singapore has not yet made any decision to deploy nuclear energy, government policy today reflects a long-term, capability-centred approach. Official statements and parliamentary replies confirm that nuclear deployment has not been decided but that authorities are steadily building capacity to understand nuclear technology suitability, safety requirements, and implications for Singapore's context. The government has set up the Energy Market Authority (EMA), which is currently assessing the feasibility of deploying advanced nuclear energy technologies in Singapore. The National Environment Agency has also convened an advisory panel to support Singapore's capability of building efforts in regard to nuclear energy (Pereira, 2025). The government emphasizes that any future decision regarding nuclear energy would be based on a rigorous assessment of safety, reliability, affordability, and environmental sustainability (Ministry of Trade and Industry, 2023). Budgetary discussions have further signalled this strategic orientation. In Singapore's Budget 2025, the government announced a reorganisation to provide greater emphasis on building nuclear capabilities and continued support for emerging clean energy technologies as part of the broader energy transition (Economic Development Board, 2025). This shows that Singapore is taking a cautious, long-term approach by building nuclear expertise without committing to deployment, ensuring any future decision is based on safety, sustainability, and national suitability.

Singapore's nuclear efforts also include active international cooperation to strengthen technical knowledge and regulatory frameworks. In July 2024, Singapore signed a civil nuclear cooperation agreement ("123 Agreement") with the United States, aimed at supporting capability building, knowledge exchange, and access to advanced nuclear technology expertise, including frameworks like the U.S. Department of Energy's foundational programs for SMRs (Energy Market Authority, 2024). Subsequent cooperation agreements with organisations such as Battelle Memorial Institute and the Idaho National Laboratory further formalise technical collaboration on nuclear energy capability studies. These partnerships enable Singaporean agencies to work with international experts on aspects of nuclear technology and safety (Energy Market Authority, 2025). Singapore also collaborates internationally through frameworks such as the International Atomic Energy Agency (IAEA) to share best practices in nuclear safety, emergency preparedness, and regulatory development. All these are part of the Government's broader strategy to remain informed about global nuclear developments (Channel NewsAsia, 2024).

Scope of Debate

Case for adopting nuclear energy

Stable and low carbon energy source

Nuclear energy is an attractive alternative energy source as it can provide reliable, large-scale electricity generation with operational carbon emissions that are close to zero (International Atomic Energy Agency, 2026; World Nuclear Association, 2023). Singapore has pledged to achieve net-zero emissions by 2050 (NCCS, 2025) and has sought to gradually transition towards cleaner and lower-carbon energy. Such efforts include expanding solar deployment (Housing & Development Board , 2019), improving energy efficiency, exploring hydrogen and carbon capture technologies (Ministry of Trade and Industry, 2022) and participating in regional low-carbon electricity trade such as the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP). However, these alternative energy sources can be intermittent and less reliable (Jessen, 2025), with Singapore's small land area also limiting our ability to deploy renewable energy solutions such as solar energy at scale. In comparison, nuclear energy being both stable and low-carbon would be a feasible alternative option (Economic Development Board, 2025; Energy Market Authority, 2025; JTC, 2025; Varadhan, 2025;).

Energy self-sufficiency

Nuclear energy will allow Singapore to be more energy self-sufficient. Currently, Singapore's reliance on other countries for our energy leaves us highly vulnerable to energy security and geopolitical risks (Lau, 2024) as well as price fluctuations driven by global demand and supply shocks (Lee et al., n.d.). As of 2024, natural gas accounted for approximately 94-95% of

Singapore's fuel mix (Energy Market Authority, 2023; Ministry of Trade and Industry, 2025), with almost all of it imported from Malaysia and Indonesia (Singapore LNG Corporation, 2021). Energy diversification into potentially domestically produced nuclear energy is thus a strategic necessity for Singapore, especially in a climate where global energy markets facing growing volatility (Elcano Royal Institute, 2025; IEA, 2025) due to geographical tensions, supply chain disruptions, and rising demand from digitalisation (Castro et al., 2024; Hudspith, 2024; KPMG, 2025; Koester et al., 2023; Rich, 2025).

Case against adopting nuclear energy

Land limitations

Singapore is a small and densely populated country with a total land area of approximately 735.7 square kilometers, with about 70% of that land already used for housing and infrastructure. It would not be feasible for Singapore to build large reactors that would take up 1 to 3.5 square kilometres. Small Modular Reactors (SMR) would be a better option as they require less space and come with advanced safety features designed to minimize the likelihood of leaks or meltdowns (Huebner, 2025). However, even if smaller and safer reactors can be built, space is still needed to dispose of highly dangerous nuclear waste which can remain highly radioactive for thousands of years (Igini, 2022). Deep geological disposal, a practice where radioactive waste is isolated deep underground in stable rock formations, is widely agreed to be the best solution (World Nuclear Association, 2024). However, unlike other countries, Singapore does not have

extensive underground rock formations due to its limited land size, further curtailing its ability to deal with nuclear waste.

Negative environmental impacts

Environmental hazards associated with nuclear power are a known risk. Environmental disasters such as exposure to radiation, even when rare, can be catastrophic when one considers that Singapore is a highly populated country (International Atomic Energy Agency, 2018). Moreover, due to Singapore's geographical location as an island state surrounded by water, any kind of nuclear disaster will likely cause long-term environmental damage (World Health Organization, 2016). The storage of nuclear waste underground, if not properly managed, could also lead to soil and groundwater pollution (Igini, 2022). In addition, nuclear reactors require the use of immense amounts of water for cooling systems (World Nuclear Association, 2023). Hence, while nuclear energy provides a chance for Singapore to shrink its carbon footprint, environmental tradeoffs in the long run remain a critical point of debate.

Conclusion

Adopting nuclear energy is increasingly becoming an important topic of discussion for Singapore. Despite its drawbacks and risks, nuclear energy is a highly clean source of energy and

will help Singapore to achieve greater energy self-sufficiency Weighing its pros and cons will allow Singapore to decide if adopting nuclear energy will be safe and effective.

