WORLD ENERGY COUNCIL
INDIA

Growth Trajectory of India's Data Centers

A Compilation by WEC India

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Data centre has emerged as the backbone of the digital economy, in today's hyper-connected world. A data centre is a specialized facility that houses computing and storage infrastructure, enabling organizations, governments, and individuals to store, process, and distribute vast volumes of information. From running enterprise software and e-commerce platforms to powering artificial intelligence, cloud computing, and streaming services, data centres make modern life possible.

At their core, data centres provide reliable compute power, storage systems, networking, and security within a controlled environment that ensures uninterrupted operations. To achieve this, they rely on redundant power supply, advanced cooling systems, fire suppression, robust cyber and physical security, and highspeed connectivity.

Classification of Data Centres

Data centres are broadly categorized as Enterprise, Colocation and Hyperscale.

1.Enterprise Data Centres –

Owned and operated by one company for its internal use. Built and managed in-house for full control over security and performance. Example, Banks such as SBI, HDFC etc.

2.Colocation Data Centres (Colo) –

Shared facilities where companies rent space for their servers. Operator provides power, cooling, and security; clients manage their hardware. The operator developing above facilities are STT GDC, Yotta, CtrlS, NTT etc.

3.Hyperscale Data Centres –

Massive centres built by tech giants to power cloud services. Designed to handle global-scale computing and storage. Some of the major players in India are AWS, Microsoft Azure, Google Cloud, Meta.

Why DCs are required as on date?

Data centres were not essential a decade ago because India's digital ecosystem was still small, low-data, andmostly offline. Today, with billions of daily transactions, AI workloads, and **data-driven services, data centres have become the digital backbone of the economy —**as indispensable as roads and power gridswere in the industrial era.

Comparison of Factors: 5-10 Years Ago vs. Today

	5–10 Years Ago	Today
Internet users	~200 million	850 million +
Data usage per user	1 GB/month	20 GB/month
Primary storage	On-premise / foreign servers	Local cloud data centers
Key drivers	IT firms, banking	AI, IoT, 5G, fintech, OTT
Policy	Minimal regulation	Data protection & localization
Govt. digital stock	Basic e-governance	UPI, Aadhaar, DigiLocker, ONDC
Latency needs	Moderate	Ultra-low latency (real-time)
Global presence	Minor	Emerging global hub

Why are Data Centres measured in GW (Gigawatts)?

When people say data centre capacity in GW, what they are often referring to is the power capacity (i.e. electrical power draw) that the facility can support (or is expected to support) rather than, say, number of servers or floor area. Here's why:

- GW reflects the electrical power capacity a data centre can draw — not its size or server count.

- Power is the main limiting factor for running servers, cooling, and backup systems. India's operational data centre IT load is currently around 1–1.3 GW, and when you include cooling and auxiliaries the grid-facing requirement is roughly 1.5–2.0 GW today, depending on the assumed efficiency (PUE) mix.

- Electricity often accounts for 50–60% of total operating costs (OPEX), so measuring in GW directly relates to financial and energy planning.

- For planners and investors, "GW-scale" signals a large hyperscale facility.

In short: GW links a data centre's computing scale directly to its power footprint and cost.

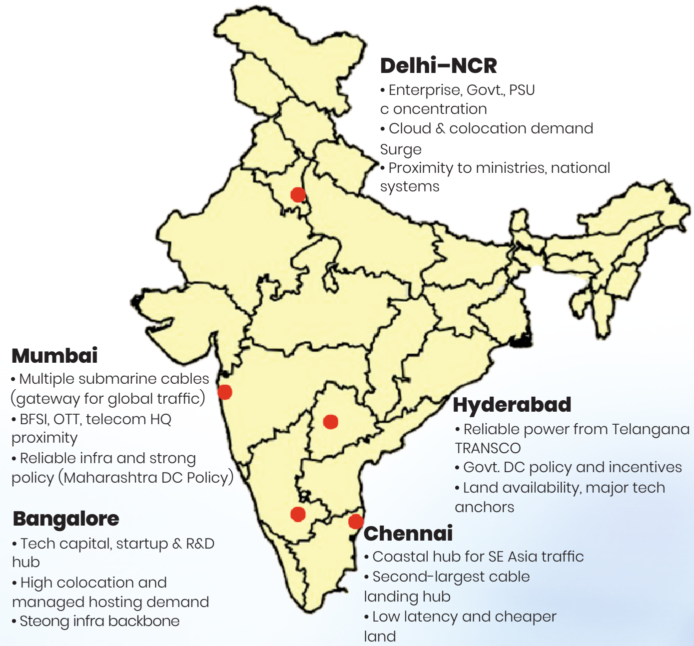
Current Scenario of Data Centres in India

Market size & growth

India's data centre capacity has grown sharply in recent years: from ~ 0.30 GW in 2018 to ~ 1.26 GW by April 2025.

- The data centre industry in India has been growing at ~24 % CAGR since 2019 in capacity terms.
- Currently, much of the capacity is concentrated in a few "metro" clusters (Navi Mumbai, Noida, Bangalore, Hyderabad, Gurgaon) but the trend is toward expansion into Tier-2/Tier-3 cities for edge deployments.

MAJOR DATA CENTER LOCATIONS (CURRENT HUBS)



Emerging Hubs

Pune
-Proximity to Mumbai but cheaper land & cooler climate

Ahmedabad / GIFT City (Gujarat)
-State policy incentives, reliable power, low seismic risk

Kolkata
-Eastern connectivity to Bangladesh & ASEAN

Kochi / Vizag
-Coastal, cable landing, redundancy to Mumbai/Chennai

Jaipur / Indore / Nagpur
-Tier-2 edge & government digital corridors

Lucknow / Noida Extension
-Policy support (UP DC Policy), good fiber and power

Bhubaneswar
-Smart city and digital public infrastructure focus

Why India Stands Out as a preferable Global Data Centre Hub?

India is emerging as one of the world's most attractive destinations for data centres — driven by its massive digital demand, geographic advantage, and strong policy support. While challenges like high temperatures, power reliability, and regulatory hurdles exist, the country's growth potential and renewable energy drive make it a "high potential–high challenge" market for global investors.

Factor/Enablers	Highlights
1. Large& Growing Digital Demand	850M+ internet users; rapid cloud, AI, and analytics adoption ensures strong domestic base load.
2. Strategic Geography & Connectivity	Positioned between the Middle East & Africa (to the west) and Southeast Asia (to the east); multiple undersea cable landings (Mumbai, Chennai, Kochi).
3. Supportive Government Policies	Digital India push, data localization norms, 100% FDI approval, and state incentives (Maharashtra, Tamil Nadu, UP).
4. Cost Competitiveness	Lower land, labor, and power costs vs Singapore or Hong Kong; negotiable industrial tariffs.
5. Climate & Renewable Push	Expanding solar and wind integration; scope for green-powered DCs and improved PUE efficiency.
6. Untapped Market Potential	India contributes a small fraction of global DC capacity despite large data generation—huge growth runway.

Why Green Data Centres Are Becoming Essential

Data centres already consume 2–3% of global electricity, and India's demand could exceed **5 GW by 2030**—equal to several large cities. Without renewables, this growth risks higher carbon intensity and clashes with India's **Net Zero 2070** goal.

Governments and states like **Maharashtra, Tamil Nadu, Gujarat, and Telangana** now promote renewable or hybrid power use, while operators face **ESG mandates** for clean, traceable energy.

Green integration isn't just regulatory — it's **strategic:** reducing fossil reliance, stabilizing energy costs, attracting ESG-focused investors, and improving efficiency through lower **PUE** and **OPEX.**

India's data centre ecosystem stands at the intersection of digital demand, policy reform, and green transition. The combination of scale, location, and skilled talent positions India as a future hyperscale hub for Asia — provided infrastructure and regulatory execution keep pace.

PWC | Greening the Data Centres in India

Balancing Digital Growth with Sustainable Energy

India's energy demand for data computing is rising and expected to grow exponentially from mere 960 MW in 2023 to 9 GW in 2030. This is expected to add up to about 3% of India's electricity consumption in 2030, up from less than 1% currently. Driven by the tailwinds from Cloud Services demand and the burgeoning AI sector, India positions itself as a rising powerhouse in the global digital infrastructure landscape.i The Data Centre and related infrastructure would be the cornerstone to support such emerging business ventures. Greening the supply chain of Data Centre would be essential to support such growth trajectory.

Important Drivers for Data Ecosystem

- India's active internet user base grew 8% Y-o-Y to 886 million (in 2024) and is projected to cross 900 million by 2025 with uninterrupted access to social media and digital content consumption.
- Over the past decade, UPI transactions grew from 72 lakhs (worth INR 2271 crore) to nearly 1790 crore (worth INR 23.9 lakh crore) by 2025.
- India has world's third-largest startup ecosystem, with over 159,000 recognized startups as of early 2025 across sectors such as fintech, edtech, health-tech driving technology adoption and growth.

