Annexes: Selected Issues

1. Data Center Boom in Malaysia: Recent Developments and Challenges[55]

The rapid growth in global demand for computing power and data storage has led to a boom in data center constructions, with Malaysia emerging as a major beneficiary in the ASEAN+3 region due to a host of physical and geographic advantages. As a result, data center capacity in Malaysia is set to grow robustly in the near term, particularly in Klang Valley and Johor as the main hubs. Despite positive spillovers to economic growth and employment, several challenges lie ahead, such as natural resource constraints, limited domestic value added, and questionable impact on long-term employment.

1. The global surge in demand for computing power and data storage underpins the rapid construction of data centers in many countries. A key driver is the global AI boom, particularly the proliferation of large language models (LLMs), which are highly compute-intensive across both their primary operational phases. The demands on computing infrastructure are substantial during the training stage—the foundational phase where models learn patterns from vast datasets to build general knowledge—and the inference stage—the deployment phase where already-trained models use learned parameters to generate responses to user prompts. For example, a ChatGPT search requires four to 10 times computing power used in a basic Google search. Meanwhile, increasingly widespread usage of cloud services is driving up demand for data storage, which necessitates substantial investment in data centers.

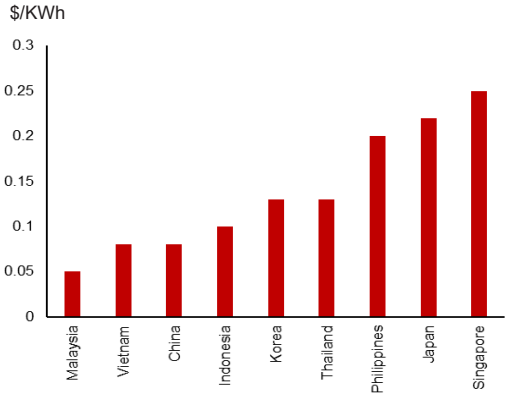
2. Malaysia's natural resource endowments provide a strong foundation for data center operations. Data centers use large quantities of electricity to run servers continuously, and vast amounts of water to cool the servers. In light of these demands on natural resources, Malaysia is well placed as a strategic site for data centers. Its average electricity tariff is the lowest among the ASEAN-5 economies and compares favorably against rates prevailing in advanced countries (Figure A1.1).[56] Moreover, Malaysia's power reserve margin is projected to be 28-36 percent over 2024-2030, a comfortable buffer relative to the International Energy Agency's recommended threshold of 20-35 percent. Water availability reinforces this advantage further—Malaysia ranks among the lowest in water stress compared with regional peers, underpinned by abundant rainfall, plentiful surface water sources, and well-developed dams and reservoirs.

3. A unique set of geographic attributes further strengthens Malaysia's appeal as a data center destination. Situated outside the Pacific Ring of Fire, the country is largely insulated from seismic activity and natural disasters that can disrupt data center operations elsewhere. Moreover, Malaysia's proximity to Singapore, which has a dense network of undersea cables and landing sites, results in low network latency (i.e. fast data transfer across networks) and limited costs of connecting to existing cable infrastructure. The proximity to Singapore's workforce has also enhanced the benefits of locating data centers in Malaysia, particular in the state of Johor, which directly borders Singapore as data centers sometimes need to engage off-site employees for urgent support. Singapore's talent pool is widely viewed as a valuable complement to Johor's data centers, especially in light of the creation of the Johor-Singapore Special Economic Zone (JS-SEZ).[57]

[55] Prepared by Jade Vichyanond, Senior Economist.
[56] However, with the July 2025 electricity tariff revision, data centers may see their electricity bills rise by 10-14 percent, which could narrow this advantage.
[57] Signed in January 2025, the JS-SEZ was created to enhance the value proposition of Johor and Singapore as a high-value investment destination by improving connectivity between the two regions and strengthening the business ecosystem within the economic zone.

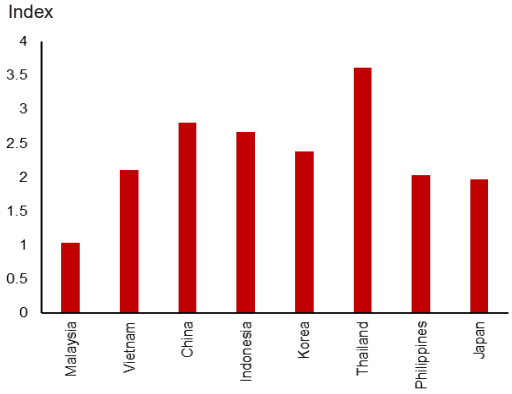
Furthermore, Singapore's ban on new large-scale data center construction during 2019-2022 helped boost data center investment in the neighboring state of Johor in Malaysia.[58] Lastly, the US-China tech decoupling and broader geopolitical considerations around data sovereignty have added to Malaysia's appeal as a neutral destination for data center investment from both sides.