QARMAs

To what extent should Singapore rely on clean energy imports, given concerns over energy security and geopolitical risk?

How can Singapore ensure that the adoption of nuclear energy brings more benefits than harm to Singapore?

Bibliography

SEADS. (2022, September 29).*Building the ASEAN Power Grid: Opportunities and Challenges* Adb.org. https://seads.adb.org/articles/building-asean-power-grid-opportunities-and-challenges

Castro, V., Georgiou, M., Jackson, T., Hodgkinson, I. R., Jackson, L., & Lockwood, S. (2024). Digital data demand and renewable energy limits: Forecasting the impacts on global electricity supply and sustainability. *Energy Policy*, *195*, 114404. https://www.sciencedirect.com/science/article/pii/S0301421524004245?via%3Dihub

Chua, D. (2025, July 29). *The ASEAN Power Grid: Singapore's Renewable Energy Lifeline in a Climate-Conscious Era*. Thefinancialcoconut.com; The Financial Coconut. https://www.thefinancialcoconut.com/blog/the-asean-power-grid

Chen, Y.T. (2025, February 19). *Forum: Nuclear power can bring many benefits to Singapore. The Straits Times.* https://www.straitstimes.com/opinion/forum/forum-nuclear-power-can-bring-many-benefits-to-energy-sector

Choo C. (2023 November 9) Environmental experts sound the alarm on how fast Singapore's only landfill Semakau is filling up *Channel New Asia* https://www.channelnewsasia.com/singapore/semakau-landfill-filling-waste-management-incineration-reduce-reuse-recycle-3909436

Earth.Org. (2023). *Nuclear waste disposal and environmental risks.* https://earth.org/nuclear-waste-disposal/

Energy Market Authority (2022, June 23) *Singapore commences first renewable energy electricity import via regional multilateral power trade*. https://www.ema.gov.sg/news-events/news/media-releases/2022/singapore-commences-first-renewable-energy-electricity-import-via-regional-multilateral-power-trade

Energy Market Authority (2022, June 23). *Media Release Singapore commences first renewable energy electricity import via regional multilateral power trade Keppel and Electricite du Laos sign power purchase agreement, pioneering cross-border power trade of renewable energy into*

Singapore.

https://www.ema.gov.sg/content/dam/corporate/news/media-releases/2022/20220623_MediaRelease_Singapore-commences-first-renewable-energy-electricity-imports-100MW.pdf

Energy Market Authority. (2023). *EMA | SES Chapter 2: Energy Transformation*. EMA .

https://www.ema.gov.sg/resources/singapore-energy-statistics/chapter2

Energy Market Authority Singapore. (2023). Singapore Energy Statistics.

https://www.ema.gov.sg/content/dam/corporate/resources/corporate-publications/nuclear-background-paper/EMA-Resources-Corporate-Publications-Building-SG-Capabilities-to-Assess-Nuclear-Energy.pdf.coredownload.pdf

Energy Market Authority (2023, August 11) Is Singapore considering nuclear power plants?

https://www.ema.gov.sg/resources/faqs/energy-supply/low-carbon-alternatives/is-singapore-considering-nuclear-power-plants

Energy Market Authority (2025, September 2) *EMA to Conduct Study on the Safety and Technical Feasibility of Advanced Nuclear Energy Technologies*

https://www.ema.gov.sg/news-events/news/media-releases/2025/ema-to-conduct-study-on-safety-technical-feasibility-of-advanced-nuclear-energy-technologies

Energy Market Authority (2025, October 27) *Singapore Deepens Cooperation with the United States on Nuclear Energy Capability Building*

https://www.ema.gov.sg/news-events/news/media-releases/2025/sg-deepens-cooperation-with-us-on-nuclear-energy-capability-building

Energy Market Authority (2025, September 29) *Four Switches for Singapore's Energy Transition* https://www.ema.gov.sg/resources/corporate-publications/annual-sustainability-report-2024-2025/four-switches-for-sg-energy-transition

Europe, in. (2025, July 21). *What drives natural gas price volatility in Europe and beyond? – Analysis - IEA*. https://www.iea.org/commentaries/what-drives-natural-gas-price-volatility-in-europe-and-beyond

Energy Supply. (2025). Ministry of Trade and Industry. https://www.mti.gov.sg/energy-and-carbon/energy-supply/

Energy & Infrastructure M&A 2025. (2025, November 19). *Chamber and Partners*. Retrieved January 14, 2026, from https://practiceguides.chambers.com/practice-guides/energy-infrastructure-ma-2025/singapore/trends-and-developments.

Elcano Royal Institute (2025, March 27) *The volatility of energy prices and its effect on industry*. https://www.realinstitutoelcano.org/en/analyses/the-volatility-of-energy-prices-and-its-effect-on-industry/

ERIA (June 2013) *ERIA Research Project Report summarising 2012 pre-feasibility info* https://www.eria.org/RPR-FY2012-28.pdf

European Commission. (2024). *Small Modular Reactors explained - European Commission*. Energy.ec.europa.eu; European Union.

https://energy.ec.europa.eu/topics/nuclear-energy/small-modular-reactors/small-modular-reactors-explained_en

Goldberg, S., & Rosner, R. (2026). *Nuclear Reactors: Generation to Generation | American Academy of Arts and Sciences*. Www.amacad.org. https://www.amacad.org/publication/nuclear-reactors-generation-generation/section/5

Ghi, T. (2025, August 1). *The race to become a gas hub in South/Southeast ASIA | Arthur D. Little*. https://www.adlittle.com/en/insights/viewpoints/race-become-gas-hub-southsoutheast-asia.

