ELECTRICITY DEMAND FORECASTING FOR VIETNAM'S DATA CENTER SECTOR: IMPLICATIONS FOR SUSTAINABLE ENERGY PLANNING

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Abstract

This study forecasts electricity demand for Vietnam's data center sector through 2030 in the context of rapid digitalization and the accelerating adoption of Artificial Intelligence (AI), both of which are expected to exert significant pressure on national power infrastructure. Using a baseline IT load of 524.7 MW in 2025 derived from industry market reports, the analysis employs a scenario-based approach with two growth trajectories: a high-growth case using a 16% CAGR and a market-aligned case using a 12.61% CAGR. Applying a Power Usage Effectiveness (PUE) value of 1.4, consistent with Vietnam's green data center standards, projected electricity demand increases from 734.6 MW in 2025 to 1,542.8 MW under the high-growth scenario and 1,330.6 MW under the moderate-growth scenario by 2030, corresponding to increases of 110% and 81%, respectively. These findings indicate that the expansion of digital infrastructure will require proactive power system planning. The study highlights the importance of integrating renewable energy through Direct Power Purchase Agreements (DPPAs) and implementing stringent energy-efficiency standards to ensure the sustainable development of Vietnam's data center ecosystem.

Keywords: Artificial Intelligence (AI), Data Center, Energy Transition, Forecasting, Power Demand.

1. Introduction

The global digital economy is undergoing a profound transformation, driven by the rapid expansion of data and Artificial Intelligence (AI) (Abbas Khan et al., 2025). This surge has increased demand for data centers, the backbone of digital infrastructure, leading to a considerable rise in electricity consumption (Jia, 2024). Globally, data centers account for 1-2% of total electricity use, with projections indicating a rise to 3-4% by 2030 (Goldman Sachs, 2024a; IEA, 2025), driven by AI workloads that are up to ten times more energy-intensive than traditional searches (Goldman Sachs, 2024b). This trend poses notable challenges to energy grids worldwide, requiring substantial investment in power generation and infrastructure.

Vietnam is emerging as a pivotal digital hub in Southeast Asia, fueled by a thriving economy, supportive government policies, and favorable investment frameworks. The National Digital Infrastructure Master Plan (Decision 36/QĐ-TTg) aims to establish Vietnam as a regional data center hub by promoting green standards, such as a power usage effectiveness (PUE) of 1.4, and allowing 100% foreign ownership of data center ventures (Lien Hoang, 2024; Prime Minister of Vietnam, 2024). This has attracted global tech giants like Nvidia and Google, alongside rapid growth by domestic providers (Francesco Guarascio & Phuong Nguyen, 2024; Ministry of Planning and Investment, 2024). Market analysis project Vietnam's data center sector to grow at a compound annual growth rate (CAGR) of 12.61% to 16% through 2030 (Goldman Sachs, 2024a; Mordor Intelligence, 2025), driven by AI adoption and digital infrastructure investments.

However, this growth presents critical challenges to Vietnam's energy security and climate goals. The rising power demand intersects with the ambitious energy transition outlined in Power Development Plan VIII (PDP8), which targets a 150 GW grid capacity by 2030, with 47% from renewables, while phasing out new coal projects (Ha-Duong, 2025). Yet, the grid faces constraints, including reliance on hydropower vulnerable to climate change and the need for considerable investment to support large-scale loads (Nguyen et al., 2024).

Despite these trends, there is a lack of updated, forecasts tailored to Vietnam's data center sector, particularly in the context of its unique growth drivers and policy frameworks. This study addresses this gap by: (1) projecting electricity demand for Vietnam's data center sector to 2030 using two growth scenarios (CAGR 12.61% and 16%) based on a 2025 baseline of 524.7 MW; (2) evaluating the implications for the national grid under PDP8; and (3) proposing a coordinated strategy of policy and technological solutions to ensure sustainable development. This research provides a critical evidence base for policymakers and investors navigating the intersection of digital transformation and energy transition in one of Asia's most dynamic economies.

2. Methodology

This study employs a scenario-based deterministic model (Li et al., 2022; Ma et al., 2024) to project the electricity demand of Vietnam's data center sector through 2030. The methodology comprises three key stages: (1) establishing a baseline and growth rate using authoritative market data; (2) projecting future IT capacity with a compound growth formula; and (3) converting IT capacity into total power demand based on a national efficiency standard. The model integrates data from Vietnam's national policies and global industry reports to ensure accuracy and relevance.