The India Growth Story

India's current Data Centre capacity stands at around 1.3 GW, with Mumbai and Chennai leading as a primary hub, followed by cities like Bangalore and Delhi NCR. Hyderabad is emerging as a significant hyperscale hub, with Pune and Kolkata also witnessing considerable expansions. With capital expenditure expected to exceed $22 billion,ii the industry is set for a transformative decade, supported by both private investments and strategic government interventions. The additional impetus in India over and above the AI boom is due to the Indian Government (MeitY) policy to house all its data within its own geography. The following elements will further drive the energy consumption for Data Centres in India, projected at 9 GW (by 2030) as depicted in the adjacent figure.iii

City	No. of Data Centers	Total Capacity (MW)
Mumbai	42	490
Pune	18	64
Delhi-NCR	33	94
Hyderabad	13	48
Bangalore	31	97
Kolkata	8	10
Chennai	22	147

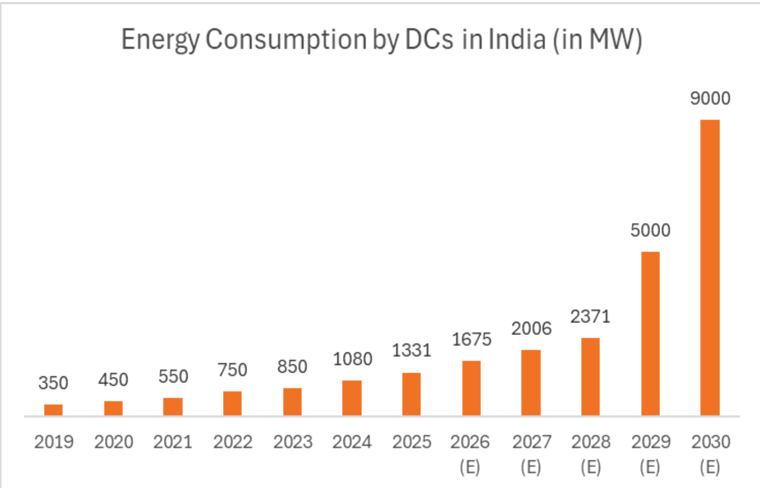


Figure 1: Energy Consumption (in MW) by Data Centres in India

* **Digitalization:** India's economic growth relies heavily on digital services like UPI, DPI and e- Commerce, leading to a significant surge in data generation and consumption

* **Artificial Intelligence (AI):** AI is a primary driver of increased energy demand from data centres, as it requires immense computing power

* **Government Policies:** The data centre market in India has expanded significantly with the MeitY policy of housing all Indian Data within its geographical border

Evolution of Data Centres

Originally conceived to house mainframes and critical computing equipment, Data Centres evolved from large Server Rooms. It began burgeoning in the late 1990s when internet use exploded and maintaining this hardware was costly and impractical as companies grew further. Subsequently, the concept of co-location facilities evolved, allowing companies to rent space in specialized Centres designed to handle their load in a multitenant environment.

As the internet expanded, a transformative idea took shape—cloud computing. It promised limitless storage and computing resources without the physical constraints of traditional servers. The leading Hyperscalers offered flexible, on-demand services globally, round the clock.

Data Centres: Power Consumers of the Digital Age

An average hyperscale Data Centre can consume up to 100 MW of power continuously. At the current rate, Data Centres will consume about 3% of global energy by 2030. Global Data Centre electricity consumption is projected at 945- terawatt hours (TWH) by 2030. China and the United States are the most significant regions which will drive around 70% of global growth for Data Centres by 2030iv.

Data Centres, built around Servers, Storage, Networking and Security devices and put into vertical racks, needs uninterrupted high quality electricity and cooling to run continuously to ensure minimal latency and maximum up-time. Any downtime of Data Centres is often the biggest threat to corporates and governments alike. Redundancy requirements of large Data Centres made them consider for Disaster Recovery Centres, which nearly doubled the power consumption for each unit of data. A single rack consumes about 5-50kW of energy, while larger Data Centres reach about 50 MW or more. Hyperscale Data Centres consume more than 30 MW, which is equivalent to the power consumption of tens of thousands of homesv. The table below shows the energy consumption for various scales of Data Centres.

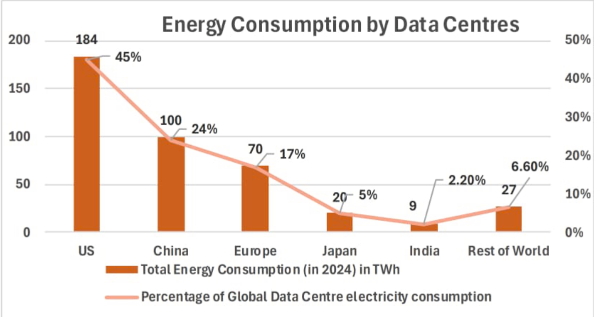


Figure 2: Share of Energy consumption by Data Centres as a % of total energy consumption

Table 1: Power consumption by various scales of Data Centres

Data Centre Si e	Small	Medium	Large
Building Si e (sq. ft.)	5,000 – 20,000	20,000 – 100,000	100,000 to millions
Server Count	500 – 2,000	2,000 – 10,000	10,000 to 100,000
Power Capacity (MW)	1 – 5	5 – 20	20 – 100+
Example	Enterprise Data Centres	Co-location Companies	Hyperscale Hubs

Cooling these massive devices to prevent overheating is often the most energy-consuming aspect beyond the computer Server and Storage load. Traditional cooling systems contribute substantially to greenhouse gas emissions, pointing to the pressing need for optimizing energy efficiency measures within these operational nexuses. Cooling a Data Centre takes up to 40% of its total energy consumption. Though the hyperscale hubs use more efficient cooling systems, the energy consumption of the accelerated processors gurgles more power than ever before taking the overall consumption on a steep climb.

An ideal Power Usage Effectiveness (PUE1) is 1.0, representing perfect efficiency where all power goes to IT equipment. However, real-world Data Centres have a PUE greater than 1.0, with the excess power used for overhead like cooling, lighting, and power distribution. A lower PUE indicates better energy efficiency. as less power is wasted on non-IT functions.

Integration of Data Centre Consumption with India's Energy Transition Goals

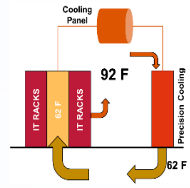
India currently ranks 4th globally in installed renewable energy capacity, according to IRENA RE Statistics 2025. India's renewable energy target for 2030 is projected at 500 gigawatts (GW) of installed capacity, including both renewable energy and nuclear power sources.vi Data Centres, forming a major energy consumer of the digital economy, can play a pivotal role in India's rank in the renewable energy transition goals. To fuel these data power houses, it would be pertinent to (i) Driving energy efficiency and (ii) Sourcing green power for DC operations through Industry collaborations

[1] PUE (Power Usage Effectiveness) is a widely adopted data centre metric that measures energy efficiency by calculating the ratio of total facility power consumption to the power used by the IT equipment. PUE is measured as Total Facility Energy / IT Equipment Energy.

Enhancing energy efficiency through Infrastructure design and innovation

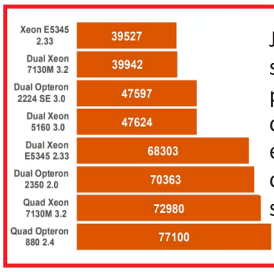
Driven by Global innovations over the last decade, advancements were made for Data Centre operations, particularly around the following elements:

I **HVAC and Cooling Systems:** Advanced cooling processes like the hot aisle/cold aisle containment technique reduce air mixing and improve the cooling efficiency significantly. This showcases possibility of energy savings and cooling efficiency improvements when applied effectively in Indian Data Centres.[vii]



A study conducted by the CII (Confederation of Indian Industries) illustrates that by containing the dissipated heat through thermal zone containment, reduced the cooling requirement from 180 TR to

ii **Energy-Efficient Processors and Smart Racks:** Advancements in processor technology have reduced power consumption in recent years. Energy-efficient Servers contribute to overall energy savings through innovations like accelerated server refresh strategies and effective storage utilization. Use of accelerated servers can result in substantial reductions in total energy usage spanning across all IT equipment and peripheral systems.[viii]

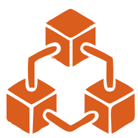


Java server benchmarking system found energy efficient processors could lead to savings of more than 20% in server energy consumption under an optimal load condition for the same application.