Figure A1.1. Average Electricity Tariffs (2024)



Source: World Population Review; AMRO staff calculations

Figure A1.2. Water Stress (2023)



Source: World Population Review; AMRO staff calculations

4. As a result, data center capacity in Malaysia is projected to rise from 0.86-1GW as of end-2025 to 3-4GW by 2029, with Klang Valley and Johor as the main hubs. Geographically, almost 70 percent of the country's data centers are located in Klang Valley, the area around the capital city with a long history of data centers thanks to the development of Cyberjaya as a digital hub in the 1990s (Table A1.1). However, data centers in Klang Valley are mostly small-scale (less than 10MW), accounting for around 20 percent of Malaysia's capacity in 2024. Johor, by contrast, has emerged as a major data center location in recent years due to the aforementioned benefits of proximity to Singapore's—Johor's data center capacity expanded from almost zero in 2020 to around 80 percent of the country's total operational capacity in 2024. More than half of Johor's data centers are large-scale (>100MW), driven by demand from international data center operators that provide cloud and AI-intensive services.

Table A1.1. Data Center Locations and Capacity (2024)

Region / State	Existing Supply		Future Supply	
	No. of Data Centers	Estimated Capacity (MW)	No. of Data Centers	Estimated Capacity (MW)
Johor	12	396.9	28	898.7
Klang Valley	37	107	28	378.5
Penang	3	0.4	-	-
Sarawak	2	0.6	2	17.8
Negeri Sembilan	0	-	2	16
Kedah	0	-	1	2
Total	54	504.9	61	1313

Source: Knight Frank; AMRO staff compilation

5. Some of the government's key financial incentives for data center investment are provided through Digital Ecosystem Acceleration (DESAC) scheme and Malaysia Digital (MD). Under the DESAC scheme, new companies carrying out business activities

[58] Since 2022, Singapore has been approving new data center investment as long as sustainability requirements are satisfied. This new scheme may be economically feasible for certain retail operators, less so for hyperscalers, thus not posing as a major challenge to Johor's efforts to attract hyperscalers.

as a digital infrastructure provider can choose to receive either an investment tax allowance of 60 or 100 percent for capital expenditure or a special tax rate of 10 or 15 percent on statutory income. Existing companies get an investment tax allowance of 30 or 60 percent for capital expenditure. In all these cases, the actual percentage granted depends on the conditions satisfied.[59] As for the MD initiative, various types of incentives are available to qualifying companies on a case-by-case basis, ranging from income tax exemption and investment tax allowance to exemption from import duties and foreign knowledge worker quotas and passes.

6. Malaysia has also distinguished itself through a relatively systematic and comprehensive regulatory framework for data center development. In November 2024, the government approved Data Centre Planning Guidelines to standardize site selection, planning permission, and operational control for data center construction.[60] To attract investment by companies with sustainability requirements or priorities, the authorities further issued Guidelines for Sustainable Development of Data Centers in December 2024 to outline efficiency parameters, some of which are related to requirements for tax incentive eligibility under the DESAC scheme.[61] To facilitate sustainability-oriented investment, the Corporate Renewable Energy Supply Scheme was put in place in September 2024 to allow companies to purchase renewable energy directly from independent power producers. Most recently, the Data Centre Framework was announced in July 2025 as an overarching set of guidelines for strategic coordination, regulatory approval, and sustainability of all new projects and expansion of existing ones. As a result, Malaysia's data center development framework is considered more systematic and sustainable than most other regional economies that are also trying to attract data center investment. In Indonesia, Thailand, and Vietnam, data center investment frameworks and regulations are more fragmented, and sustainability mandates are relatively limited.[62] Lastly, greater investor confidence in Malaysia's legal enforcement compared to other regional countries, especially with regard to data privacy, has cemented the country's appeal as a major data center hub.

Challenges

7. Some of the key challenges for data center development in Malaysia concern the availability of natural resources. As of December 2024, applications for data center power supply had exceeded 11,000MW, equivalent to around 40 percent of Peninsular Malaysia's capacity of 27,000MW. Despite the country's continued efforts to ramp up electricity generation—6-8GW of gas-powered capacity is expected to be added by 2030 amid the phasing out of coal—fast-rising demand for electricity may still outstrip these measures. Klang Valley has already experienced occasional but isolated power outages in recent years, while in Johor, around 30 percent of data center applications submitted during June-October 2024 were rejected, largely due to operators not demonstrating sustainable practices in resource utilization. Water availability presents an equally pressing constraint. Cooling high-performance servers—through methods such as evaporative cooling and cooling towers—is highly water-intensive: every 100MW of data center capacity requires around 4.2 million liters of water per day, equivalent to usage by 10,000 persons. This