2.1 Baseline and growth rate scenarios

The baseline for Vietnam's data center IT capacity is set at 524.7 MW for 2025, sourced from market reports by Mordor Intelligence, a reliable benchmark for market sizing (Mordor Intelligence, 2025). To account for market uncertainty, two growth scenarios are developed:

- Baseline Scenario (CAGR 12.61%): This scenario uses a compound annual growth rate (CAGR) provided by Mordor Intelligence, specific to the Vietnam market (Mordor Intelligence, 2025). It represents a continuation of current, officially reported market trends.

- High-Growth Scenario (CAGR 16%): This scenario adopts the CAGR from Goldman Sachs Research's forecast for the U.S. data center market (Goldman Sachs, 2024a). This higher rate is justified by Vietnam's rapid digitalization and strategic investments in AI, which could lead to growth comparable to leading global markets.

2.2. Forecasting model

The total IT capacity P_{IT} for a given year (t) in each scenario is calculated using the compound annual growth formula (Murugan et al., 2025):

$$P_{IT}(t) = P_{IT}(2025) \times (1 + CAGR)^{(t-2025)} \quad (1)$$

where $P_{IT}(2025)$ is 524.7 MW, and CAGR is either 12.61% or 16%.

The total electricity demand (P_Demand) is derived by multiplying P_{IT} by the power usage effectiveness (PUE) ratio. A PUE of 1.4 is used, as mandated by Vietnam's National Digital Infrastructure Master Plan (Decision 36/QĐ-TTg) for new data centers, aligning with national green standards (Prime Minister of Vietnam, 2024).

$$P_{\_Demand} = P_{IT} \times PUE \quad (2)$$

2.3. Verification and contextual analysis

The projections from both scenarios are validated against Vietnam's Power Development (PDP8) (Vietnam Gov., 2023). Results are contextualized with global trends from reports by the International Energy Agency (IEA) and the Joint Research Centre (JRC) (IEA, 2025; Kamiya & Bertoldi, 2024). The use of two distinct growth scenarios inherently demonstrates the model's sensitivity to market growth assumptions and enhances the robustness of the findings by providing a forecast range rather than a single-point estimate.

3. Results and discussion

3.1. Projected electricity demand

The forecasting model projects the electricity demand for Vietnam's data center sector from 2025 to 2030 under two growth scenarios, as detailed in Table 1 and Figure 1. Using a baseline IT capacity of 524.7 MW in 2025 (Mordor Intelligence, 2025) and a Power Usage Effectiveness (PUE) of 1.4 (Prime Minister of Vietnam, 2024), the model estimates demand based on two compound annual growth rates (CAGR): 12.61% (baseline scenario, reflecting Vietnam's market trends (Mordor Intelligence, 2025) and 16% (High-growth scenario, aligned with global AI-driven growth (Goldman Sachs, 2024a).

In the baseline scenario (CAGR 12.61%), the IT capacity grows from 524.7 MW in 2025 to 950.4 MW by 2030, resulting in a power demand increase from 734.6 MW to 1330.6 MW, an 81% rise over five years. In the high-growth scenario (CAGR 16%), the IT capacity reaches 1102.0 MW by 2030, with power demand rising to 1542.8 MW, a 110% increase. These projections highlight a considerable strain on Vietnam's power infrastructure, with demand potentially reaching 0.89-1.03% of the national grid's targeted 150 GW capacity by 2030, as outlined in Power Development Plan VIII (PDP8) (Ha-Duong, 2025).

Table 1. Projected electricity demand for Vietnam's data centers (2025–2030)

Year	Total IT Capacity (MW) (CAGR 16%)	Power Demand (MW) (CAGR 16%, PUE = 1.4)	Total IT Capacity (MW) (CAGR 12.61%)	Power Demand (MW) (CAGR 12.61%, PUE = 1.4)
2025	524.7	734.6	524.7	734.6
2026	608.7	852.2	590.9	827.3
2027	706.0	988.4	665.4	931.6
2028	819.0	1146.6	749.6	1049.4
2029	950.0	1330.0	844.1	1181.7
2030	1102.0	1542.8	950.4	1330.6