iii. **AI-Driven Energy Management Systems:** By using real-time data analytics, AI can adjust energy usage to match demand fluctuations and reduce idle-time operations, thus preventing energy waste. This is achieved by optimizing the operation of high-energy-consuming equipment like servers and storage. For example, AI systems can dynamically manage cooling based on server load and external weather conditions. AI technologies also enhance resource allocation, allowing Data Centres to run closer to peak efficiency, which is crucial in both reducing the carbon footprint and operating costs. [ix]

Studies conducted by Science Direct, and AI design organizations have demonstrated that AI-driven systems could yield more than 15% energy savings in a Data

iv. **Modular Data Centres:** Modular Data Centres exemplify scalability and rapid deployment. High replication potential of modular systems align well with dynamic growth needs. This approach not only saves time but also reduces infrastructure costs, making it a desirable path for expanding digital infrastructure rapidly. Such concepts will reduce energy consumption of the additional cooling for an otherwise large Data Centre.[x]



- A study by a leading Hyperscaler have found that utilizing prefabricated modules can reduce deployment times by 50%.
- A Canadian telecom provider used prefabricated modular solutions to implement a data centre in just 8 months in British Columbia, Canada.
- In South Africa, a DC was disassembled into 12 units and reassembled on site and ready for testing in under 6 weeks

v. **Integrated Building Management Systems (IBMS):** The integration of comprehensive monitoring systems across Data Centre infrastructures has demonstrated notable energy savings. As highlighted in the document, integrated systems optimize efficiency by coordinating various operational components— HVAC, electrical, security, and fire safety. Such systems, when smartly adapted to, can improve resource allocation, enhance sustainability, and lead to comprehensive control over operational environments.[xi]

Multiple studies conducted by OEMs and Benchmarking authorities and found that implementation of Integrated Control Systems within the Data Centre brought about energy savings of up to 35%.

Sourcing green power for DC operations through Industry collaborations

Setting up a comprehensive ecosystem for greening the power consumption by Data Centres in India would involve collaboration between multiple stakeholders, including government bodies, private companies, research institutions, and non-governmental organizations (NGOs). A holistic approach, demanding cooperation between private and public sectors would also entail critical last-mile partnerships between Data Centre operators, energy providers, technological innovators, and environmental organizations.

Apart from the Green Corridor the existing Green Open Access Regulations and Green Open Access Registry are also significantly aiding the cause of green energy adoption by various industries. These existing enablers and possible future catalysts are depicted in the diagram alongside and described in detail below. With proper planning and execution, India can not only reduce the environmental impact of its Data Centres but also position itself as a leader in sustainable data technology.

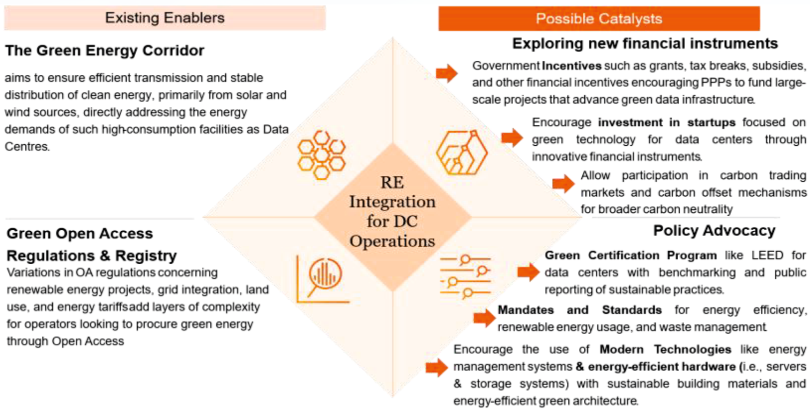


Figure 3: Existing enablers and possible catalysts for RE integration in Data Centre Operations

Leveraging the Green Energy Corridor (GEC)

India's Green Energy Corridor plays a pivotal role in supporting the integration of renewable energy The corridor enhances the reliability of renewable energy supply, making it ideal for Data Centres that require consistent round the clock green power. At present, significant advancements have been made in expanding the infrastructure needed for this integration.

	Type	RE Capacity Integration
GEC Phase -I	Intra State Transmission System (InSTS)	24 GW across 8 States (AP, GJ, HP, KA, MP ,MH, RJ, TN)
	Inter State Transmission System (ISTS)	6 GW
GEC Phase -II	Intra State Transmission System (InSTS)	20 GW across 7 States (GJ, HP, KA, KL, RJ, TN, UP)
	Inter State Transmission System (ISTS)	13 GW

Table 2: RE Integration Capacity of GEC Projects[xii]

Intra State Projects (for four states) under Phase I are delayed due to delays in land acquisition, Right of Way (ROW) issues and forest clearances. InSTS & ISTS Projects under Phase II are expected to be complete by 2027 and 2030 respectively. Government of India is planning to advance on Phase III of the GEC with an estimated budget of ~INR 56,000 Croresxiii. Such corridors can be explored for sourcing round the clock green power for sustainable Data Centre operations

Banking on Green Energy Open Access for wide access to power markets and exchanges

Green Energy Open Access (GEOA) regulations in India, notified by Ministry of Power in June 2022 are aimed at facilitating the integration and utilization of renewable energy sources by consumers, thus promoting sustainable practices across various industries.

- **Eligibility:** Consumer with connected load> 100kW
- **National Single Window Portal** for facilitating application & approval process
- **Approval Timeline:**15 days else deemed granted
- **Tariff Charges:** Determined by Appropriate commission
- **Accessible Platform :** for all stakeholders in Indian Power Market
- Consumers purchasing green energy can receive **green certificates** to meet their **Renewable Purchase Obligations (RPO)**

Currently, twenty-seven (27) states have notified their respective GEOA regulations with few states like Madhya Pradesh, Karnataka, Haryana and West Bengal having completely adopted the Green Open Access Registry (GOAR), managed by Grid Controller of India Ltd. (earlier known as POSOCO). These regulations and GOAR can be leveraged in greening the Data Centres in the following manner:

i **Access to Cleaner Energy:** provide Data Centres with easier access to renewable energy sources, such as solar, wind, biomass and combination of storage technologies

ii **Cost Efficiency:** Data Centres may benefit from lower energy costs and simplified process for availing open access, enabling a financially viable switch to green power.

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iii **Sustainability Goals:** help Data Centres meet corporate sustainability goals and comply with increasing governmental and international mandates on carbon reduction and environmental stewardship.

Computation of landed cost of power procured through open access depend on several factors. Electricity which a concurrent subject in the Indian Constitution, allows states to exercise discretion while formulating GEOA policies. The adjacent table captures indicative cost elements that are to be considered while designing a program for sourcing green power through open access.

#	Cost Elements	Units	Governing body
1	Inter-state transmission charges		Central regulations – CERC (Central Electricity Regulatory Commission)
	Long/Medium Term	INR/MW/month	
	Short Term	INR/kWh	
2	Scheduling, system operation charges	INR per month	
3	Inter-state transmission losses	%	
4	Cross-subsidy surcharge	INR/kWh	State Specific regulations
5	Additional surcharge	INR/kWh	
6	SLDC Charges	INR/MW per day	
7	Transaction charges	INR per month	
8	Wheeling Charges	INR/kWh	
9	Wheeling loss	%	
10	Intra State transmission losses	%	
11	Electricity Duty	INR/kWh	State government directives
12	Application Processing Fee	Depends on OA capacity	
13	Operating Charges	Depends on OA capacity	

Figure 4:Various cost elements as applicable to consumer for sourcing power through Open Access

In summary, this would necessitate careful consideration on the availability of renewable energy, transmission corridors, regulatory and commercial framework to support adoption of clean energy solutions in Data Centre operations.

Allowing Data Centres to participate in the Green Market (Term Ahead and Day Ahead) which accounted for 8760 MUs, which is 7.2% of total energy traded in IEX (121 BUs)xiv. Data Centres may also leverage Time of Day (ToD) tariffs and use BESS/thermal storage to arbitrage and reduce peak loads to facilitate sourcing of green power. Few case studies of such RE procurement initiatives by Data Centre entities are illustrated below.

