

Silicon vs. Sustainability: Singapore's AI Dilemma

Introduction

In his 2025 National Day Rally speech, Prime Minister Lawrence Wong described AI as a “defining technology of our time”.¹ Given AI’s ability to raise productivity and “create new value through every part of the economy,” AI was seen as “foundational” for business growth and for the long-term competitiveness of national economies.²

However, Singapore could not support the unrestricted growth of AI data centres due to the island’s hard physical limits. With its small land size and tropical climate, the city-state was not a natural choice for the AI industry’s data centre infrastructure that usually sprawled over vast areas and operated most efficiently in cooler temperatures.³ Overcoming these restrictions without adequate planning could generate significant negative externalities, most notably higher greenhouse gas emissions that threatened the attainment of Singapore’s climate goals.

This case study will take a detailed look at how Singapore negotiated its constraints while pursuing its ambition of becoming a hub for AI technology and data centres. It will examine the risks that the AI industry posed to the environment and outline how Singapore continued to innovate in the development of its digital economy. It will then examine key government interventions to regulate the AI industry and provide a few selected international comparisons.

Background

AI and data centres

Artificial intelligence, or AI, was a field of technology focused on building machines capable of performing cognitive tasks usually carried out by humans.⁴ These tasks included learning, reasoning, problem-solving, perception and language comprehension.⁵ Developments in machine learning, greater accessibility of publicly available AI software and an exponential growth in AI investment contributed to an AI boom in the 2020s. Global corporate investment in AI grew significantly between 2013 to 2024 from US\$14.57 billion to US\$252.33 billion.⁶

According to the World Economic Forum, data centres had become a focus of industrial policy around the world.⁷ These were facilities that housed IT infrastructure like network equipment, data storage devices and computer servers. They were the “factories” of the information economy, and

¹ Lawrence Wong, “National Day Rally 2025” (speech, Institute of Technical Education College Central, Singapore, August 17, 2025), Prime Minister’s Office, <https://www.gov.sg/ndr2025>.

² Alexey Navolokin, “The Critical Edge for AI in Singapore,” *The Business Times*, October 11, 2025, <https://www.businesstimes.com.sg/opinion-features/critical-edge-ai-singapore>.

³ Hazel Gandhi and Rina Chandran, “We Mapped the World’s Hottest Data Centers”, *Rest of World*, December 15 2025, <https://restofworld.org/2025/data-center-heat-map/>.

⁴ “What Is AI, How Do Apps like ChatGPT Work and Why Are There Concerns?”, *Technology*, *BBC News*, June 14, 2023, <https://www.bbc.co.uk/news/articles/c2l799gxijpo>.

⁵ “What Is Artificial Intelligence (AI)?”, Michigan Technological University, accessed September 12, 2025, <https://www.mtu.edu/computing/ai/>.

⁶ Nestor Maslej et al., “Artificial Intelligence Index Report 2025”, version 3, preprint, arXiv, 2025, <https://doi.org/10.48550/ARXIV.2504.07139>.

⁷ Mark Esposito, “AI Geopolitics and Data in the Era of Technological Rivalry”, *World Economic Forum*, July 24, 2025, <https://www.weforum.org/stories/2025/07/ai-geopolitics-data-centres-technological-rivalry/>.

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their construction represented a “gold rush” as governments introduced policies to attract these facilities. As the globe’s major technological powers – China and the United States – competed for digital dominance, other governments were also prioritising domestic data centre capacity to bolster national resilience.

How the AI boom spurred data centre investment

Computing historically relied on central processing units (CPUs), but AI compute instead required graphics processing units (GPUs) that could process large amounts of data and run the same type of calculations repeatedly and in parallel.⁸ AI models were trained on large datasets and required the use of high-end computational resources.⁹ It was estimated that the demand for AI computational power was growing at 450% year on year.¹⁰

Unfortunately, many legacy data centres could not simply be retrofitted to accommodate new AI servers because GPUs produced much more heat than CPUs. Additionally, GPUs needed to be clustered together to facilitate high-bandwidth data transfers, which changed the ways data centres had to be designed¹¹ and resulted in a global surge in new data centre construction and investment. McKinsey predicted in 2025 that an additional US\$6.7 trillion would have to be invested in global data centre infrastructure by 2030 to meet growing demand.¹²

Data centres were not just infrastructure projects, but also economic opportunities in and of themselves. The global value of the data centre sector was expected to increase from US\$242 billion to US\$584 billion by 2032, growing at an annual rate of 11.7%.¹³ A 2023 study found that this sector added S\$2 billion to Singapore’s GDP annually and was a key source of productive, high-paying jobs.¹⁴ In addition to direct economic benefits, data centre projects also attracted further investment in complementary tech industries, making them high-value assets in the digital economy.¹⁵

Environmental Impact

A key challenge in harnessing the economic potential of the AI investment was managing the technology’s environmental footprint. A 2025 UK government report predicted that global AI water usage would increase from 1.1 billion to 6.6 billion cubic metres by 2027 because of cooling needs.¹⁶ And a 2025 report by the International Energy Agency (IEA) estimated that data centres accounted

⁸ FT Reporters, “Inside the Relentless Race for AI Capacity”, *Financial Times*, July 31, 2025, <https://ig.ft.com/ai-data-centres/>.

⁹ Jai Vipra and Sarah Myers West, “Computational Power and AI”, *AI Now Institute*, September 27, 2023, <https://ainowinstitute.org/publications/compute-and-ai>.

¹⁰ David Crawford et al., “How Can We Meet AI’s Insatiable Demand for Compute Power?”, *Bain*, September 23, 2025, <https://www.bain.com/insights/how-can-we-meet-ais-insatiable-demand-for-compute-power-technology-report-2025/>.

¹¹ FT Reporters, “Inside the Relentless Race”.

¹² Marcus Law, “AI Infrastructure to Require \$7tn by 2030, Says McKinsey”, *Data Centre Magazine*, May 14, 2025, <https://datacentremagazine.com/articles/ai-infrastructure-to-require-7tn-by-2030-says-mckinsey>.

¹³ *Data Center Market Size, Share, And Growth Report [2025-2032]*, no. FBI109851 (Fortune Business Insights, 2025), <https://www.fortunebusinessinsights.com/data-center-market-109851>.