Housing and Development Board (2019) *SolarNova Page* https://www.hdb.gov.sg/cs/infoweb/about-us/our-role/smart-and-sustainable-living/solarnova-page

Huebner S. (2025, March 15) *Commentary: If Singapore decides to invest in nuclear energy, floating power plants deserve a closer look*. Channel News Asia https://www.channelnewsasia.com/commentary/singapore-nuclear-energy-small-reactor-smr-safety-floating-4997551

Hudspith, J. (2024, October 21). *How Geopolitical Events Affect the Energy Market and Prices*. Dbsne.com. https://www.dbsne.com/post/how-geopolitical-events-affect-the-energy-market-and-prices

Igini M. (2022, September 12) The Nuclear Waste Disposal Dilemma. *Earth.Org* https://earth.org/nuclear-waste-disposal/

International Atomic Energy Agency. (2018). *Environmental Consequences of the Chernobyl Accident and their Remediation: Twenty Years of Experience.* https://www.iaea.org/publications/7382/environmental-consequences-of-the-chernobyl-accident-and-their-remediation-twenty-years-of-experience

International Atomic Energy Agency. (2022). *Climate change and nuclear power.* https://www.iaea.org/topics/nuclear-power-and-climate-change/climate-change-and-nuclear-power-2022

International Atomic Energy Agency. (2024, October). *Advances in Small Modular Reactors.* https://www-pub.iaea.org/MTCD/Publications/PDF/p15790-PUB9062_web.pdf

International Atomic Energy Agency. (2026, January 27). *Five Reasons the Clean Energy Transition Needs Nuclear Power*. Iaea.org. https://www.iaea.org/newscenter/news/five-reasons-the-clean-energy-transition-needs-nuclear-power

Jessen, J. (2025, November 20). *ABB: How Nuclear Baseload, SMRs & Policy can Power Net Zero*. Sustainabilitymag.com; Bizclik Media Ltd. https://sustainabilitymag.com/news/abb-how-nuclear-baseload-smrs-policy-can-power-net-zero

JTC (2025, October 27) *Singapore Energy Lecture by Min (EST) Tan See Leng at the 2025 Singapore International Energy Week*. https://www.jtc.gov.sg/about-jtc/news-and-stories/press-releases/singapore-energy-lecture-by-min-tan-see-leng

KPMG (2025) *Top geopolitical risks 2025: Energy insights* https://kpmg.com/xx/en/our-insights/risk-and-regulation/top-risks-forecast/energy.html

Koester, G., Gonçalves, E., Gomez-Salvador, R., Doleschel, J., Andersson, M., Pardo, B. G., & Lebastard, L. (2023). *Inflation developments in the euro area and the United States.* European Central Bank, 1(7). https://www.ecb.europa.eu/press/economic-bulletin/focus/2025/html/ecb.ebbox202502_03~8eba688e29.en.html

Liou, J. (2023, September 13). *What Are Small Modular Reactors (SMRs)?* International Atomic Energy Agency; IAEA Office of Public Information and Communication. https://www.iaea.org/newscenter/news/what-are-small-modular-reactors-smrs

Lim, J. (2025). *Nuclear education needed in Singapore as Asean neighbours explore deployment: Tan See Leng*. The Business Times. https://www.businesstimes.com.sg/esg/nuclear-education-needed-singapore-asean-neighbours-explore-deployment-tan-see-leng

Lau D., Zalizan T. (2024 May 27) *Explainer: Why Singapore is exploring nuclear energy and what needs to happen before plans get underway,* Channel News Asia https://www.channelnewsasia.com/singapore/explainer-singapore-nuclear-energy-plans-process-5588526

Ministry of Trade and Industry (2012) FACTSHEET NUCLEAR ENERGY PRE-FEASIBILITY STUDY Singapore's Energy Landscape.

https://isomer-user-content.by.gov.sg/166/b1ebdf8b-e453-494a-bd85-7eb89e3dd68e/pre-fs-factsheet.pdf

Ministry of Trade and Industry (2012, October 15) *Second Minister S Iswaran's reply to Parliament Question on Nuclear Energy Pre-feasibility Study in Singapore* MTI https://www.mti.gov.sg/newsroom/second-minister-s-iswaran-s-reply-to-parliament-question-on-nuclear-energy-pre-feasibility-study-in-singapore

Ministry of Trade and Industry. (2022). *Hydrogen*. https://www.mti.gov.sg/energy-and-carbon/energy-supply/low-carbon-alternatives/hydrogen/

Pereira, M. (2025, November 17). *Singapore building nuclear expertise to be an "intelligent observer" amid regional push: Expert*. Channel News Asia https://www.channelnewsasia.com/singapore/singapore-nuclear-energy-intelligent-observer-laurence-williams-5471481

Ministry of Trade and Industry (2024, July 31) *Joint Statement on the Signing of the United States-Singapore 123 Agreement* MTI https://www.mti.gov.sg/Newsroom/Press-Releases/2024/07/Joint-Statement-on-the-Signing-of-the-United-States-Singapore-123-Agreement

Ministry of Trade and Industry (2025, October 22) *Nuclear Energy* MTI https://www.mti.gov.sg/energy-and-carbon/energy-supply/low-carbon-alternatives/nuclear-energy

National Climate Change Secretariat (2025). *Overview of Singapore Climate Targets*. https://www.nccs.gov.sg/singapores-climate-action/singapores-climate-targets/overview/

National Climate Change Secretariat. (2026) *Singapore's Approach To Alternative Energy*. https://www.nccs.gov.sg/singapores-climate-action/singapore-approach-to-alternative-energy/

National Environment Agency (2025, July 11) *Singapore Nuclear Research And Safety Initiative Established As Full-Fledged Research Institute* https://www.nea.gov.sg/media/news/news/index/singapore-nuclear-research-and-safety-initiative-established-as-full-fledged-research-institute

National Climate Change Secretariat. (2021). *Impact of Climate Change in Singapore* https://www.nccs.gov.sg/singapores-climate-action/impact-of-climate-change-in-singapore/

Office of Nuclear Energy; U.S. Department of Energy. https://www.energy.gov/ne/articles/advantages-and-challenges-nuclear-energy

Prime Minister's Office Singapore. (2022). *Singapore Green Plan 2030 and net-zero ambitions.* https://www.pmo.gov.sg