Recent RE procurement initiatives undertaken by the key DC operators in the country:

Equinix signed PPA with CleanMax to Develop 33 MW captive RE project

- **Location:** Maharashtra, India
- **Project details:** Construction of a 33 MW (26.4 MW solar & 6.6 MW wind) captive RE
- **Timeline:** Project set to become operational in phases during 2025
- **Impact:** Reduces carbon footprint of Equinix's DC operations in Mumbai
- **Equinix has set a goal to achieve climate neutrality by 2030**

Equinix signed PPA with CleanMax to Develop 33 MW captive RE project

- **Location:** Nagpur, Maharashtra, India
- **Project details:** The solar farm's 62.5 MWp capacit went live in June 2024, while an additional capacity of 62.5 MWp is under-implementatio
- **Impact:** 125 MWp solar farm will power 60% of CtrlS'Mumbai CtrlS DC
- **CtrlS plans to develop over 1 GW of RE capacity by 2030 to help them achieve Net Zero goal by 2040**

Princeton Digital Group (PGD) signs 25-year PPA with Tata Power Renewable Energy Limited for its 48 MW Mumbai DC

- **Location:** Airoli, Mumbai
- **Project details:** PDG's MU1 data center will consume power generate by a solar project located in Nanded district, Maharashtra.
- **Impact:** Long-term agreement will enable PDG's Mu1 data center to advance digital decarbonization, up to 50% RE
- **PDG's targets to achieve net+zero Scope 1 and Scope 2 emissions by 2030**

Sify Technologies has contracted 231 MW RE with Vibrant Energy

- **Location & capacity:** 14 Data Centers (Mumbai, Noida, Hyderabad, Bengaluru, Chennai, Kolkata) with 227+ MW IT power
- **Project details:** 231 MW RE of which 67MW solsr PPA had been signed in March 2021 and expanding to 407 MW+ by 2025
- **Impact:** 50% reduction in carbon footprint as of 2023

Exploring financial instruments including Carbon Offset Initiatives

Complementing the direct measures to reduce energy consumption, Data Centres may also result in carbon offset initiatives. This may open up avenues for Data Centre entities to participate in carbon trading markets and contribute to a broader carbon neutrality strategy. In addition, the emerging green financing instruments may be explored while mobilizing investment to establish Data Centres. Some selected examples of such green financing instruments could be:

I Labeled and KPI-linked debt such as Green bonds and green rupee (masala) bonds aligning to SEBI's green debt framework, sustainability-linked loans/bonds with coupons/loan margins against pre-defined KPI ranges.

ii Service and performance-based models (off-balance sheet) such as Energy-as-a-Service, Cooling-as-a-Service, Battery-/Storage-as-a-Service wherein 3rd party finances, operates and gets paid as per OpeX model based on pre-defined SLAs.

iii Carbon market-linked finance which may include forward sale and prepayment of Indian Carbon Market credits to raise upfront capital, monetization of verified energy savings schemes (e.g. PAT & ESCerts)

iv. Structured and pooled vehicles such as Green InvITs for energy supply to Data Centre parks aggregating offsite solar/wind/storage assets contracted to multiple Data Centres

v. Schemes encouraging Public-private and policy-linked mechanisms such as Pay-for-performance programs with BEE/EESL where financiers are repaid per verified MWh saved or tCO2e reduced.

vi. Digital instruments and market infrastructure enabling tokenized RECs and real time monitoring, reporting, and verification (MRV).

Policy Advocacy

To formulate a more enabling regulatory eco-system, a unified and coherent policy framework is essential. Harmonizing the state and national regulations can facilitate smoother transitions and provide clear guidelines for operators. Additionally, establishing incentives and benchmarks can accelerate the adoption of sustainable practices while ensuring compliance and fostering innovation. Indian Policy makers may consider the following:

- Green certification programs for Data Centres such as IGBC Green Building Rating System and GRIHA in line with international certifications such as LEED and EDGE, when coupled with rigorous benchmarking and public reporting in India, can reinforce green power consumption in Data Centres through a three pronged approach (i) standardize what "good" looks like, (ii) make performance transparent and comparable, and (iii) unlock capital and policy benefits for those who lead
- Enforcing standards for PUE (power usage effectiveness), CUE (carbon usage), WUE (water usage), Energy Reuse Factor, Renewable Energy Factor, IT utilization etc. will set minimum performance floors, align incentives across the value chain, enable verification & benchmarking and reduce investor risks
- Apart from standardization and use of best practices, ISO 50001 and Usage of Energy Management Systems (EMS) technology solutions lead to significant energy savings, lower operational costs, better compliance, market competitiveness and Carbon Footprint Reduction
- The transition towards sustainable Data Centre operations requires the adoption of new technologies and practices, which often necessitate skilled personnel for implementation and maintenance. Policy initiatives shall bring together academia, industry leaders, and government agencies to for adequate skillset building through in-house training and international knowledge-transfer programs

All these initiatives would channel capital toward high-efficiency, grid-interactive, and increasingly carbon-neutral Data Centres. By spearheading this transformation, India can lead the way in global sustainable digital development, nurturing a future where digital growth harmonizes with planetary wellness.

EY|India's Data Centre Growth and Energy Transition: Building a Sustainable Digital Backbone

India is in the middle of a rare double inflection: explosive growth in digital infrastructure and a once-in-a-century energy transition. Data centres (DCs)—from cloud regions and AI training clusters to co-locationfacilities—sit right at this intersection. The question is no longer if India can scale its data centre foot-print, but how to do it while holding the line on cost, uptime, and carbon. Recognising its strategic importance, the government has granted the sector **infrastructure status,** created a favourable policy environment, and attracted nearly **US$6.5 billion** in cumulative investments over the past decade. In the last year alone, the industry generated around **US$1.2 billion in revenue,** underscoring its potential as a driver of economic growth.

India now hosts **262 operational data centres,** ranking seventh globally—just behind France and Canada, which have 264 each. But the real story lies ahead: capacity is expected to expand from **1.4 GW in 2023 to nearly 9 GW by 2030,** making data centres one of the fastest-growing electricity consumers in the country. Their share of national power demand will rise from less than 1% today to nearly 3% by the end of the decade. Meeting this surge sustainably is both a challenge and an opportunity—one that will define how India balances digital growth with its net-zero commitments.

Powering the Digital Economy Without Compromise

The expansion of data centres is not simply about building more server racks; it is about ensuring **reliable, affordable, and low-carbon power** around the clock. Hyperscale facilities often demand 50–200 MW or more, comparable to major industrial plants. AI workloads and cloud clusters intensify this demand further, with peaky, high-density loads that must run continuously.

This creates a threefold challenge: securing assured power availability in regions with grid constraints, keeping tariffs competitive, and decarbonising rapidly to meet corporate ESG and client requirements. The sector is moving **toward hourly carbon matching** rather than annual offsets, a higher bar that requires better integration of renewables and storage.

Renewables at the Core of the Data Centre Revolution

India begins this energy transition from a position of strength. With **over 240 GW of installed renewable energy capacity** as of August 2025, it is the world's fourth-largest RE market. Its abundant solar irradiance and strong wind corridors in Gujarat, Rajasthan, Tamil Nadu, and Karnataka provide a compelling case for **Round-the-Clock (RTC) renewable power.**

Operators are increasingly signing open-access PPAs, exploring group captive models, and deploying **battery energy storage systems (BESS)** to shift solar generation into evening peaks. Emerging **Green Energy Supply Agreements (GESA)** are expected to allow real-time carbon matching, enabling facilities to operate on verifiably clean power every hour of the day rather than on annual averages.

National and State Policy Momentum

The **Draft National Data Centre & Cloud Policy (2020)** by MeitY set a clear ambition to develop energy-efficient, green, and secure data zones across the country. In **August 2025,** MeitY reopened consultations to refresh the policy, aligning it with emerging challenges such as AI-driven demand growth, state-level power coordination, and sustainable water use.

States are complementing this national push with dedicated policies:

- Karnataka offers capital subsidies, land incentives, and stamp duty waivers to attract over 200 MW of new capacity by 2025.

- Tamil Nadu provides power through TANGEDCO at industrial tariffs and offers a 100% electricity tax waiver for five years. Importantly, open-access charges are capped at 50% of conventional rates, significantly reducing the cost of sourcing renewable power.
- Uttar Pradesh has one of the most ambitious programmes, targeting 250 MW of capacity with incentives such as a 7% capital subsidy, dual-grid power supply on demand, and electricity duty exemptions for ten years.
- West Bengal aims to build a 400 MW ecosystem by 2025, offering stamp duty and registration fee exemptions along with electricity duty waivers for five years.

Private Sector and Global Players Step Up

Private investment is matching government ambition. **Reliance Jio** is developing a solar-powered data centre campus in Uttar Pradesh with an estimated **US$950 million** investment, while **AdaniConneX** is building a 1 GW renewable-powered portfolio nationwide. **CtrlS Datacentres** has implemented a building-integrated solar plant at its Mumbai site, producing roughly 1.8 million units of electricity annually. **NTT** has commissioned a 50 MW captive solar plant in Solapur, Maharashtra, to power its Mumbai operations.

Global hyperscalers are also deepening their commitment. In **July 2025, Google announced a US$6 billion plan** to develop a 1 GW data centre in Visakhapatnam, Andhra Pradesh, including **US$2 billion in dedicated renewable energy capacity—**its first such investment in India and a strong signal of confidence in the market's long-term potential.