¹⁴ Deon Loke, “Data Centres to Drive Three-Time Increase in Jobs within the Sector; Wages There Higher than National Average: Report”, *The Business Times*, September 4, 2025, <https://www.businesstimes.com.sg/singapore/data-centres-drive-three-time-increase-jobs-within-sector-wages-there-higher-national-average-report>.

¹⁵ Khalid Alaamer, “This Is the State of Play in the Global Data Centre Gold Rush”, *World Economic Forum*, April 22, 2025, <https://www.weforum.org/stories/2025/04/data-centre-gold-rush-ai/>.

¹⁶ Rich Kenny, *Water Use in AI and Data Centres* (Government Digital Sustainability Alliance (GDSA), 2025), https://assets.publishing.service.gov.uk/media/688cb407dc6688ed50878367/Water_use_in_data_centre_and_AI_report.pdf.

for 1 to 1.5% of global electricity use and would grow four times faster than electricity consumption from all other sectors to make up 4% of global electricity consumption by 2030;¹⁷ projecting that electricity demand from data centres in Southeast Asia would more than double by 2030, driven by the regional hub in Singapore and southern Malaysia.¹⁸ Diversifying the electricity used for data centres away from fossil fuels would thus be a key factor in making them more environmentally sustainable.

Singapore's AI Ambitions

According to the Infocomm Media Development Authority (IMDA), the digital economy represented 18.6% of the nation's GDP at S\$128.1 billion in 2024. The bulk of this growth was driven by digitalisation in non-Information & Communications (I&C) sectors as more firms adopted AI technologies for business functions and the demand for professionals with AI-related skillsets grew.¹⁹ A 2024 report by Access Partnership and Google suggested that the effective adoption of AI technologies could generate S\$198.3 billion in economic value for Singapore — almost 30% of its 2023 GDP.²⁰

Singapore was well-positioned to benefit from the global AI boom. In 2025, Singapore came in third globally and first in Asia in IMD's World Digital Competitiveness Ranking, a measure of economies' capacity to use digital technologies as key drivers for business, government and wider society.²¹ Both the public and private sectors were investing heavily in Singapore's AI sector. In Budget 2024, the government announced a S\$1 billion investment in AI over the following five years to support this crucial pillar of future economic growth.²² Private investment was higher; Between the second half of 2024 to the first half of 2025, Singapore saw S\$1.31 billion invested in AI. This figure comprised 55% of all the AI investments in Southeast Asia during that period, cementing Singapore's status as the region's AI hub.²³

NAIS 1.0 & 2.0

The 2019 National AI Strategy (NAIS) 1.0 outlined Singapore's plans for establishing the country as a leader in the development and deployment of AI solutions by 2030.²⁴ A National AI Office was created under the Smart Nation and Digital Government Office (SNDGO) to set the country's AI agenda as well as to partner with research and industry.

¹⁷ "Data Centres & Networks", IEA, accessed September 15, 2025, <https://www.iea.org/energy-system/buildings/data-centres-and-data-transmission-networks>.

¹⁸ *Energy and AI* (IEA, 2025), <https://www.iea.org/reports/energy-and-ai>.

¹⁹ *Singapore Digital Economy Report 2025* (Infocomm Media Development Authority, 2025), <https://www.imda.gov.sg/-/media/imda/files/about/resources/corporate-publications/annual-report/imda-sgde-report-fy2024-2025.pdf>.

²⁰ Access Partnership and Google, *Economic Impact Report: Strengthening Singapore's AI Leadership with Google* (Singapore, 2024), <https://www.edb.gov.sg/en/business-insights/market-and-industry-reports/economic-impact-report-strengthening-singapores-ai-leadership-with-google.html>.

²¹ *IMD World Digital Competitiveness Ranking 2025* (IMD – International Institute for Management Development, 2025), https://imd.widen.net/content/xclarczvwr/pdf/WDCR_Report_2025.pdf.

²² Claire Huang and Osmond Chia, "Budget 2024: New Tax Credit to Support Firms' Innovation and Green Transition", *The Straits Times*, February 16, 2024, <https://www.straitstimes.com/singapore/budget-2024-new-tax-credit-to-support-firms-innovation-and-green-transition>.

²³ Google et al., *E-Conomy SEA 2025* (2025), https://services.google.com/fh/files/misc/e_conomy_sea_2025_report_combined.pdf.

²⁴ *National Artificial Intelligence Strategy* (Smart Nation Singapore, 2019), <https://file.go.gov.sg/nais2019.pdf>.

An update, the NAIS 2.0 was released in 2023 and focused on AI as a public good for both Singapore and the world.²⁵ The report listed three main changes: AI's shift from "opportunity to necessity", Singapore's expanded ambition to become a world leader in AI and the adoption of a systems-based (instead of a project-based) approach to integrate AI at scale. The goal of NAIS 2.0 was to triple Singapore's AI workforce to 15,000 and build a "compute-enabled" ecosystem.

The compute bottleneck

However, NAIS 2.0 also explicitly recognised that Singapore's AI ambitions were constrained by its domestic compute capacity, and that Singapore would not be able to secure its status as a global AI hub without building more data centres. The resource-intensive nature of data centres, Singapore's land scarcity, and high labour and energy costs put it at a significant disadvantage relative to neighbouring countries. Singapore would need to find a way to reconcile its AI ambitions with its physical constraints and climate commitments.

Competition from regional AI hubs

Just within Southeast Asia, Singapore faced stiff competition from lower-cost, high-growth countries like Malaysia, Indonesia and Thailand. Johor – the Malaysian state closest to Singapore – reached 900MW of data centre capacity in 2025, and experts expected it to challenge Singapore's regional dominance.²⁶ Johor's proximity to Singapore – being separated from the latter by just a narrow strait – meant that companies there could largely leverage Singapore's business infrastructure while taking advantage of Johor's cheaper land and utilities. Major players in the data centre industry like Nvidia, AirTrunk, GDS International and YTL Power made significant data centre investments in Johor for this reason.²⁷

Further afield, Batam, Indonesia and Bangkok, Thailand were also growing rapidly, with their respective governments encouraging foreign investment with corporate tax incentives and grants.²⁸ In 2025, Thailand's Board of Investment approved four new data centre projects worth a total of US\$3.1 billion.²⁹ Singapore's hub status was at risk. In 2025, Singapore only had 537MW of data centre capacity in the development pipeline compared to Johor's 13GW.³⁰

²⁵ NAIS 2.0 (Smart Nation Singapore, 2013), <https://file.go.gov.sg/nais2023.pdf>.