SLNG (2014, February 25) *Prime Minister Lee Hsien Loong Officially Opens The Singapore LNG Terminal* https://www.slng.com.sg/prime-minister-lee-hsien-loong-officially-opens-singapore-lng-terminal

Rich, W. (2025, April 15). *Global Supply Chain Disruptions in 2025: Causes, Effects, and Resilience Strategies*. Global Banking and Finance Review; Global Banking & Finance Review. https://www.globalbankingandfinance.com/global-supply-chain-disruptions-in-2025-causes-effects-and-resilience-strategies/

Samsung C&T Global PR Manager. (2024, August 22). *Emerging Energy Technology for the Future: Small Modular Reactors (SMRs) - Samsung C&T Newsroom*. Samsung C&T Newsroom. https://news.samsungcnt.com/en/features/engineering-construction/2024-08-emerging-energy-technology-for-the-future-small-modular-reactors-smrs/

Sudarshan Varadhan. (2025, June 29). Singapore's renewables usage hits record high as imports, solar output rise. *Reuters*. https://www.reuters.com/sustainability/boards-policy-regulation/singapores-renewables-usage-hits-record-high-imports-solar-output-rise-2025-06-27/

IUCN (2025, April 17).*Singapore's role in the Mekong's sustainable energy transition*. https://iucn.org/story/202504/singapores-role-mekongs-sustainable-energy-transition

Southeast Asia Public Policy Institute. (2025, November 19) *Framing a Nuclear-Powered Future for ASEAN* . Southeast Asia Public Policy Institute. https://seapublicpolicy.org/work/nuclear-powered-future-asean/

Tham D. (2025, September 24) IN FOCUS: Where will Singapore's rubbish go after Semakau landfill is full? *Channel News Asia* https://www.channelnewsasia.com/singapore/semakau-landfill-waste-recycling-rubbish-in-focus-5358016

Teo E. D. (2025, March 13). *Building a sustainable future: Singapore's multi-pronged approach to climate mitigation* https://www.edb.gov.sg/en/business-insights/insights/building-a-sustainable-future-singapores-multi-pronged-approach-to-climate-mitigation.html

US Department of Energy. (2024, June 11). *Advantages and Challenges of Nuclear Energy*.

(2024). Nus.edu.sg. https://snrsi.nus.edu.sg/about-us/about/

US Department of Energy (2025, January 15) *U.S.-Singapore Joint Statement on the Signing of the Memorandum of Understanding Concerning Strategic Civil Nuclear Cooperation* US DOE https://www.energy.gov/articles/us-singapore-joint-statement-signing-memorandum-understanding-concerning-strategic-civil?utm_source=chatgpt.com

World Nuclear Association. (2023). *Nuclear power and the environment.* https://world-nuclear.org/information-library/energy-and-the-environment

World Nuclear Association (2024, April 30) Storage and Disposal of Radioactive Waste *World Nuclear Association* https://world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-waste/storage-and-disposal-of-radioactive-waste

World Nuclear Association. (2025, November 22). *Radioactive waste management.* https://world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-waste/radioactive-waste-management

World Health Organization. (2016). *Radiation emergencies and environmental impact.* who.int/health-topics/radiation-emergencies

Cabinet B - The Environment

Topic 2: Should Singapore take more steps to attain Net Zero Emissions by 2050?

Written By: N Remila, Celeste Chee, Zelia, Raaj, Rahish

[18th March 2026-20th March 2026]

Background

Singapore's pursuit of net-zero emissions by 2050, an attempt to balance between the amount of greenhouse gas produced by human activity and the amount removed from the atmosphere, takes place within a broader global momentum toward deep decarbonisation (University of Waterloo, 2023). Since the early 1990s, international climate governance has evolved rapidly, beginning with the United Nations Framework Convention on Climate Change (UNFCCC) in 1997, followed by the Kyoto Protocol in 2006 that required industrialized countries and economies in transition to reduce greenhouse gas (GHG) emissions in line with predetermined individual targets (The Kyoto Protocol, 2022), and culminating in the 2015 Paris Agreement, which Singapore signed in 2016 (NCCS, 2022; National Environment Agency, 2015; UNFCCC, 1992; UNFCCC, 2025). Together, these frameworks have created a global expectation that all countries, even small, resource-scarce city-states, must contribute meaningfully to long-term climate change mitigation.

Singapore joined the UNFCCC in 1997 and ratified the Doha Amendment in 2014 (Elena, 2014; NCCS, 2022), reiterating its commitment to transparent climate reporting and international climate cooperation. While Singapore contributes approximately 0.1% of global emissions, it remains the 2nd-highest CO_2 emissions per capita in ASEAN as of 2023 (Aik et al., 2023; SG Green Plan, 2020; TheGlobalEconomy.com, n.d.). This is not the result of policy neglect but rather reflects structural realities of Singapore - having a heavy industrial base centred on petrochemical activities on Jurong Island, being an export-oriented economy, and possessing a

tropical climate that necessitates year-round cooling (Aik et al., 2023; Lau et al., 2021; Su et al., 2017; NCCS, 2024). These characteristics place Singapore in a category similar to other industrialised economies such as the Netherlands and the Republic of Korea, which also face the challenge of balancing carbon-intensive economic structures with ambitious climate targets (Elberry et al., 2025; ABN AMRO Bank, 2023; ABN AMRO Bank, 2017; OECD, 2025; Rashid, 2025).

Energy production further compounds this challenge. Approximately 95% of Singapore's electricity is generated from imported natural gas, exposing the country to international price fluctuations and geopolitical supply risks, especially with the ongoing Russia-Ukraine war disrupting the supply of items like food staples and crude petroleum (oec.world, 2021; Crude Petroleum in Ukraine, n.d.), while simultaneously constraining decarbonisation options (Energy Market Authority, 2023; Ministry of Trade and Industry, 2025; Energy Market Authority, n.d.; Aung, 2022). As the economy digitalises, electricity demand is projected to rise sharply as a result of data centres, electrified transport, and advanced manufacturing (IEA, 2025a; IEA, 2025b; Poudineh, 2025; Globalxetfs.com, 2025). This mirrors trends observed in other high-income economies, such as Japan and Hong Kong, where digital growth and dense urbanisation have significantly increased electricity consumption despite efficiency improvements (Reuters, 2024; Mackenzie, 2025; South China Morning Post, 2024).