Designing for India's Climate: Cooling, Water, and Efficiency

AI workloads are pushing rack densities to 30–80 kW and beyond, making **liquid-to-chip cooling** or immersion systems a necessity for keeping Power Usage Effectiveness (PUE) near 1.2–1.3 in India's warm climate. Water management is equally critical: many operators are turning to hybrid or dry cooling and wastewater reuse systems to minimise fresh-water draw, an increasingly important ESG metric in water-stressed regions.

Challenges: From Grid Bottlenecks to Storage Costs

The path ahead is not without hurdles. Transmission capacity and substation readiness can delay project commissioning by months. Regulatory differences between states—especially in open-access approvals, energy banking, and cross-subsidy surcharges—create uncertainty for investors.

On the technology side, even with an 80% drop in battery prices over the last decade, **utility-scale BESS remains capital-intensive.** India's lack of standardised incentives or viability-gap funding for storage projects has slowed large-scale adoption, limiting the ability to create a firm renewable baseload. Land acquisition, permitting delays, and multi-agency approvals also remain major bottlenecks, underscoring the need for a single-window clearance mechanism.

Roadmap to 2030: Building a Resilient, Low-Carbon Digital Backbone

To align nearly 9 GW of data centre capacity with India's net-zero trajectory, a clear roadmap is needed. In the **short term,** operators should lock in land with grid-ready plans, sign hybrid renewable PPAs, and deploy BESS pilots for peak shaving and outage management.

By the **mid-2020s**, data centres should source the majority of their power from RTC or firmed renewable portfolios, adopt liquid cooling for AI workloads, and disclose carbon intensity on an **hourly basis** for greater transparency. By **2030,** the goal should be to achieve **80–90% time-coincident clean power,** design campuses as microgrids with islanding capability, and cut diesel genset runtime drastically through HVO, biogas, or hydrogen-ready alternatives.

McKinsey| Powering India's digital future: the next frontier of data centres

A trillion-dollar digital economy needs a strong data backbone

India today stands at the cusp of becoming one of the world's largest digital economies. Internet penetration has already crossed 50% of the population and is projected to reach 80% by 2029. With over 850 million internet users, rapid 5G adoption, and the rise of digital public infrastructure such as UPI, Aadhaar, and ONDC, India's demand for secure, scalable, and sustainable data storage and processing is surging.

Against this backdrop, data centres (DCs) have emerged as a critical backbone for the country's Viksit Bharat ambition. India's deployed capacity stood at around 1.3 GW in 2024 with USD 8–9 billion invested and is expected to grow at ~25% CAGR to reach 5 GW by 2028. This growth trajectory positions India as one of the fastest-expanding data centre markets globally.

Drivers for India's data centre ecosystem

- **Digital consumption boom:** Cloud adoption, AI/ML workloads, connected devices, gaming, and OTT streaming are driving exponential demand for computing and storage.
- **Demographics and enterprise demand:** India's large youth population, technology start-ups, BFSI, e-commerce, and manufacturing sectors are leading adopters of digital infrastructure.
- **Favourable policy regime:** Data localisation laws, fiscal incentives (tax exemptions, subsidies, single-window clearances), and the new data privacy bill have significantly boosted investor confidence.
- **Capital inflows and partnerships:** Global majors (Equinix, Digital Realty, EdgeConneX, etc.) and Indian conglomerates (Adani, Reliance, Sify) are entering through joint ventures and acquisitions, strengthening both capacity and know-how.

Key challenges: power demand, sustainability, and capital intensity

- **Rising power requirements:** Shift towards AI/ML workload and high-performance computing is impacting the size of datacentres – these facilities are growing larger (3050 MW to 100-200 MW), thereby demanding more power.
- **Transmission & distribution constraints:** Core markets such as Navi Mumbai and Chennai are facing power transmission & distribution constraints (upgrading transformers, substation capacity, etc.) leading to delays in project completion
- **Sustainability commitments:** Hyperscalers have set ambitious 24/7 carbon-free energy targets by 2030. However, the pace of grid 'greening' in India (renewable penetration, storage integration) lags behind these expectations, creating a gap between demand and sustainability supply.
- **High capital intensity:** Capital costs remain high at INR 50–70 crore/MW while power costs constitute 50–70% of typical operating expenses of a data centre. While returns are attractive (15–17% IRR, 25–30% EBITDA for smaller players, up to 50% for larger ones), the need for scale makes access to low-cost financing critical.

A joint agenda for Government and industry

Strengthen energy and grid infrastructure

- Prioritise transmission upgrades in DC clusters such as Mumbai, Chennai, Hyderabad, and NCR.
- Create green energy corridors for data centres, ensuring reliable access to 24/7 renewable power.
- Enable open access and faster approvals for corporate PPAs to meet hyperscaler sustainability goals.

Incentivise green and efficient data centres

- Extend fiscal incentives to encourage renewable integration, storage adoption, and efficient cooling technologies.

- Introduce a Green Data Centre certification framework aligned with global best practices to incentivise early movers.

Accelerate policy support and ease of doing business

- Operationalise the draft National Data Centre Policy with clear guidelines on land use, power allocation, and single-window clearances.
- Provide concessional financing for data centre infrastructure under priority sector lending.
- Support the creation of data centre parks and SEZs in Tier-2 and Tier-3 cities to decongest existing hubs.

Foster Public–Private Partnerships (PPPs)

- Leverage partnerships to unlock capital for large-scale projects, as demonstrated by recent global JVs.
- Enable state utilities to collaborate with private players in building power and cooling infrastructure around data centre hubs.

Towards a Sustainable Digital India

India has the opportunity to leapfrog into the next era of digital infrastructure. By addressing power and sustainability challenges, accelerating regulatory clarity, and deepening public-private collaboration, India can not only meet its surging domestic digital needs but also position itself as the regional hub for sustainable, world-class data centres. The choices made today will determine whether India's data centre industry becomes merely a fast-growing sector, or a strategic pillar of the nation's economic transformation.

WORLD ENERGY COUNCIL INDIA

Deloitte | India's Data Centre Growth and Energy Transition

India's data centre industry is entering a defining decade. Rapid digitalisation, cloud computing, AI, and 5G are driving demand like never before. The country already hosts more than 150 data centres, with around 1.2 GW of installed capacity. Another 1 GW is expected by FY 2026, and total capacity could touch 4–6 GW by 2030.

Behind this digital expansion lies a massive power challenge. Data centres are energy-intensive — they need continuous, high-quality electricity for IT loads, cooling, and redundancy. India's data centre power demand, roughly 9–10 TWh in FY 2025, could grow four-fold to 35–50 TWh by 2030, which is around 1.5–2% of India's total electricity demand. Managing this energy demand surge sustainably is crucial.

Powering the digital economy

Most data centres still depend on grid electricity dominated by coal. India's grid remains about 70 % coal-based, so most data centres still run primarily on fossil electricity. That's changing quickly. The sector's renewable share (including hydro) is already climbing — currently around 20–22%, expected to reach nearly 30% by 2030.

Electricity costs make up nearly 50% of a data centre's operating expenses, so clean energy isn't just a sustainability goal, it's a cost strategy. Major players like Adani Connex, Yotta, Nxtra, and STT GDC are locking in renewable contracts to secure long-term price stability.

India's Power Usage Effectiveness (PUE) averages 1.6–1.8 today. New facilities are targeting 1.3 or better through improved cooling, liquid immersion, and AI-based operations. Efficiency gains will help, but they won't offset total consumption. The real transformation must come from how this power is generated.

Many data centre developers are exploring co-located renewable farms or group-captive structures to ensure reliable green power. Some of the leading examples include[xiv]:

- **Yotta Infrastructure sourcing** ~30 % of its power from renewables, with plans to increase this to 80% % by 2029
- **Nxtra (Airtel)** entering long-term PPAs with Ampin and Amplus for 72 MW of solar supply.
- **Microsoft** signing green PPAs with ReNew and Ampin to power Indian operations.
- **Google** contracting a solar-wind hybrid from Adani Green's Khavda park in Gujarat (from 2025).
- **Adani Connex** planning 100 % renewable-powered data centres across its portfolio.
- **CtrlS** aims to achieve 100% renewable energy use by 2030

Regional hotspots and demand drivers

Data centre development is expanding from metros to a wider geography. Mumbai remains India's largest hub, thanks to cable landing stations and robust infrastructure. Chennai, Hyderabad, Bengaluru, and Delhi NCR follow close behind, with Ahmedabad, Kochi, Visakhapatnam, and Jaipur emerging as next-wave sites.