²⁶ Laily Li and Cheng Ting-Fang, "Malaysia's Data Center Boom: An inside Look at Asia's Battle for AI Supremacy", *Nikkei Asia*, December 17, 2025, <https://asia.nikkei.com/business/technology/tech-asia/malaysia-s-data-center-boom-an-inside-look-at-asia-s-battle-for-ai-supremacy>.

²⁷ Amir Yusof, "Johor's Data Centres Getting a Boost from the Singapore Factor; Water, Power Remain Bottlenecks", *CNA*, May 6, 2024, <https://www.channelnewsasia.com/asia/malaysia-johor-data-centres-nvidia-ytl-kulai-sedenak-sez-us-china-trade-war-4310496>.

²⁸ ARC Group, "Harnessing ASEAN's Data Center Boom", *Insights*, March 21, 2025, <https://arc-group.com/asean-data-center-boom-opportunities/>.

²⁹ Saf Malik, "Thailand Greenlights \$3.1bn in Hyperscale Data Centre Investments", *Capacity*, November 10, 2025, <https://capacityglobal.com/news/thailand-greenlights-3-1bn-in-hyperscale-data-centre-investments/>.

³⁰ Shikhar Gupta, "Johor Fastest-Growing South-East Asian Data Centre Hub; Singapore Expansion Remains 'Constrained'", *The Business Times*, September 10, 2025, <https://www.businesstimes.com.sg/international/asean/johor-fastest-growing-south-east-asian-data-centre-hub-singapore-expansion-remains-constrained>.

Singapore's climate commitments and physical constraints

Hard limits

In 2025, 95% of Singapore's electricity was generated using natural gas, all of which was imported.³¹ In 2020, power production contributed to 40% of Singapore's primary greenhouse gas emissions.³² Reducing its electricity consumption – or decarbonising its sources of energy – would therefore be critical for Singapore to hit its climate targets. The Energy Market Authority (EMA) stated that Singapore expected to meet around a third of its power demand from clean electricity imports by 2035.³³ A Reuters article from 2025 suggested that cross-border power trade was “key to easing regional reliance on fossil fuels amid growing data centre-driven power demand”. Singapore had two active cross-border power trade deals: the Lao PDR-Thailand-Malaysia-Singapore (LTMS) Power Integration Project and the Energy Exchange Malaysia (ENEGEM) pilot with Malaysia's Tenaga Nasional Berhad.³⁴

Singapore's geography severely constrained its own domestic ability to generate renewable energy. Solar was the most viable source of renewable energy in Singapore despite its extensive cloud cover, but its growth was significantly constrained by deployable area.³⁵ Other forms of renewable energy like hydropower and geothermal energy were even less viable due to Singapore's lack of major hydrological systems and geological heat sources.³⁶ Wind turbines – widely deployed elsewhere globally – were incompatible with Singapore's low average wind speeds.³⁷ The government continued to explore other carbon-free energy sources like hydrogen and nuclear power, but these nascent technologies were unlikely to see wide adoption in the short to medium term.³⁸

These constraints meant that Singapore faced significant difficulties in scaling up renewable energy quickly enough to meet growing AI demand. Even at the broader level, the target outlined in *Singapore Green Plan 2030* to increase solar energy deployment to at least 2 GigaWatt-peak (GWp) would meet just 3% of the country's projected 2030 electricity demand.³⁹ A 2023 sustainability report from Google showed that a mere 4% of electricity consumption for the company's Singapore-

³¹ “Natural Gas”, Energy Market Authority, accessed 17 December 2025, <https://ema.gov.sg/our-energy-story/energy-supply/natural-gas>.

³² Ginny Yinjin Lee, “Decarbonizing Singapore's Energy: Emissions and Cost Comparison of H2 Technologies” (presentation, Winter 2024 - Semi-annual IEA-ETSAP meeting, Singapore, October 24, 2024), Singapore Institute of Manufacturing Technology, A*STAR, https://iea-etsap.org/workshop/winter_semi-annual_meeting_oct_24/S1-1%2020241021%20IEA-ETSAP.pdf.

³³ “Regional Power Grids”, Energy Market Authority, accessed December 19, 2025, <https://ema.gov.sg/our-energy-story/energy-supply/regional-power-grids>.

³⁴ Sudarshan Varadhan, “Singapore's Renewables Usage Hits Record High as Imports, Solar Output Rise”, *Reuters*, June 30, 2025, <https://www.reuters.com/sustainability/boards-policy-regulation/singapores-renewables-usage-hits-record-high-imports-solar-output-rise-2025-06-27/>.

³⁵ Philip Andrews-Speed, “Commentary: Why Hasn't Solar Energy in Singapore Taken Off in a Big Way After So Long?”, *CNA*, February 7, 2021, <https://www.channelnewsasia.com/commentary/solar-energy-singapore-panels-cloudy-unpredictable-electricity-1882996>.

³⁶ Euston Quah et al., *Decarbonisation Pathways for Singapore*, ASEAN Green Future – Phase 2 Reports (Nanyang Technological University Economic Growth Centre (EGC), 2024), https://files.unsdsn.org/AGF%20-%20Singapore%20-%202021_2.2_Report%20-%20FINAL.pdf.

³⁷ Eric Koons, “Does Wind Energy Have a Place in Singapore?”, *Energy Tracker Asia*, June 27, 2022, <https://energytracker.asia/wind-energy-singapore/>

³⁸ “Hydrogen”, Ministry of Trade and Industry, October 22, 2025, <https://www.mti.gov.sg/energy-and-carbon/energy-supply/low-carbon-alternatives/hydrogen/>; Chelsea Ong, “Singapore Appoints UK Firm Mott MacDonald to Study Nuclear Energy Technologies”, *CNA*, September 2, 2025, <https://www.channelnewsasia.com/singapore/singapore-appoint-uk-firm-mott-macdonald-study-nuclear-energy-technologies-5328191>.