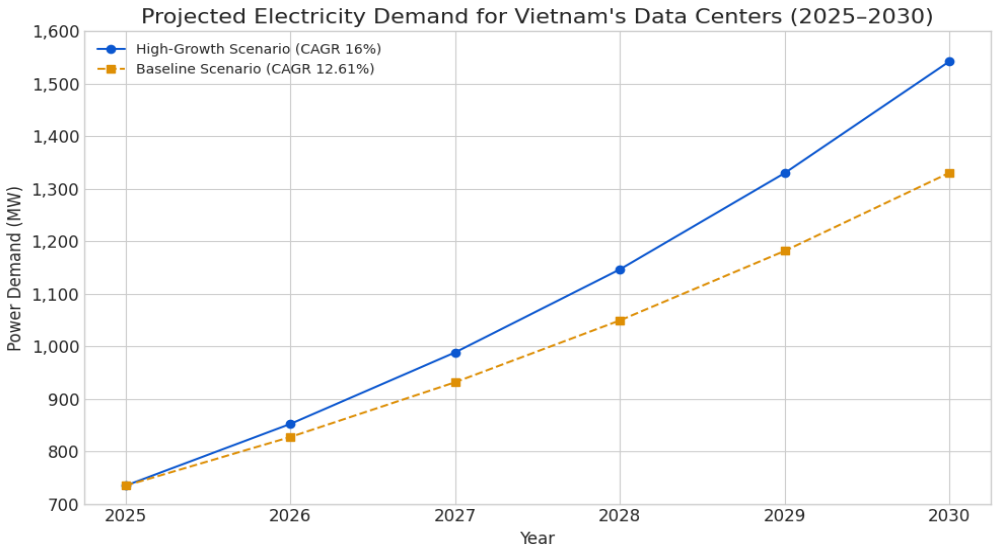

Figure 1. Projected electricity demand for Vietnam's data centers (2025–2030).
(Source: Author, 2025)

3.2 Implications for Vietnam's power infrastructure

The projected demand of 1330.6-1542.8 MW by 2030 poses notable challenges to Vietnam's energy security and Power Development Plan VIII (PDP8) targets, which aim for 47% renewable energy in a 150 GW grid (Ha-Duong, 2025). Data centers, driven by AI workloads, could consume a notable portion of the grid's capacity, competing with other industrial and residential demands. Vietnam's current reliance on hydropower, which is vulnerable to climate variability (Goldman Sachs, 2024a; M. P. Nguyen et al., 2024), and the phase-out of new coal projects further constrain supply. The International Energy Agency (IEA) notes that data centers globally may account for 3-4% of electricity consumption by 2030 (IEA, 2025), underscoring the need for Vietnam to align with global efficiency benchmarks (Prime Minister of Vietnam, 2024).

3.3. Recommendations for sustainable development

To address these challenges, a coordinated policy and technological approach is essential. First, Vietnam should accelerate the adoption of Direct Power Purchase Agreements (DPPAs), which allow data centers to procure renewable energy directly from producers, reducing reliance on the national grid (Vietnam Gov., 2023). Second, enforcing PUE standards of 1.4 or lower through incentives and regulations can enhance energy efficiency (Prime Minister of Vietnam, 2024). Third, investments in grid infrastructure,

such as high-voltage transmission lines and smart grid technologies, are critical to accommodate the growing load. These measures align with Vietnam's National Digital Infrastructure Master Plan and net-zero commitments, ensuring sustainable growth of the data center sector.

4. Conclusion

This study forecasts a notable rise in electricity demand from Vietnam's data center sector, driven by rapid digitalization and the global AI boom. Projections based on two growth scenarios indicate that demand will reach a range of 1330.6 MW to 1542.8 MW by 2030, posing a considerable challenge to Vietnam's energy security and its goals under Power Development Plan VIII (PDP8).

Vietnam stands at a pivotal juncture: its ambition to become a regional digital hub depends on a resilient, sustainable energy infrastructure. A coordinated strategy is essential to address this demand. First, implementing Direct Power Purchase Agreements (DPPAs), as endorsed by Decision 36/QĐ-TTg, will enable data centers to procure renewable energy, encouraging private investment in clean energy. Second, enforcing the mandated Power Usage Effectiveness (PUE) of 1.4, alongside investments in smart grids and energy storage, will enhance efficiency and reliability.

By aligning digital growth with energy transition goals, Vietnam can mitigate grid instability and carbon emissions, ensuring a prosperous and sustainable path to becoming a leading digital economy. Future research should leverage operational data to refine demand models and evaluate carbon impacts under diverse energy scenarios.

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