Hub	Strengths & Drivers
Mumbai	• India's largest DC hub (~45–50% of total capacity) • Proximity to multiple international submarine cable landing stations • Mature infrastructure with reliable power, land, and connectivity • Favourable state incentives (MIDC zones, power tariff subsidies)
Chennai	• Rising hub for SaaS, manufacturing IT, and fintech • Increasing hyperscaler interest due to coastal access and better undersea cable connectivity
Hyderabad	• Fast-emerging Tier-1 market • Strong IT/ITES base (HITEC City, Cyberabad) • Telangana's proactive data centre policy with land and power incentives
Bangalore	• Robust software and startup ecosystem • High-density AI/ML and enterprise cloud workload zone
DelhiNCR	• Strong base for public sector, government cloud, and fintech demand • Proximity to regulatory agencies and PSUs • High demand from north-based enterprises • Uttar Pradesh DC policy with capital and power subsidies
Emerging cities (Ahmedabad, Visakhapatnam, Kochi, Jaipur, Bhubaneswar)	• Driven by 5G roll-out and edge computing requirements • Focus on low-latency data for smart cities, EV infrastructure, and public services • Incentivized by regional governments to decentralize digital infra

The drivers are clear:

- AI and cloud workloads needing local compute power.
- 5G and IoT pushing low-latency edge data centres in Tier II/III cities.
- Fintech, BFSI, and public-sector digital platforms demanding domestic data localisation.
- Strong policy support from state governments offering power and land incentives.

This shift is turning data centres into an important anchor load for India's electricity system — predictable, high-quality demand that can enable more renewable integration if planned smartly.

Opportunities and challenges ahead

The next phase of India's data centre journey will depend on energy strategy and infrastructure readiness. To stay ahead, developers and policymakers need to align on a few priorities:

- Expand grid and transmission capacity near data centre clusters.

- Streamline open-access rules for renewable sourcing across states.
- Promote energy-storage adoption for 24/7 green power.
- Modernise backup solutions, moving away from diesel.
- Create uniform benchmarks for green data centre design and reporting.

The industry is at a point where energy planning and data infrastructure planning must go hand in hand. Without it, rising digital demand could strain both the grid and the climate agenda.

Looking ahead

India’s data centre industry is not just a story of digital infrastructure, it’s a test of how fast we can balance growth with responsible energy use. If the current momentum continues, data centres could become models of sustainable industrial energy consumption, running largely on renewables, backed by smart storage and efficient cooling.

The path ahead is clear:

- Scale renewables in sync with data capacity.
- Build stronger grid and policy frameworks. Establish a national policy providing fiscal incentives for usage of renewable energy for data centres
- Standardise the state-level banking policies for use of renewable energy to enable data centres to capitalise on it
- Treat every megawatt of new IT load as an opportunity to add clean energy to the system.

The country’s focus on renewable energy, combined with substantial investments in sustainability, aligns with the global trend towards energy-efficient data centres. India's strategic geographical location also allows it to serve domestic and regional South Asian markets effectively, positioning it as a critical node in the global data centre ecosystem. These factors collectively make India a hotspot for AI-powered data centre development in the coming years.predictable, high-quality demand that can enable more renewable integration if planned smartly.

Kearney| India's Data Centre Demand Outlook (2025–2030)

1. Introduction: A Digital Giant with Infrastructure Deficit

India sits at the epicentre of the global digital economy. With over **820 million internet users** and average monthly consumption of **~29 GB per user,** India is one of the world's largest data generators. Monthly mobile data traffic is **~26 exabytes,** nearly equal to China, and far ahead of the US (~10 EB) and EU (~17 EB).

Yet, India's hosting capacity lags far behind:

- **India:** ~1 MW of installed IT load per million users (~0.8 watts per person).
- **China:** ~4 MW per million users (~4 watts per person).
- **European Union:** ~12 MW per million users (>10 watts per person).

This mismatch is stark: Despite India's high user base and usage, it accounts for **just ~1% of global DC capacity.** Closing this gap is not just desirable – it is essential to support India's $1 trillion digital economy ambition by 2030.

2. Demand Drivers: What Will Unlock India's DC Growth?

India's demand for data centres is projected to rise from **~1.4 GW in 2024 to 5–7 GW by 2030.** To contextualize the scale of the opportunity, if India were to merely close the per-capita gap with China, it would already require ~5–6 GW of installed capacity. Reaching European levels of DC availability would push this requirement to nearly ~18 GW — more than 10x today's base. In other words, the 5–7 GW target for 2030 is not an aspirational ceiling, but rather the bare minimum needed for India to converge with global peers.

Five reinforcing factors will power this surge:0

2.1 Consumption at Scale

With **820 million internet users and 1.2 billion mobile connections,** India already consumes nearly **29 GB per user per month,** at among the highest levels worldwide. Payments platforms like **UPI now process more than 400 million transactions daily,** while the explosive growth of **social media, OTT video, e-commerce, and online gaming** is accelerating the need for **low-latency, high-capacity infrastructure.** This intensity of usage ensures that demand for compute capacity will rise structurally, independent of policy shifts.

2.2 Need for Speed: Edge Computing and 5G

The rollout of **5G networks** and the rapid proliferation of **IoT applications** are driving demand for **ultra-low latency infrastructure.** This shift is catalyzing interest in **Tier-II and Tier-III cities,** where edge data centres are emerging to complement the large metro hubs of Mumbai, Chennai, and Hyderabad.

2.3. Data Localization and Regulation

India's regulatory framework is already shaping a base level of demand. For instance, the RBI mandates that financial data be stored domestically, while the DoT applies similar rules for telecom data. As a result, financial institutions and telecom operators are among the largest users of data centres today, creating a structural base load even before consumer or AI workloads are considered.

Building on this, the **Digital Personal Data Protection Act (DPDPA 2023)** empowers the government to require sensitive personal data to be stored in India. Though not a blanket localization rule, its enforcement strength across sectors like e-commerce and social media will be pivotal. Limited enforcement would keep India closer to the **5 GW baseline,** while broader or stricter mandates could push requirements up to or beyond the **7 GW ceiling.**

A useful comparison is EU's GDPR, which restricts the transfer of personal data outside the EU except under stringent safeguards. If India were to adopt a similarly strict framework, it would effectively mandate that all categories of consumer and enterprise data be stored within national borders, significantly amplifying domestic demand and pushing scenarios well above 7 GW. Hence, the extent to which data protection laws are strengthened and implemented will directly shape overall demand.

2.4 AI Workloads

The adoption of artificial intelligence is adding a new dimension to data centre demand. **Inference workloads** are already being hosted domestically, driving the need for high-density racks and GPU-ready infrastructure. **Training workloads,** however, remain largely offshore due to their compute intensity. If these were to shift onshore, they could push India's demand **well beyond the 7 GW high case**. As a result, facilities that are AI-ready and GPU-optimized will not only capture premium pricing but also enjoy stronger tenant stickiness.

2.5 India for the World – Deliver a Cost Advantage

India's cost competitiveness is a major differentiator. **Build costs average USD 6–10M per MW**, compared to USD 12–15M in Singapore and USD 10–12M in Europe, while **energy and land costs are also lower relative to peers.** In addition, **supportive state and central government policies, like tax incentives and data centre park initiatives are providing further thrust to the sector,** improving project viability and attracting global investors. This combination makes India attractive not just for domestic hosting but also as a **regional hub,** potentially absorbing spillover from constrained hubs like Singapore.

3. Demand Scenarios to 2030

Three broad scenarios capture the possible pathways for India's demand:

- **Base Case (5–7 GW):** This assumes continued growth in usage at ~20% CAGR, demand for low latency DC capacity, and moderate enforcement of the DPDPA. It reflects India gradually closing the DC capacity gap with peers (i.e., catching up to China's current per capita penetration) but still operating below global benchmarks.
- **Downside (<5 GW):** This scenario may materialize if policy clarity is delayed, or if policy guidelines or its enforcement is weak. In such a case, enterprises could continue to host workloads offshore in Singapore or in the Middle East, restricting domestic demand below 5 GW. This scenario may also not manifest if usage doesn't grow at the expected CAGR or ~20%.
- **Upside (>7 GW):** Stricter localization (extending to consumer and social media data), onshoring of AI training workloads, or APAC capacity reallocation could push India well above 7 GW. In this case, India would move beyond catch-up and begin to position itself as a true regional hub.

In summary, India's demand outlook is anchored in a base case of 5–7 GW by 2030, with the eventual outcome shaped by continuation of data usage, the strength of regulatory enforcement, and the pace of AI adoption. The range of possibilities reflects a simple reality: India's digital intensity ensures that demand growth is inevitable, but the degree of enforcement and acceleration will determine how fast the curve bends.

4. Supply: If Demand is Inevitable, Can Supply Keep Pace?

The demand side of India's data centre story is no longer in doubt. Whether the market lands closer to 5 GW or well beyond 7 GW by 2030, the direction is clear: demand will continue to rise. The real question now is whether supply can scale quickly enough to match this trajectory. To close the gap, India's data centre buildout must overcome structural challenges and deliver at speed. This will require progress across four imperatives:

1. **Power & Energy Sustainability**

   Data centres are energy intensive. By 2030, their share of India's total electricity demand could rise from ~0.5% today to nearly 3%. Ensuring renewable power supply, grid stability, and cost efficiency is critical.