³⁹ “Our Targets”, SG Green Plan, accessed 18 December 2025, <https://www.greenplan.gov.sg/targets/>.

based data centres was carbon-free, a figure in line with the proportion of electricity generated from renewable sources in Singapore that year.⁴⁰

In 2019, data centres accounted for approximately 5% of Singapore's total electricity consumption, rising to approximately 7% in 2020.⁴¹ Such rapid growth in data centres would severely impact Singapore's climate targets.

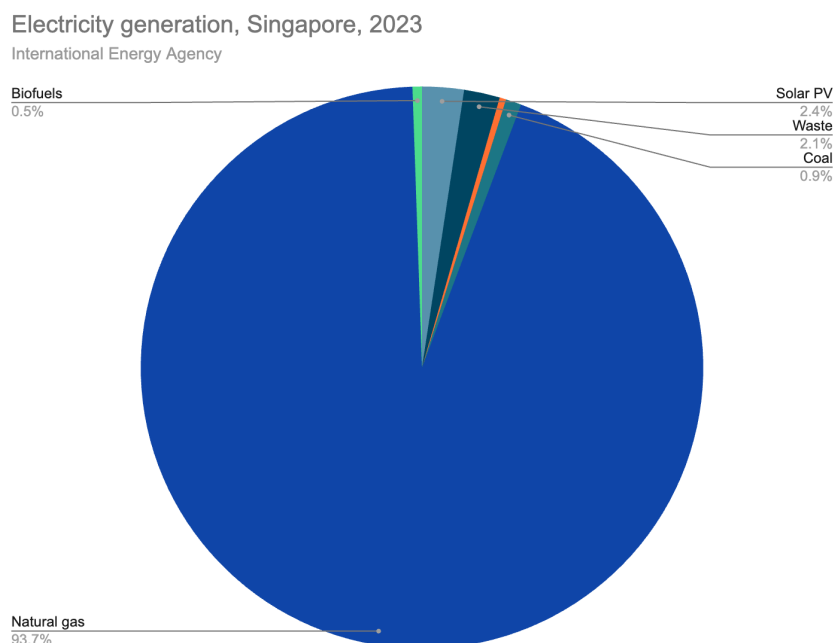


Figure 1: Sources of electricity generated in Singapore in 2023

Source: International Energy Agency, <https://www.iea.org/countries/singapore/energy-mix>.

Singapore's Sustainability Goals & Net Zero 2050

Being a tropical, low-lying island nation, Singapore was especially susceptible to the effects of climate change such as rising sea levels, which could inundate about one-third of its land area.⁴² As part of the global effort to mitigate climate change, Singapore committed to a target of net-zero planet-warming emissions by 2050.⁴³ In the medium term, the government had pledged to reduce greenhouse gas emissions to between 45 and 50 million tonnes of carbon dioxide equivalent (MtCO₂e) by 2035, considerably below its 2022 emissions of 58.59 MtCO₂e.⁴⁴ Countries that had ratified the Paris Agreement were required to submit nationally determined contributions (NDCs) outlining their efforts to limit the increase in the global average temperature to 1.5°C above pre-

⁴⁰ Google Sustainability, *Google 2024 Environmental Report* (2024),

<https://www.gstatic.com/gumdrop/sustainability/google-2024-environmental-report.pdf>.

⁴¹ Parliament of Singapore, "Data on Current and Expected 2021 Total Carbon Emissions by Data Centres in Singapore and Efforts to Reduce Emissions for Data Centres", Singapore Parliamentary Reports, Vol. 95, July 27, 2021.

⁴² Sheryl Tian Tong Lee et al., "How Singapore Fights Rising Sea Levels", *TIME*, October 10, 2023, <https://time.com/6322111/singapore-fights-rising-sea-levels-climate-change/>.

⁴³ Audrey Tan, "Singapore Aiming to Have Emissions Reach Net Zero by 2050; Public Feedback Sought", *The Straits Times*, September 5, 2022, <https://www.straitstimes.com/singapore/environment/singapore-aiming-to-have-emissions-reach-net-zero-by-2050-public-feedback-sought?ref=inline-article>.

⁴⁴ Shabana Begum, "Singapore Releases New Emissions Targets for 2035, on Track to Reaching Net Zero by 2050", *The Straits Times*, February 10, 2025, <https://www.straitstimes.com/singapore/singapore-releases-new-emissions-targets-for-2035-on-track-to-reaching-net-zero-by-2050>.

industrial levels, a temperature increment target that the Paris Agreement noted would “significantly” reduce the risks and impacts of climate change.⁴⁵

To achieve net zero emissions by 2050, Singapore needed to decarbonise its economy, industry and society. To reach net zero would require Singapore to decouple economic growth from carbon emissions – a near-impossible feat without technological breakthroughs.

Singapore’s participation in international agreements like the United Nations Framework Convention on Climate Change (UNFCCC) was part of one of four key thrusts to achieve the low-carbon transition. In addition to pursuing effective international cooperation, the other three key thrusts were catalysing business transformation, investing in low-carbon technologies and adopting low-carbon practices.

Carbon tax, designed to shape business decisions and consumer behaviour, supported the four key thrusts and was seen as an enabler of the low-carbon transition. Singapore first implemented a carbon tax in 2019, levying it on facilities that emitted more than 25,000 tonnes of carbon dioxide equivalent (tCO₂e) annually. Singapore’s carbon tax covered around 80% of its national emissions at point of introduction, and was initially set at S\$5/tCO₂e. It was raised to S\$25/tCO₂e in 2024 and would be further raised to S\$45/tCO₂e in 2026 and to between S\$50–80/tCO₂e by 2030. Revenue earned from the carbon tax increase would be used to fund decarbonisation efforts.⁴⁶

Criticisms

The Singapore government’s plans for achieving net zero faced some criticism for being ineffective. For example, Singapore’s National Climate Change Secretariat (NCCS) granted carbon tax concessions to high emitters like petrochemical companies of up to 76% for 2024 and 2025 to ease their financial burden.⁴⁷ Experts suggested that carbon tax rebates could weaken the intended goal of reducing emissions because companies could simply choose to pay the tax if it was cheaper than decarbonising.⁴⁸

It has also been suggested that Singapore’s carbon tax did not go far enough. The Intergovernmental Panel on Climate Change’s (IPCC’s) Sixth Assessment Report found that carbon pricing would have to be set at about US\$170/tCO₂e to US\$290/tCO₂e in 2030, over three times higher than Singapore’s projected 2030 carbon tax, for global warming to be limited to 1.5°C.⁴⁹ In comparison, Liechtenstein’s carbon tax was already US\$136/tCO₂e in 2024 and covered 72% of the country’s emissions, and was the world’s most ambitious carbon pricing framework.⁵⁰

⁴⁵ “Paris Agreement”, conclusion date: December 12, 2015, United Nations Treaty Series Online, registration no. I-54113, https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_english.pdf.