[59] These conditions pertain to paid-up capital, capital expenditure, full-time local employees, local vendor development programs, and adoption of Industry 4.0 and green technology.
[60] For example, the guidelines, which mainly target data center developments exceeding 1MW in capacity, have specific zoning requirements, limiting construction to commercial and industrial areas and requiring mandatory buffer zones near residential areas to minimize noise disturbance.
[61] These include power usage effectiveness (PUE), carbon usage effectiveness (CUE), and water usage effectiveness (WUE).
[62] For example, unlike Malaysia or Singapore, Indonesia does not have a "single-window" investment approval system, forcing potential investors to navigate a complex array of bureaucratic processes. Moreover, delays in securing tax exemptions discourage investors from choosing Indonesia as a destination for data center investment.

demand can strain local water infrastructure in areas already experiencing rapid growth in data center construction.

8. **Domestic value added from Malaysia's data center industry stems is relatively limited during the investment stage.** Most of the equipment used in Malaysian data centers is imported, with foreign manufacturers producing equipment for almost every aspect of data center infrastructure, from power and cooling (e.g., uninterruptible power supplies, generators) to networking (e.g., routers, switches), storage (e.g., storage area networks, network attached storage), computing (e.g., servers, server racks), and security (e.g., access control systems, biometric scanners). For example, despite the country's established metal fabrication industry, Malaysia still imports large numbers of integrated server racks for data center investment, although it is worth noting that some of the demand for integrated server racks is met by foreign manufacturers based in Malaysia, supporting demand for local assembly labor.[63] At any rate, it is estimated that only around 30 percent of value added from capital expenditure is captured domestically, mostly from construction-related activity, which benefits, for example, producers of cement, steel, and glass.

9. **However, domestic value added is significantly higher during the operational stage of data centers.** The share of domestic value added in data centers' operating expenses is estimated at around 70 percent, involving mainly leasing and utilities expenses, most of which accrue to domestic entities as local income. At the same time, data centers can generate ICT services exports through cross-border provision of cloud computing, data hosting, and processing services. Given that electricity costs are a major component of domestic value added of data centers' operating expenses, it is vital that Malaysia be equipped to meet the projected electricity demand of data centers in the pipeline with a view to ensuring sustained growth of ICT services exports going forward. International experience—most notably in Ireland and Singapore—shows that deepening domestic linkages through encouraging local participation in higher value-added segments, such as software development and enterprise services, can further enhance the contribution of data centers to export earnings and overall economic value added.

10. **While most data centers employ limited numbers of permanent staff on-site, they also create indirect jobs that benefit the local economy.** Typically, the life cycle of an average data center consists of strategic planning, design, construction, commissioning, and operations, all of which cover a wide range of job domains, such as business support, operations engineering, and network and connectivity (Table A1.2). The lion's share of jobs created by data centers takes place at the pre-operational stages; once operations begin, most data centers on average create only 30-50 permanent jobs. That said, during the operations stage, a variety of indirect jobs are also created, generally through partnerships with external vendors that supply periodic services such as maintenance, repairs, and upgrades.

11. **Even when full-time employees are needed for data center operations, it is sometimes challenging to meet such demand, particularly for skilled labor.** Skilled labor shortage has been plaguing Malaysia's semiconductor industry for years due to insufficient numbers of engineering graduates with applicable knowledge in areas such as integrated circuit (IC) design, device physics, fabrication, and process engineering. A

[63] Smaller data centers that mainly provide co-location services generally use simple server racks, most of which are produced by Malaysian companies. However, hyperscalers rely more on integrated server racks, which are more complex (i.e. containing IT equipment and power management and cooling systems) and for the most part imported or produced by foreign companies with manufacturing capacity in Malaysia (i.e., Wiwynn and Supermicro).

similar lack of skilled graduates is also faced by the budding data center industry, which requires specific skill sets related to IT infrastructure, hardware management, and environmental controls. The shortage is exacerbated by brain drain, particularly to Singapore, home to around 60 percent of the 1.8 million Malaysians working overseas. As such, continued government efforts to address the labor shortage by equipping students with industry-relevant skills—such as the AWS Skills to Jobs Tech Alliance, a joint initiative by AWS and Malaysia Digital Economy Corporation (MDEC), and the Data Centre Technician Program, a training program developed by the Johor Talent Development Council to enhance technicians' workforce readiness—will be crucial in safeguarding the future of the country's data center industry.

Table A1.2. Data Center Job Domains

Job domain	Strategy	Design	Construction	Commissioning	Operations
Business Support	◆	◆		◆	◆
Strategy	◆	◆			
Design		◆	◆	◆	
Construction			◆	◆	
Operations Engineering	◆	◆		◆	◆
IT Hardware		◆			◆
Network and Connectivity	◆	◆		◆	◆
Controls and Monitoring	◆	◆		◆	◆
Operations					◆

Source: Uptime Institute; AMRO staff compilation

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