2. Land & Infrastructure

Securing large land parcels with reliable connectivity remains a challenge in urban hubs. Delays in ap provals and high real estate costs can constrain capacity additions. Additionally, robust fiber and subsea connectivity, and high-capacity transmission corridors to major hubs (domestic & international) is crucial.

3. Policy & Regulation

While the government has announced supportive policies, clarity on taxation, localization criteria and its enforcement – cross-border data flows, incentives for tier-II/III city deployments, and environmental standards remains a work in progress.

4. Skilled Workforce & Technology

Operating hyperscale, AI-ready data centres requires specialized engineering and operationalexpertise, which is still scarce in India.

5. Conclusion & Implications

India's data centre industry is at an inflection point. From **~1.4 GW in 2024, capacity is set to rise to 5–7 GW by 2030,** with upside beyond that if AI and localization accelerate.

- **For Operators:** Prioritize **AI-ready, renewable-backed builds** and **expand footprints beyond current large DC hubs.** Critical to ensure timely access to equipment to ensure that capacity comes online on time.
- **For Financial Investors:** Anchor capital behind proven developers; pre-commit with hyperscalers to de-risk. With fewer quality assets available and **valuations already elevated,** having a **robust business case** to underwrite those valuations is critical.
- **For Customers:** Enterprises need a clear **data centre strategy.** This includes defining **what type of facility they require** (Tier III vs. Tier IV), the **attributes they prioritize** (on-premises vs. cloud, green power, low latency, privacy compliance, cost efficiency), and the **kind of partners** they want to work with. Aligning these choices with evolving privacy laws and sustainability expectations will be central to long-term resilience.
- **For Government:** Provide regulatory clarity, accelerate renewable integration, and enable metro plus edge buildout.

India is **data-centre starved** today, but the opportunity is clear: if supply keeps pace, India could evolve into **Asia's next digital infrastructure hub,** capturing not just domestic but regional demand.

Techno| Data Centres : Foundation of the Digital Age

The Global Story

Data centres — once modest server rooms tucked away in office basements — have evolved into the critical infrastructure powering today's digital economy. Over the past decade, demand has exploded with the rise of cloud computing, streaming, IoT, big data, and AI. Hyperscale operators like AWS, Microsoft Azure, Google Cloud, and Alibaba have reshaped the industry with massive campuses optimized for efficiency, density, and sustainability.

While North America, Europe, and East Asia have matured markets, the next frontier of growth lies in emerging economies. And at the centre of that conversation today is **India.**

India's Data Centre Journey

India's progress in this space has been rapid, though it started relatively late compared to Western markets. In the early 2010s, most enterprises still relied on overseas data storage. But by the mid-2010s, several forces converged: the government's Digital India push, skyrocketing smartphone penetration, booming internet adoption, and growing regulatory requirements for local data storage.

The numbers tell the story. Installed capacity has grown from about **307 MW in 2018 to 1,263 MW in 2025 —** a fourfold increase in just seven years. By 2030, India is projected to cross **4.5–5 GW,** requiring an investment of up to **USD 22 billion.** Edge data centres are also scaling fast, with capacity expected to triple by 2027.

Geographically, the market is concentrated in **Mumbai (41 %), Chennai (23 %),** and **Delhi-NCR (14 %).** But the next phase of growth will inevitably expand into Tier II and Tier III cities.

Yet, despite this momentum, India still accounts for only **3 % of global capacity,** even though it generates nearly **20 % of the world's data.** Not only this, but it also leads in per-capita data consumption: at roughly **32 GB per person per month,** India is ahead of **China's ~29 GB and the USA's ~22 GB.** Bridging this gap is both a strategic necessity and an economic opportunity

Growth Drivers

Several demand-side tailwinds are propelling India's Data Centre boom:

- **Regulation & localization:** Laws mandating domestic data storage are pushing enterprises to host workloads within India.
- **Artificial Intelligence:** AI is driving a massive transformation in the data centre industry, demanding higher power, faster connectivity, and advanced cooling for AI workloads. As India's AI ecosystem expands, the need for AI-ready, sustainable infrastructure — from hyperscale to regional edge data centres — is rapidly accelerating. |
- **Global hyperscaler investment:** When the giants commit capital, they bring ecosystems of vendors, supply chains, and skills along with them.
- **Enterprise digitization:** Businesses across finance, healthcare, retail, and government are accelerating cloud migration and IT modernization.
- **Emerging tech:** AI/ML workloads, IoT, Web3, and real-time analytics are resource-intensive and favor large, resilient facilities.
- **Streaming, gaming, and AR/VR:** Heavy content delivery needs more distributed caching and reliable low-latency infrastructure.
- **5G rollouts:** With exponentially higher speeds and lower latency, 5G will require edge infrastructure to support real-time applications.

Energy and Power Challenges on the Road Ahead
Despite the optimism, India's data centre journey faces serious hurdles:

Available Peak Demand Capacity in Tier 1 Cities
Many data centres are in major metros (Tier 1 cities) where power grids are already stressed.

For instance, Mumbai s peak demand has been reported around ~4,500 MW. In such a scenario, if data centres already consume ~ 400 MW, that is close to ~9–10 % of total consumption — though this specific ratio should be treated with caution.

It is estimated by 2030 Mumbai s peak demand capacity will touch ~8,000 MW, and with planned and announced capacity of ~3,200 MW of data centres, we may safely assume a consumption of ~2,400 MW, that entails to 30% of peak capacity being choked by data centres or in other words, 1 in 3 electricity units in Mumbai will be consumed by data centres.

Demand Charges
Many data centre projects request high capacity (say 100 MW) but often begin by commissioning only 5–10 MW initially and expanding over 5–7 years. This "phased growth" is prudent but complicates grid planning— upgrades to substations and transmission lines often must be built in advance, raising capital costs.

Many operators overstate power draw (demand capacity) to ensure access to higher voltage feed (e.g. 220–400 kV instead of 33 kV). But that leads to paying for "demand charges" even if actual consumption is far lower. This mismatches capacity reservations and actual usage, leading to waste. Because demand charges or capacity payments are often fixed regardless of utilization, data centres end up bearing higher costs than justified, hurting economics. In many states, electricity duties, cess, surcharges and other levies add further costs, eroding the proposition of low tariffs. Battery energy storage systems (BESS) or large on-site energy storage require sizable real estate, which is tough to find in Tier I cities.

Sustainability: The Strategic Imperative
Data Centres being power guzzling should endeavour Carbon Zero in their operations. Located at densely populated areas of Tier 1 city, makes it impossible to develop on-site renewable energy and Battery Energy Storage System (BESS).

For Instance, providing sustainable source of renewable energy to ensure Carbon Zero in the operations of Data Centre requires 1200 Acres of On-site solar and additionally ~600 to 960 containers for 12-hour battery energy storage system on 20 Acres of land.

With ~625 MW of installed Data Centre capacity in Mumbai, the diesel backup fleet alone for data centres is ~800 MW – that's about 50% of the city s in-house generation capacity.

Now imagine load shedding or a grid failure – and nearly a gigawatt of DG s roaring to life inside Mumbai. By 2030, the DG capacity will touch ~2,400 MW, that is more than double of city s in-house generation capacity and the chaos is left to imagination.

The above challenges are not limited to Mumbai but every Tier 1 city, whether it is Mumbai, Chennai, Delhi NCR, Hyderabad, Bangalore, Kolkata, Pune or any other major destination for data centre development.

The Roadmap for India
For India to transform into a true global data hub, several strategic shifts are essential:

1. **Incentivise Development Closer to Generation -** Locating data centres near energy generation hubs — like renewable parks and transmission corridors — can cut power losses, ease grid stress, and lower costs.

For instance, India s largest RE park (30 GW) at Khavda, Gujarat, and another at Bhadla, Rajasthan, require HVDC systems costing about ₹2/unit to transfer power. Building data centres near such RE clusters, instead of distant load centres, would enable efficient utilization of cheaper renewable energy and support India s green energy goals.

2. **Promote Tier II/III Developmen**t – India's data centre growth must move beyond Tier I metros facing land and power constraints. Expanding into Tier II and III cities like Pune, Kochi, Indore, and Jaipur can lower costs, tap renewable corridors, and boost local jobs — creating balanced, sustainable digital infrastructure across the country.

3. **Strengthen Power Partnerships –** Early coordination between data centre developers, DISCOMs, and state utilities can prevent capacity bottlenecks and enable efficient renewable integration. Aligning project timelines and offering flexible tariffs will ensure grid stability — making public–private collaboration key to building India's energy-secure digital future.