⁴⁶ National Climate Change Secretariat, “Carbon Tax”, Singapore’s Climate Action, accessed December 19, 2025, <https://www.nccs.gov.sg/singapores-climate-action/mitigation-efforts/carbontax/>.

⁴⁷ Trixie Sher Li Yap and Chen Aizhu, “EXCLUSIVE Singapore Offers Carbon Tax Rebates for Refiners near Term, Sources Say”, *Climate & Energy*, *Reuters*, June 20, 2024, <https://www.reuters.com/sustainability/climate-energy/singapore-offers-carbon-tax-rebates-refiners-near-term-sources-say-2024-06-13/>.

⁴⁸ Shabana Begum, “S’pore’s Projected Carbon Tax Revenue for 2024 Lower than Expected after Fivefold Hike in Tax Rate”, *The Straits Times*, June 10, 2025, <https://www.straitstimes.com/singapore/environment/spores-projected-carbon-tax-revenue-for-2024-lower-than-expected-after-fivefold-hike-in-tax-rate>.

⁴⁹ P. R. Shukla et al., eds, *Climate Change 2022: Mitigation of Climate Change* (IPCC, 2022).

⁵⁰ Diana Cardenas Monar and Géraud Cayol, *Global Carbon Accounts 2025* (Institute for Climate Economics, 2025), https://www.i4ce.org/wp-content/uploads/2025/06/Global-carbon-accounts-2025_V1.pdf.

Governing the trade-off: data centre regulation

Singapore's evolving stance on data centre growth demonstrated the delicate balance the country had to strike between economic growth and its climate commitments.

The data centre moratorium (2019–2022)

Between 2019 and 2022, Singapore imposed a moratorium on the construction of new data centres. This involved a pause on the release of state land for data centres and the development of new data centres on existing state land.⁵¹ In 2021, then-Minister for Trade and Industry Chan Chun Sing said that this was to “moderate the growth” of data centres. He described data centre approvals as experiencing a “rapid increase” between the most recent and preceding five-year periods, going from 12 centres with a total capacity of 307MW to 14 with 768MW.

In a 2022 written reply to a Parliamentary Question on data centres, Minister for Trade and Industry Gan Kim Yong explained that the government had embarked on a review of the data centre industry to sustainably manage its resource-intensive growth in a manner consistent with Singapore's climate change commitments.⁵² Gan said that the government would be more selective in data centres projects, prioritising facilities that were “best in class” in terms of resource efficiency while still contributing to Singapore's economic and strategic objectives.

Post-moratorium

Call for applications (July 2022)

Following the review, the Singapore Economic Development Board (EDB) and IMDA launched a pilot call for applications (CFA) exercise for new data centres that would meet a tightened set of criteria.⁵³ This mechanism rationed new data centres under a competitive, government-controlled allocation system. Proposals that adhered to best practices in energy efficiency and decarbonisation, and strengthened Singapore's international connectivity and regional hub status, were encouraged. This shift demonstrated the Singapore government's treatment of data centre capacity as a strategic resource that had to be earned by demonstrating exceptional sustainability and economic value. If selected, applicants were required to certify data centres under the existing BCA-IMDA Green Mark for New Data Centre (GM-NDC) criteria and obtain Platinum certification, achieve a Power Usage Effectiveness (PUE) of 1.3 or better, and outline plans to use renewable energy or invest in it to offset the facility's carbon footprint.⁵⁴ For comparison, the pre-moratorium PUE had been just 1.8 (lower is better energy efficiency).

Pilot CFA (Awarded July 2023)

Only 4 out of a total 20 applications for the pilot CFA were successful: Equinix, Microsoft, GDS and an AirTrunk-ByteDance consortium.⁵⁵ The data centre operators were provisionally awarded 80MW of

⁵¹ Parliament of Singapore, “Number and Capacity of New Data Centres”, Singapore Parliamentary Reports, Vol. 95, February 1, 2021.

⁵² Parliament of Singapore, “Steps to Reduce Carbon Footprint of Data Centres in Singapore”, Singapore Parliamentary Reports, Vol. 95, January 11, 2022.

⁵³ “EDB and IMDA Launch Pilot Data Centre”, Infocomm Media Development Authority, July 20, 2022, <https://www.imda.gov.sg/resources/press-releases-factsheets-and-speeches/press-releases/2022/launch-of-pilot-data-centre---call-for-application-to-support-sustainable-growth-of-dcs>.

⁵⁴ “ANNEX A: Summary of Pilot DC-CFA Key Parameters & Criteria”, Infocomm Media Development Authority, July 20, 2022, <https://www.imda.gov.sg/-/media/imda/files/news-and-events/media-room/media-releases/2022/07/annex-a---summary-of-pilot-dc-cfa-key-parameters-and-criteria.pdf>.

⁵⁵ Rebecca Uffindell, “Singapore Awards Four Data Centre Operators with 80MW of New Capacity”, *Techerati*, July 17, 2023, <https://www.techerati.com/news-hub/singapore-awards-four-data-centre-operators-80mw-new-capacity-airtrunk-bytedance-equinix-gds-microsoft-moratorium/>.

capacity in July 2023.⁵⁶ This figure was a modest addition to the existing 1000MW in installed data centre capacity; and small relative to the high market demand.⁵⁷ This rationing of data centre capacity drove some operators to explore secondary markets like Johor, which had more than 490MW in the development pipeline that year.⁵⁸ IMDA announced that it aimed to allocate more capacity in the following 12 to 18 months while being committed to Singapore's net-zero targets, demonstrating the government's extreme caution with regards to the sector's growth.⁵⁹

Roadmaps for green data centres and supporting technologies

The *Green Data Centre Roadmap* was published in 2024 and outlined how the government planned to partner with industry to advance data centre sustainability on two fronts: accelerating data centres' hardware and software energy efficiency, and accelerating the use of green energy.⁶⁰ It also announced the allocation of at least 300MW of additional capacity with a potential 200MW allocated only to operations powered by green energy.⁶¹

Accelerating Energy Efficiency

In line with the criteria for the data centre pilot, the roadmap laid out a goal for all data centres in Singapore to achieve a PUE ≤ 1.3 by 2034.