Current Situation

Singapore formally committed in 2020 to achieving net-zero emissions by 2050 under the Long-Term Low-Emissions Development Strategy (LEDS) (NCCS, 2022; National Environment Agency, 2015). This ambition is implemented through the Singapore Green Plan 2030, which spans five pillars: *City in Nature*, *Sustainable Living*, *Energy Reset*, *Green Economy,* and *Resilient Future* (SG Green Plan, 2021; SG Green Plan, n.d.). Crucially, the Green Plan is not framed solely as environmental policy but also links climate action to economic competitiveness, national security, and long-term climate resilience, reflecting Singapore's belief that decarbonisation must be economically viable and socially sustainable (Goh, 2025). Singapore has implemented a substantial policy architecture to support this transition. Existing measures include the Carbon Pricing Act (2018), which is Southeast Asia's first economy-wide carbon tax (Ministry of Sustainability and the Environment, 2024), the Energy Conservation Act mandating energy management for large facilities (National Environment Agency, n.d.), enhanced Green Mark standards for buildings (BCA Corp, 2021), the Zero Waste Masterplan (National Environment Agency, 2021), electric vehicle transition policies such as the EV Early Adoption Scheme (EEAI) and a 2030 phase-out of new internal combustion engine vehicles. registrations (National Environment Agency, 2025; CNA, 2021), and so on. The carbon tax is also set to rise progressively from S$5/tonne to S$50–80/tonne by 2030 (Ministry of Sustainability and the Environment, 2024), although debate remains over whether this price signal is sufficient to drive structural change. At the same time, Singapore has been exploring regional power imports,

international carbon credits under Article 6 of the Paris Agreement, and investments in new and emerging technologies such as hydrogen and carbon capture and storage (NCCS, 2021). These efforts represent a strategy that seeks to address both the challenges of domestic action and the opportunities of international cooperation.

However, despite these efforts made, Singapore continues to face constraints typical of small island states. Unlike larger economies that are land-rich with abundant renewable resources, Singapore's land scarcity makes large-scale domestic renewables such as onshore wind farms, hydropower dams, or utility-scale solar installations physically unfeasible. (Seah, 2023; Ministry of Sustainability and Environment, 2019). Additionally, Singapore is also acutely vulnerable to the impacts of climate change. As a low-lying coastal city-state, it faces grave risks from sea-level rise, extreme rainfall and flash floods, chronic heat stress, and disruptions to global energy and food supply chains (NCCS, 2024). These risks underscore that net-zero is not merely an environmental aspiration but a strategic imperative that allows for national survival and long-term resilience (Ministry of Sustainability and the Environment, 2025). Taken together, these global pressures, domestic constraints, and existing policies regarding climate change hence frame the central question of this entire situation: whether Singapore should take more steps beyond its current trajectory to achieve net-zero emissions by 2050, and if so, how far it can do so without undermining economic competitiveness, energy security, and citizens' welfare.

Scope of Debate

Case for taking more steps to achieve net-zero emissions

Urgency of mitigating climate change and its impacts

There is an urgent need to accelerate decarbonization to prevent Singapore from being locked into long-term fossil fuel use. While natural gas is cleaner than coal, it is still a major source of emissions and cannot help Singapore achieve net-zero emissions (NCCS, 2021). Further delay will increase the transition costs of the future and make more drastic policy changes necessary. The need for urgent action is also driven by the expected increase in electricity demand. The growing use of digital technology, air-conditioning, and electric vehicles is expected to drive up electricity demand substantially, potentially increasing emissions unless the energy mix is changed (EMA, 2025b). Early action will enable emissions reductions to be made more gradually and affordably. From the security point of view, climate change poses an existential threat to Singapore due to sea-level rise, heat stress, and flooding (IPCC, 2023). Early decarbonization can therefore be seen not only as a climate imperative but also as a long-term investment in economic and national security.

Opportunities to reduce fossil fuel dependence through regional cooperation

Despite the lack of land and resources in Singapore, the country can still reduce its dependence on fossil fuels by importing low-carbon electricity from its regional partners. Countries such as Laos and Malaysia have a competitive advantage in land-intensive forms of renewable energy

such as hydropower and solar energy, which will enable Singapore to decarbonize without using much land in Singapore. Regional power grid connections also improve energy security by adding new sources of supply and making the sector less vulnerable to price volatility in a single fuel market. With the help of strong bilateral arrangements and power grid redundancy, electricity imports can become a strong foundation of Singapore's energy transformation rather than a weakness. Market mechanisms also support the country's transition to a low-carbon economy. The carbon tax encourages companies to invest in energy efficiency and low-carbon solutions, while the use of high-quality international carbon credits can help the country reduce emissions at a lower marginal cost during the transition period (NCCS, 2021). These mechanisms are flexible and give the country breathing room to wait for the development of new low-carbon solutions.

Case against taking more steps to achieve net-zero emissions

Structural constraints in decarbonising Singapore's energy system

The structural and physical constraints of Singapore are major factors that impede the country's decarbonisation efforts. The electricity industry in Singapore is still very reliant on fossil fuels, especially natural gas, which contributes about 95% to electricity production (Energy Market Authority, 2023). Although natural gas is cleaner than coal and oil, it still produces a substantial amount of greenhouse gas emissions and cannot support deep decarbonization (National Climate Change Secretariat, 2021). Concurrently, the demand for electricity in Singapore is increasing because of the increasing population, increased cooling demand, transportation electrification,

and the development of energy-intensive industries such as data centers (EMA, 2025b). If no further action is taken, the power sector's greenhouse gas emissions are expected to continue rising, putting Singapore on a high-emissions path that becomes increasingly hard and expensive to reverse.