As data centres consumed large amounts of energy for cooling, the Tropical DC standard was developed in 2023 with the aim of supporting cooling energy savings of 2–5% with every 1°C increase in operating temperature.⁶² The ideal temperature range for data centre operations had been 18°C–27°C, which put all Singapore data centres outside of the optimal range.⁶³ A new research initiative, the Sustainable Tropical Data Centre Testbed (STDCT), was launched that same year, co-led by NUS and NTU with industry collaboration to research sustainable data centre operations in tropical climates.⁶⁴

⁵⁶ Dan Swinhoe, "Singapore Selects Equinix, Microsoft, AirTrunk, and GDS for 80MW Data Center Trial", *Data Center Dynamics*, July 14, 2023, <https://www.datacenterdynamics.com/en/news/singapore-selects-equinix-microsoft-airtrunk-and-gds-for-80mw-data-center-trial/>.

⁵⁷ Robert Clark, "Singapore Ends Data Center Pause as It Seeks Sustainable Growth", *Light Reading*, July 24, 2023, <https://www.lightreading.com/ai-machine-learning/singapore-ends-data-center-pause-as-it-seeks-sustainable-growth>.

⁵⁸ Zhao Yifan, "Singapore's Data-Centre Market to Surpass 1GW Milestone, Challenges Ahead: Cushman & Wakefield", *The Business Times*, August 25, 2023, <https://www.businesstimes.com.sg/startups-tech/startups/singapores-data-centre-market-surpass-1gw-milestone-challenges-ahead-cushman>.

⁵⁹ "4 Proposals Selected from Data Centre Application", Infocomm Media Development Authority, July 14, 2023, <https://www.imda.gov.sg/resources/press-releases-factsheets-and-speeches/press-releases/2023/four-data-centre-proposals-selected-as-part-of-pilot-data-centre-call-for-application>.

⁶⁰ *Driving a Greener Digital Future* (Infocomm Media Development Authority, 2024), <https://www.imda.gov.sg/-/media/imda/files/how-we-can-help/green-dc-roadmap/green-dc-roadmap.pdf>.

⁶¹ "Singapore to Expand Data Centre Capacity by at Least One-Third, Pushes for Green Energy Use", *The Straits Times*, May 30, 2024, <https://www.straitstimes.com/tech/s-pore-to-expand-data-centre-capacity-by-at-least-one-third-pushes-for-green-energy-use>.

⁶² "Tropical Data Centre (DC) Standard", Infocomm Media Development Authority, September 23, 2025, <https://www.imda.gov.sg/how-we-can-help/green-dc-roadmap/tropical-dc-standard>.

⁶³ Brien Posey, "Data Center Temperature and Humidity Guidelines", *TechTarget*, February 10, 2025, <https://www.techtarget.com/searchdatacenter/tip/Data-center-temperature-and-humidity-guidelines>.

⁶⁴ "World's First Tropical Climate Data Centre Testbed, Led by NUS and NTU, Will Boost Singapore's Competitiveness in Sustainable Data Centres", *NUS News*, November 29, 2023, <https://news.nus.edu.sg/worlds-first-tropical-climate-data-centre-testbed/>, John Boyd, "Cool(Ing) Ideas for Tropical Data Centers", *IEEE Spectrum*, February 4, 2024, <https://spectrum.ieee.org/data-centers-designed-for-tropics>, Gandhi and Chandran, "World's Hottest Data Centers".

Grants like the Resource Efficiency Grant for Emissions (REG(E)) and Energy Efficiency Grant (EEG) for the DC sector were listed in the roadmap as support measures for data centres to navigate business costs incurred to achieve higher energy efficiency. Such costs could include upgrading mechanical and electrical systems and deploying smart energy optimisation tools. The REG(E) was funded by carbon tax revenue and was made available for investments in data centre projects that resulted in measurable and verifiable carbon abatements of at least 250 tonnes per year.⁶⁵ The EEG was launched in December 2024 to offset a portion of energy-efficient IT equipment costs, primarily aimed at SMEs.⁶⁶

The second Data Centre-Call for Application (Launched December 2025)

The EDB and IMDA launched the second Data Centre-Call for Application (DC-CFA2) on 1 December 2025. DC-CFA2 would allocate at least 200MW of capacity, with a potential undisclosed amount of additional capacity available through the adoption of “new and innovative green energy pathways”.⁶⁷ The DC-CFA2 set exacting sustainability standards for data centre operators.

The 2022 CFA requirement for PUE ≤ 1.3 was further tightened to ≤ 1.25 . Applicants also needed to meet or exceed IT energy efficiency standards that were set out in the new Singapore Standard on Energy Efficiency of Data Centre IT Equipment (SS 715:2025). The standard established guidelines for the industry to safely raise the operational temperatures of data centres to 26°C or higher, rather than the industry standard of 22°C and below.⁶⁸ Data centres which adhered to the SS 715:2025 standard were expected to see at least 30% savings in energy consumption.⁶⁹

At least 50% of the new data centre capacity needed to be powered by “eligible green energy pathways” like low-carbon hydrogen, biomethane and novel fuel cells, rather than having their energy use offset through the purchase of Renewable Energy Certificates (RECs), which some existing data centre operators depended on to offset their carbon emissions.⁷⁰

International comparisons

This balance of technological ambitions with sustainability targets varied internationally. Some jurisdictions relied heavily on regulatory frameworks while others left it more to the market.

⁶⁵ “Resource Efficiency Grant for Emissions (REG(E))”, Economic Development Board, accessed December 19, 2025, <https://invest.edb.gov.sg/gov-support/resource-efficiency-grant-for-emissions-reg-e>.

⁶⁶ “Energy Efficiency Grant for the Data Centre (DC) Sector”, Infocomm Media Development Authority, June 26, 2025, <https://www.imda.gov.sg/how-we-can-help/energy-efficiency-grant>.

⁶⁷ “Launch of Second Data Centre – Call for Application”, Infocomm Media Development Authority, December 1, 2025, <https://www.imda.gov.sg/resources/press-releases-factsheets-and-speeches/factsheets/2025/launch-of-second-data-centre>.

⁶⁸ “New Standard to Help Data Centres in Singapore Save on Energy Costs, Increase Efficiency”, *The Straits Times*, June 8, 2023, <https://www.straitstimes.com/tech/tech-news/new-standard-to-help-data-centres-in-singapore-save-on-energy-costs-increase-efficiency>.

⁶⁹ Amit Roy Choudhury, “Singapore Introduces New Benchmark for Data Centre IT Equipment”, *GovInsider*, August 25, 2025, <https://govinsider.asia/intl-en/article/singapore-introduces-new-benchmark-for-data-centre-it-equipment>.

⁷⁰ Felicia H. M. Liu et al., “Decarbonising Digital Infrastructure and Urban Sustainability in the Case of Data Centres”, *Npj Urban Sustainability* 5, no. 1 (2025): 15, <https://doi.org/10.1038/s42949-025-00203-1>.

European Union

The EU had a suite of regulations and guidelines that focused on transparency and efficiency rather than capping growth outright.⁷¹

The Energy Efficiency Directive (EED) – first adopted in 2012 and updated in 2023 – established “Energy Efficiency First” as a fundamental principle of EU energy policy. Through the EED, the EU adopted a delegated regulation as a first phase for establishing an EU-wide rating scheme for data centres in 2024.⁷² The legislation required data centre operators to submit annual reports on a number of sustainability indicators like PUE, energy consumption, use of renewable energy and temperature set points.⁷³ These reports were communicated on either the European database or via each country’s national reporting scheme. The EU stated that the data would be used to design further measures for the data centre industry to promote sustainability.

Servers and online data storage products sold in the EU after 2019 were subjected to the Ecodesign Directive to limit their environmental impact. Products had to adhere to standards such as the minimum efficiency of power supply units, maximum power consumption in idle states and product operating temperature boundaries. This was projected to save the EU 3.0 TWh by 2030.⁷⁴

Other regulations were not explicitly targeted at data centres but had downstream impacts on their power consumption. One such example was the EU AI Act introduced in 2024. This authorised the EU AI Office to demand technical documentation on energy consumption from General-Purpose AI model providers and incentivised low energy use through “compliance burdens”.⁷⁵

Finally, the EU was expected to propose a new Data Centre Energy Efficiency Package in early 2026 with the aim of making data centres carbon neutral by 2030.

United States (Virginia)

The US lacked data centre regulations at the federal level, but the state of Virginia is a useful example to examine, being dubbed the “data centre capital of the world”. Virginia had 6,247MW of capacity and another 2,610MW in development in 2025. In 2023, data centres accounted for 26% of Virginia’s total power consumption.⁷⁶

The Virginia Clean Economy Act (VCEA) was passed in 2020 to mandate a carbon-free electric grid by 2050. However, data centre electricity demand grew 25-30% annually following VCEA and was expected to quickly surpass total residential electricity consumption.⁷⁷ Data centres thus posed a serious challenge to the VCEA’s target. One of Virginia’s largest utility companies, Dominion Energy,

⁷¹ Alison Matte, “The EU Energy Efficiency Directive and Its Impact on CIOs, Data Centre Owners and Operators”, *Schneider Electric Blog*, February 7, 2024, <https://blog.se.com/datacenter/2024/02/07/the-eu-energy-efficiency-directive-and-its-impact-on-cios-data-centre-owners-and-operators/>.

⁷² Commission Delegated Regulation (EU) 2024/1364 of 14 March 2024 on the First Phase of the Establishment of a Common Union Rating Scheme for Data Centres (2024), http://data.europa.eu/eli/reg_del/2024/1364/oj.

⁷³ “Energy Efficiency Directive”, European Data Centre Association, accessed December 19, 2025, <https://www.eudca.org/energy-efficiency-directive>.

⁷⁴ “Servers and Data Storage Products”, European Commission, December 19, 2023, https://energy-efficient-products.ec.europa.eu/product-list/servers-and-data-storage-products_en.

⁷⁵ Tim Hickman et al., “Energy Efficiency Requirements under the EU AI Act”, White & Case LLP, April 14, 2025, <https://www.whitecase.com/insight-alert/energy-efficiency-requirements-under-eu-ai-act>.

⁷⁶ Torsten Slok, “Data Centers’ Share of Total Power Consumption”, *Apollo Academy*, October 8, 2024, <https://www.apolloacademy.com/data-centers-share-of-total-power-consumption/>.

⁷⁷ Bentley and O’Dowd, “Virginia’s Climate Goals”.

was required to produce its energy from 100% renewable sources by 2045 under the VCEA.⁷⁸ However, the company claimed in its 2025 Integrated Resource Plan Update that complying with the VCEA was not possible and would cost US\$180 billion more than if the company was permitted to preserve some fossil fuel sources.⁷⁹

As of 2025, Virginia had no statewide regulations for data centres.⁸⁰ Individual counties created their own regulations that varied based on how they prioritised economic growth and environmental impact.⁸¹ A bill to introduce statewide assessments for new data centre site approvals was vetoed by the Governor in May 2025.⁸²

Australia

The Australian National AI Plan was launched in December 2025 and outlined the government's strategy to capitalise on the technology while managing its risks. The report cited Australia's "abundant renewable energy potential" as an advantage for it becoming a regional AI hub. The government stated that it would work with stakeholders like energy market bodies and the data centre industry to harness data centre growth to promote further investments in renewable energy. This report also announced the development of national data centre principles that would set "clear expectations" for sustainability that included the adoption of efficient cooling technologies and bringing new renewable energy online.⁸³

Another crucial component for ensuring the sustainability of Australia's AI sector was the energy efficiency of data centre design. The Department of Climate Change, Energy, the Environment and Water recommended that operators assess the efficiency of their operations using the National Australian Built Environment Rating System (NABERS),⁸⁴ a standard used to measure environmental impact of a building. In July 2025, all data centres hosting federal workloads were obligated to achieve a minimum five-star NABERS score. Providers that did not comply risked losing access to federal contracts.⁸⁵

Industry stakeholders also demonstrated their commitment to improving sustainability. On 8 December 2025, the Water Services Association of Australia (WSAA) released a resource for sustainable data centre development, recommending that the government consider setting minimum water and power usage effectiveness (WUE and PUE) standards for new facilities,

⁷⁸ Shannon Heckt, "Energy Demands, Regulations and Federal Funding Challenge Virginia Clean Economy Act", *Virginia Mercury*, July 2, 2025, <https://virginiamercury.com/2025/07/02/energy-demands-regulations-and-federal-funding-challenge-virginia-clean-economy-act/>.