In addition, the country's absence of domestic renewable energy sources means that other alternatives such as solar energy, even if fully utilized, can only account for a small percentage of the country's total electricity needs (EMA, 2023). For instance, even with the aggressive deployment of floating and rooftop solar, Singapore's maximum potential remains limited and insufficient to meet its national electricity demand. (Aung, 2022) Furthermore, Singapore lacks domestic renewable endowments because it has no viable inland wind corridors and no rivers suitable for hydropower and minimal geothermal potential. (NCCS, 2026) Although exploratory studies in Sembawang have identified subsurface temperatures of up to 120°C, the economic viability of harnessing geothermal energy at that site remains uncertain. (Liam, 2025; NTU, 2025) Bioenergy options are similarly constrained by land scarcity. (NCCS, 2011; IEA, 2021) Consequently, it may be that Singapore's net-zero pathway would need to diversify into a combination of clean energy imports, hydrogen, Carbon Capture, Utilisation and Storage (CCUS), aggressive efficiency improvements, and potentially nuclear technologies, rather than solely relying on domestic renewables. However, these solutions also come with risks. Overdependence on regional electricity imports makes Singapore vulnerable to geopolitical risks, policy shifts, and possible disruptions in regional infrastructure. Likewise, nuclear power

and small modular reactors (SMRs), although theoretically promising, are also prone to concerns about safety, disposal, and community acceptance in a highly populated city-state.

Implications of carbon tax on economic competitiveness

Higher carbon taxes could impose substantial burdens on emissions-intensive and trade-exposed (EITE) sectors. Higher production costs could make these sectors less globally competitive, prompting companies to shift their operations to other countries, or simply lead to carbon leakage rather than actual global emissions cuts. From a macroeconomic perspective, higher electricity costs could further worsen cost-of-living pressures, particularly for lower-income households who spend a larger share of their income on electricity. While government transfers can help offset these impacts, persistent cost increases could undermine public support for more stringent climate policies. Dependence on international carbon credits could also be a source of concern. Overdependence could postpone necessary structural changes in the country and undermine sectoral incentives to invest in long-term emissions cuts, potentially undermining the credibility of Singapore's net-zero pledge.

Conclusion

Singapore is actively taking steps to reduce its carbon emissions and to attain its goal. However, owing to its status as a thriving business and trading hub, the energy demands only continue to increase. This puts Singapore in a spot and now, it has to decide how to seamlessly reduce its manage carbon footprint while maintaining its status as a thriving business hub.

QARMAS

How should Singapore balance economic growth with the need to rapidly decarbonise, especially in hard-to-abate industrial sectors?

To what extent should Singapore rely on clean energy imports as part of its long-term energy strategy, given geopolitical and energy security risks?

How should Singapore evaluate and prioritise emerging low-carbon technologies (e.g., hydrogen, CCUS) amidst uncertainties over cost, feasibility, and safety?

Bibliography

ABN AMRO Bank (2023) *ESG - Dutch agriculture not on track to meet climate targets*. https://www.abnamro.com/research/en/our-research/esg-economist-dutch-agriculture-not-on-track-to-meet-climate-targets

ABN AMRO Bank (2017). . *Five climate challenges in Dutch climate sectors*. https://www.abnamro.com/research/en/our-research/esg-economist-five-climate-challenges-in-dutch-climate-sectors

Aung, C. (2022, December 21). *Charting Singapore's Energy Transition*. Earth.org. https://earth.org/singapore-energy-transition/

Aik, J., Ang, L., Gunther, S. H., Tang, C.-W., Lee, J., & Wei Jie Seow. (2023). Climate change and population health in Singapore: a systematic review. *The Lancet Regional Health - Western Pacific*, *40*(100947), 100947–100947. https://www.thelancet.com/journals/lanwpc/article/PIIS2666-6065(23)00265-1/fulltext

BCA Corp.(2025, November 17). *Green Mark 2021 (Pilot)*. https://www1.bca.gov.sg/buildsg/sustainability/green-mark-certification-scheme/green-mark-2021

Climate Transparency (2022) Per capita greenhouse gas (GHG) emissions above G20 average recent developments https://www.climate-transparency.org/wp-content/uploads/2022/10/CT2022-South-Korea-Web.pdf

Delgado, A. L. (2025, October 29). *Carbon tax concessions for global oil giants spark environmentalist concerns | AP News*. AP News. https://apnews.com/article/singapore-carbon-tax-climate-emissions-30b307539062bd9f53a0a02ef6a3fddb

Economic Consulting Associates (2015, February) *Carbon lock-in toolkit* ECA https://assets.publishing.service.gov.uk/media/57a08978ed915d622c000223/61516_Carbon_lock-in_toolkit.pdf

Elena. (2014, September 25). Mexico, Singapore accept Doha amendment. *SDG Knowledge Hub*. https://sdg.iisd.org/news/mexico-singapore-accept-doha-amendment

Elberry, A. M., Scheepers, M., van Stralen, J., Giraldo, J. S., & van der Zwaan, B. (2025, December). *Decarbonizing the Dutch industrial sector: between maintaining domestic production and partial relocation. Energy and Climate Change,* https://www.sciencedirect.com/science/article/pii/S2666278725000327

Energy Market Authority. (2023). *EMA | SES Chapter 2: Energy Transformation*. EMA.

https://www.ema.gov.sg/resources/singapore-energy-statistics/chapter2

Energy Market Authority. (2024). *Four switches for Singapore's energy transition*. EMA

https://www.ema.gov.sg/resources/corporate-publications/annual-sustainability-report-2024-2025/four-switches-for-sg-energy-transition

Energy Market Authority *Natural Gas*. (2025, December 24). EMA.

https://www.ema.gov.sg/our-energy-story/energy-supply/natural-gas

Energy Market Authority. (2025a). *Four switches for Singapore's energy transition* https://www.ema.gov.sg/resources/corporate-publications/annual-sustainability-report-2024-2025/four-switches-for-sg-energy-transition

Energy Market Authority. (2025b). *Electricity demand growth reports. (See EMA summary reports)*. https://www.ema.gov.sg/resources/singapore-energy-statistics/chapter2

Goh, T. (2025, October 24). *Singapore will decarbonise, but not at the expense of livelihoods, energy security: Tan See Leng*. The Straits Times.

https://www.straitstimes.com/business/companies-markets/spore-will-decarbonise-but-not-at-the-expense-of-livelihoods-energy-security-tan-see-leng

Global X (2025) *Electrification: Securing Power for Advancing Technologies*.

https://www.globalxetfs.com/articles/electrification-securing-power-for-advancing-technologies

Global-is-asia (2022, October 6) *Putting a price on carbon : Hard targets to keep Singapore going*

https://lkyspp.nus.edu.sg/gia/article/putting-a-price-on-carbon-hard-targets-to-keep-singapore-going.