⁷⁹ Pomerleau, "Data Center Power Demand in Virginia".

⁸⁰ Shannon Heckt, "Virginia Doesn't Have Statewide Data Center Regulations. Localities Are Making Their Own Rules", *Virginia Mercury*, June 20, 2025, <https://virginiamercury.com/2025/06/20/virginia-doesnt-have-statewide-data-center-regulations-localities-are-making-their-own-rules-instead/>.

⁸¹ Kate Nuechterlein, "Virginia Grapples with How to Address Data Center Growth Ahead of Legislative Session", *State, 29 News*, December 3, 2025, <https://www.29news.com/2025/12/03/virginia-grapples-with-how-address-data-center-growth-ahead-legislative-session/>.

⁸² Heckt, "Virginia Doesn't Have Statewide Data Center Regulations".

⁸³ *National AI Plan* (Australian Government Department of Industry, Science and Resources, 2025), <https://www.industry.gov.au/sites/default/files/2025-12/national-ai-plan.pdf>.

⁸⁴ "Data Centres", Department of Climate Change, Energy, the Environment and Water, accessed December 19, 2025, <https://www.energy.gov.au/business/equipment-guides/data-centres>.

⁸⁵ Jett Lobb, "Powering Australia's Data Centre Boom: Navigating Energy Compliance and Opportunity", *Dentons*, July 3, 2025, <https://www.dentons.com/en/insights/articles/2025/july/3/powering-australias-data-centre-boom>.

including by expanding NABERS.⁸⁶ The WSAA stated that these moves would “embed best practices across the market” and “encourage investment in high-performing, efficient, lower-carbon cooling solutions”.⁸⁷

Research collaborations such as the one between the UNSW Institute for Industrial Decarbonisation, the government and industry supported Australia’s strategy for sustainable growth in the data centre sector. The collaboration was expected to produce “integrated solutions for gigawatt scale electricity supply, water efficient thermal management, advanced materials, automation, robotics, land use planning and sustainable design”.⁸⁸

Conclusion

Throughout its history as an independent state, Singapore had to navigate resource constraints while pursuing economic development. By being forced to focus on human capital development and economic diversification, Singapore may have succeeded “because of – rather than in spite of – a lack of resources”.⁸⁹ The absence of abundant natural resources spurred Singapore to rely on innovation and technology rather than resource extraction to grow economically.

Despite AI being fundamentally resource-intensive, Singapore did not abandon data centre growth as part of its economic strategy. Instead, resource scarcity could become a competitive advantage through regulatory innovation. By focusing on green technology and strategic planning, Singapore could simultaneously establish itself as a regional leader in data centres while setting global benchmarks for sustainability and efficiency.⁹⁰

Data centres faced operational challenges in reducing their environmental impact due to a range of factors like heat generation, construction waste, water efficiency and energy consumption.⁹¹ This meant that states should pursue policies that best respond to their binding constraints rather than looking for a one-size-fits-all solution.

AI was reshaping the global economy, fundamentally changing the nature of work and requiring rapid technological innovation.⁹² It may still be too soon to say with certainty whether AI will become a net negative on the environment or if it could help solve the growth-sustainability

⁸⁶ Simon Dux, “Water Industry Urges National Water-Efficiency Standards for ANZ Data Centres”, *W.Media*, December 9, 2025, <https://w.media/water-industry-urges-national-water-efficiency-standards-for-anz-data-centres/>.

⁸⁷ *Data Centres and Water in Australia* (Water Services Association of Australia, 2025), <https://wsaa.asn.au/Common/Uploaded%20files/library/report/WSAA%20Data%20Centres%20and%20water%20in%20Australia%20-%20December%202025.pdf>.

⁸⁸ “Sustainable Data Centres | Institute for Industrial Decarbonisation”, UNSW Sites, accessed 22 December 2025, <https://www.unsw.edu.au/research/iid/features/sustainable-data-centres>.

⁸⁹ Terence Ho, “Avoiding the “Resource Curse” Is the Key to Singapore’s Sustained Growth”, *Global Is Asian*, November 12, 2023, <https://lkyspp.nus.edu.sg/gia/article/avoiding-the-resource-curse-is-the-key-to-singapore-s-sustained-growth>.

⁹⁰ “Data Centres: An International Legal and Regulatory Perspective Spotlight on Singapore”, Watson Farley & Williams, October 2, 2025, <https://www.wfw.com/articles/data-centres-an-international-legal-and-regulatory-perspective-spotlight-on-singapore/>.

⁹¹ Edward Ansett and Sa’ad Ahmed, “Sustainable Data Centres: The Path to Net Zero”, Ramboll, September 23, 2025, <https://www.ramboll.com/en-gb/insights/decarbonise-for-net-zero/how-to-develop-sustainable-data-centres>.

⁹² Kristalina Georgieva, “AI Will Transform the Global Economy. Let’s Make Sure It Benefits Humanity”, *IMF*, January 14, 2024, <https://www.imf.org/en/blogs/articles/2024/01/14/ai-will-transform-the-global-economy-lets-make-sure-it-benefits-humanity>.

dilemma.⁹³ Ultimately, the AI boom has sparked a global reckoning about the ways in which climate considerations had to be factored into national and international priorities, and Singapore's approach demonstrated one way of (possibly) achieving this balancing act.

⁹³ Pilita Clark, "How Hopeful Can We Be about AI Climate Tech?", *Climate Change, Financial Times*, July 3, 2025, <https://www.ft.com/content/bd835b8f-e39a-4e5f-84d0-2fb019b47b80>.