Kho, C., Ji, K. (2023, November 28). *How Singapore Unlocks Resource Constraints to Enable the Green Transition - ASEAN+3 Macroeconomic Research Office - AMRO ASIA*. ASEAN+3 Macroeconomic Research Office - AMRO ASIA. https://amro-asia.org/how-singapore-unlocks-resource-constraints-to-enable-the-green-transition/

Ministry of Sustainability and the Environment (2024) *Carbon Pricing Act* https://www.mse.gov.sg/policies/climate-change/carbon-pricing-act/

IEA. (2021, May 2021)*What does net-zero emissions by 2050 mean for bioenergy and land use? – Analysis* https://www.iea.org/articles/what-does-net-zero-emissions-by-2050-mean-for-bioenergy-and-land-use

IEA. (2025, February 14). *Growth in global electricity demand is set to accelerate in the coming years as power-hungry sectors expand - News - IEA*. IEA. https://www.iea.org/news/growth-in-global-electricity-demand-is-set-to-accelerate-in-the-coming-years-as-power-hungry-sectors-expand

IEA (2025) *Executive summary – Energy and AI – Analysis* https://www.iea.org/reports/energy-and-ai/executive-summary

International Atomic Energy Agency. (2025). *Supporting Member States' capacity building on small modular reactors*. https://www.iaea.org/projects/tc/int2023

Lau, H. C., Ramakrishna, S., Zhang, K., & Hameed, M. Z. S. (2021). A Decarbonization Roadmap for Singapore and Its Energy Policy Implications. *Energies*, *14*(20), 6455. https://www.mdpi.com/1996-1073/14/20/6455

Liam R. (2025, July 3) *Record 122°C subsurface temperature found in Sembawang, suggesting geothermal energy potential*. (2025). Channel News Asia https://www.channelnewsasia.com/singapore/geothermal-energy-potential-sembawang-admiralty-ntu-5218621

Mackenzie, W. (2025, August 26). *Wood Mackenzie*. Woodmac.com. https://www.woodmac.com/press-releases/japan-data-centers-power-demand/

Ministry of Finance. (2025). *Singapore Green Bond Report 2023*. https://www.mof.gov.sg/docs/default-source/policies/fiscal/2023-mof_sg_greenbondreport.pdf

Ministry of Sustainability and the Environment. (2019). Singapore's carbon tax framework. https://www.greenplan.gov.sg/

Ministry of Sustainability and the Environment. (2019) *Why don't we use 100% renewable energy in Singapore?* MSE https://www.mse.gov.sg/latest-news/newsletter-why-dont-we-use-100-percent-renewable-energy-in-singapore/

Ministry of Sustainability and the Environment. (2022). Carbon tax rate increase and climate strategies. https://www.greenplan.gov.sg/

Ministry of Sustainability and the Environment. (2025). Energy policy and transition. https://www.mse.gov.sg/policies/energy

Ministry of Sustainability and the Environment. (2025). *Energy policies and Singapore's net-zero commitment*. https://www.mse.gov.sg/policies/energy

Ministry of Sustainability and the Environment (2025) *Report for financial year 2024*. https://www.greenplan.gov.sg/files/fy24_greengov_sg_report.pdf

Ministry of Trade and Industry (2025, October 22) *Natural Gas* https://www.mti.gov.sg/energy-and-carbon/energy-supply/natural-gas/

Ministry of Trade and Industry (2025, October 23) *Carbon* https://www.mti.gov.sg/energy-and-carbon/carbon

Ministry of Trade and Industry.(2025, October 22) *Energy Supply* https://www.mti.gov.sg/energy-and-carbon/energy-supply/

National Climate Change Secretariat. (2022). *Singapore And International Efforts*. Www.nccs.gov.sg. https://www.nccs.gov.sg/singapores-climate-action/singapore-and-international-efforts/

National Climate Change Secretariat. (2024). *Impact Of Climate Change In Singapore*.https://www.nccs.gov.sg/singapores-climate-action/impact-of-climate-change-in-singapore/

National Climate Change Secretariat. (2025). *Singapore's climate targets and net-zero strategy*. NCCS https://www.nccs.gov.sg/singapores-climate-action/singapores-climate-targets/overview/

National Climate Change Secretariat Singapore. (2025). *Power sector and emissions mitigation* NCCS

https://www.nccs.gov.sg/singapores-climate-action/mitigation-efforts/power

National Climate Change Secretariat. (2026) *Carbon tax*

https://www.nccs.gov.sg/singapores-climate-action/mitigation-efforts/carbontax/

National Environment Agency *Singapore's Efforts in Addressing Climate Change*. (2015).

https://www.nea.gov.sg/our-services/climate-change-energy-efficiency/climate-change/singapore%27s-efforts-in-addressing-climate-change

National Environment Agency. (2021). *Sustainable and Resource Efficient Singapore*. NEA

https://www.nea.gov.sg/committee-of-supply-2022/integrated-sustainability-report-2020-2021/review-of-fy2020/ensuring-a-clean-and-sustainable-environment-for-singapore/sustainable-and-resource-efficient-singapore

National Environment Agency. (2025, December 1). *Mandatory Energy Management Practices for Existing Industrial Facilities* NEA

https://www.nea.gov.sg/our-services/climate-change-energy-efficiency/energy-efficiency/industrial-sector/mandatory-energy-management-practices-for-existing-industrial-facilities

National Environment Agency (2025) *Extension Of Vehicular Emissions Scheme (VES) And EV Early Adoption Incentive (EEAI) To Support Vehicle Electrification*.

https://www.nea.gov.sg/media/news/news/index/extension-of-vehicular-emissions-scheme-(ves)-and-ev-early-adoption-incentive-(eeai)-to-support-vehicle-electrification

National Climate Change Secretariat. (n.d.). *Singapore's Approach To Alternative Energy*.

https://www.nccs.gov.sg/singapores-climate-action/singapore-approach-to-alternative-energy/

National Climate Change Secretariat & National Research Foundation. *Biorenewables as a source of energy*. https://www.nccs.gov.sg/files/docs/default-source/default-document-library/biorenewables-technology-primer-a-summary.pdf

National Climate Change Secretariat. (2024). *Impact Of Climate Change In Singapore*. https://www.nccs.gov.sg/singapores-climate-action/impact-of-climate-change-in-singapore/

Ng, E. (2024, November 6). South China Morning Post. https://www.scmp.com/business/article/3285317/data-centres-evs-bring-growth-and-climate-challenges-hong-kong-utility-clp-ceo-says

NTU (2025, July 4).*Strong geothermal potential discovered in northern Singapore*. https://www.ntu.edu.sg/news/detail/strong-geothermal-potential-discovered-in-northern-singapore

OEC. (2021). *Ukraine (UKR) Exports, Imports, and Trade Partners*. Oec.world. https://oec.world/en/profile/country/ukr

OECD (2025) *Advancing decarbonisation and adaptation policies: OECD Economic Surveys: Netherlands 2025*. https://www.oecd.org/en/publications/oecd-economic-surveys-netherlands-2025_2dd1f4aa-en/full-report/advancing-decarbonisation-and-adaptation-policies_651ce3e9.html

Ong, J. (2025, October 1) *IN FOCUS: No new petrol-only cars in Singapore from 2030 – what infrastructure needs to change?* (2021). Channel News Asia

https://www.channelnewsasia.com/singapore/electric-vehicles-singapore-infrastructure-charging-petrol-stations-workshops-5376971

Poudineh, R. (2025). *January 2025 OIES ENERGY COMMENT Global electricity demand: what's driving growth and why it matters?* Oxford Energy https://www.oxfordenergy.org/wpcms/wp-content/uploads/2025/01/Global-electricity-demand.pdf

University of Waterloo (2023, October 5) *Pathways to deep decarbonization at the local level | Implementing Community Sustainability and Climate Plans* University of Waterloo. https://uwaterloo.ca/implementing-sustainable-community-plans/municipal-net-zero-action-research-partnership-n-zap/n-zap-research-dissemination/pathways-deep-decarbonization-local-level

PUB, Singapore's National Water Agency. (2021). *Tengeh Reservoir floating solar farm.* PUB https://www.pub.gov.sg/public/waterloop/sustainability/solar/floating

Rashid, R. (2025, August 16). *"A structural dependence on heavy industry": can South Korea wean itself off fossil fuels?* The Guardian; The Guardian. https://www.theguardian.com/environment/2025/aug/16/a-structural-dependence-on-heavy-industry-can-south-korea-wean-itself-off-fossil-fuels

Reuters Staff. (2024, May 14). Japan sees need for sharp hike in power output by 2050 to meet demand from AI, chip plants. *Reuters*. https://www.reuters.com/business/energy/japan-sees-need-sharp-hike-power-output-by-2050-meet-demand-ai-chip-plants-2024-05-14/

Reuters. (2025, October 27). Singapore power demand seen accelerating in next decade. Reuters. https://www.reuters.com/business/energy/singapore-power-demand-seen-accelerating-next-decade-2025-10-27/

SG Green Plan. (2020). *Our Global Commitment*. Greenplan.gov.sg. https://www.greenplan.gov.sg/globalcommitment/

SG Green Plan (2021, February 10).*Charts Ambitious Targets for Next 10 Years to Catalyse National Sustainability Movement*. https://www.greenplan.gov.sg/news/press-releases/2021-02-10-press-release-on-green-plan/

Su, B., Ang, B. W., & Li, Y. (2017). Input-output and structural decomposition analysis of Singapore's carbon emissions. *Energy Policy*, *105*, 484–492. https://www.sciencedirect.com/science/article/abs/pii/S0301421517301714?via%3Dihub

Stimson Center (2024). Opportunities for Singapore to drive ASEAN's green transition. https://www.stimson.org/2024/opportunities-for-singapore-to-drive-aseans-green-transition

SG Green plan (2024) A City of Green Possibilities *SG Green Plan* https://www.greenplan.gov.sg/

SG Green Plan (n.d.).*Annex A Initiatives and Targets under the Singapore Green Plan 2030*. https://www.greenplan.gov.sg/files/media-release-annex.pdf

SG101. (2025). Singapore's energy situation: energy security and dependence. https://www.sg101.gov.sg/environment/case-studies/energy

The Global Economy (n.d.) *Carbon dioxide (CO2) emissions per capita in South East Asia*. https://www.theglobaleconomy.com/rankings/carbon_dioxide_emissions_per_capita/south-east-asia/

The Observatory of Economic Complexity. *(n.d.) Crude Petroleum in Ukraine*. https://oec.world/en/profile/bilateral-product/crude-petroleum/reporter/ukr

United Nations Climate Change (2022) *The Kyoto Protocol*. Unfccc.int. https://unfccc.int/process-and-meetings/the-kyoto-protocol

UNFCCC. (1992). *United Nations Framework Convention on Climate Change*. United Nations. https://unfccc.int/resource/docs/convkp/conveng.pdf

UNFCCC. (2025). *The Paris agreement*. United Nations Climate Change. https://unfccc.int/process-and-meetings/the-paris-agreement

World Bank. (2020). Carbon pricing dashboard. https://carbonpricingdashboard.worldbank.org