4. **Waiver of Demand Charges –** Reforming demand charges can unlock major efficiency gains for India's data centre sector. Linking charges to phased usage instead of reserved capacity would cut costs, free up grid resources, and enable modular scaling — allowing developers to reinvest in innovation, renewables, and sustainability.

5. **Policy Clarity –** India needs a unified national data centre policy to replace today's fragmented regulations. A clear framework on land use, taxation, power, and compliance will streamline approvals, attract global investors, and position India as a trusted hub for secure, sustainable digital infrastructure.

September 2025

Bain | Perspectives on India Data Center Market

Summary takeaways on India data center market

- **The 3P data center market in India is 1100 MW+ currently (demand served)** but expected to reach 4.7GW+ by 2030, implying a CAGR of 22-25% over the next 5-6 years, with hyperscalers continuing to contribute almost 60-70% of the total market
- While **the current market comprises of 5-6 key players (NTT, Sify, Ctrl S, STT, Nxtra, Yotta),** there is significant investment underway in this space esp. from Indian conglomerates – with total capacity planned being 6000 MW+ (1500 MW+ already live/ under construction, 1700+ MW committed and another 3300 MW in early stage)
- The market, while **continuing to expand within metros, is expected to see emergence** of newer edge centers (as hyperscalers try to move closer to customers) and a shift in nature of workloads towards AI;
- Growth in AI workloads will need a significant rethink by CoLo providers both in terms of the **infra requirements this poses** (power, land, infra, cooling) **and offerings (going beyond rental** / power supply) **which provides ample opportunity for disruption in this space**

- **From a critical infra standpoint, power remains a top challenge for data center operators due to several considerations** – a) power contributes to 60% of opex, b) increased need for power due to AI workloads (rack densities increasing from 40kW to 150kW+), c) high wait time to get power from utilities
- **As a response to this, we see several trends emerging within the power infra landscape (opex, capex):**
  - Pivot towards more renewables driven by cost & regulatory considerations
  - Setting up of microgrids / onsite power generation to reduce time to operationalize data centers
  - Integration of battery energy storage systems (BESS) to act as a source of backup, manage peak loads, and store power generated onsite (esp. from renewables)
- **There is a fundamental need to think of policy implications to encourage green DCs** – which includes improving energy efficiency, increasing reliance on renewable sources, along with interventions to reduce waste / water usage. Some policy measures focused on power include – i) **providing DC operators access to emerging carbon trading market**, ii) direct green power purchase agreements (PPAs), and **iii) capex / tax incentives for purchase of renewable equipment & batteries for DC operators**

- This document **outlines our (evolving) point of view on the current data center demand and supply landscape** – along with evolving need for power (capex/ opex), and need for policy interventions to be thought of to incentivize the move towards green DCs

AGENDA

Outlook on demand – customers, workloads

Supply overview – key players, capacity, locations

Deep dive on critical DC infra, esp. power

Green data centers – and policy implications

Context: Global tech themes are driving accelerating demand for data centers

Growing need for data centers

DCs provide orgs with a variety of different functions that range in complexity

1 Data storage & management

Storing and organizing enterprise data, incl. structured and unstructured data

2 DATA process-sing & Analysis

Running algorithms and calculations on data

3 Cloud services

Offering on-demand access to computing resources, storage, etc

4 Backup & disaster recovery

Ensuring data resilience and minimizing downtime through data backup

5 High perform-ance computing

Providing computational power for compute-intensive tasks

6 Ai training & machine learning

Training AI/ ML models on large datasets for applications like NLP

Emerging trends

Global technology themes are driving accelerating demand for data centers

Historical drivers of data center growth

1. Increased data generation and service usage
2. Demand for cloud- based products (SaaS, Paas, IaaS)
3. Migration to cloud-based models vs on-premise
4. Rise of 'Sovereign cloud'

Upcoming trends

1. **AI/ ML adoption, particularly GenAI**
   Need for 1 GW+ data centers vs 50-200 MW today due to higher computing power and cooling infra required
2. **Shift to Green Data Centers**
   DCs account for >2% of total global emissions leading to shift to Green DCs, driven by government push, growing awareness among clients, and strong ROI

Value chain: The data center value chain is complex with a wide range of players

EXAMPLES

Data Center Operators

Hyperscalers: Google Cloud, aws, Microsoft Azure

Co-locators: STTelemedia, NTT DATA, CtrlS, nxtra by airtel, sify

Enterprises: HDFC BANK, kotak Kotak Mahindra Bank, SBI, Infosys, wipro, Flipkart, DREAM11

SUPPLY DATA CENTER CAPACITY DEMAND

Data Center Suppliers

Advisory services (incl. Land acq. etc.): CUSHMAN & WAKEFIELD, CBRE, ARUP, Knight Frank

EPC / Project Management: AECOM, Shapoorji Pallonji, LARSEN & TOUBRO, BECHTEL, DSCO group, STERLING & WILSON, Turner & Townsend

Electricity, Cooling & Non-IT Infra: Schneider Electric, HITACHI, SIEMENS, DELTA, VERTIV, ABB, Sigma Byte, Wireworks

Semicon and other IT infra: NVIDIA, intel, AMD, CISCO, sonepar India, NOKIA, Juniper NETWORKS, SAMSUNG, DELL

Telecommunication Services: airtel, Jio, BSNL, Vi, TATA COMMUNICATIONS

Ops and Management (IT Services players): tcs TATA CONSULTANCY SERVICES, wipro, HCL, Infosys, Tech Mahindra, cognizant

INVEST IN DC ECOSYSTEM

Data Center Investors

adani, Reliance Industries Limited, Brookfield, The Carlyle Group, Blackstone, Cisco investments, SBI, Fidelity Investments

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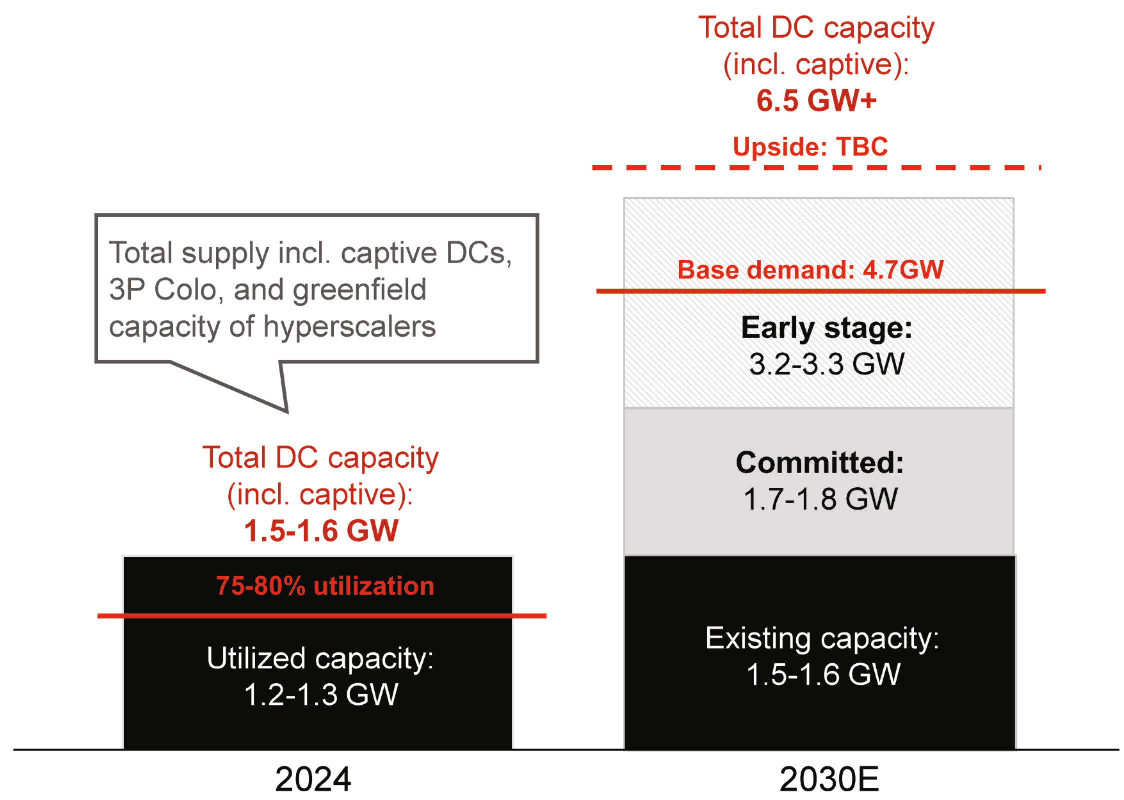
India DC market overview: India data center market is expected to grow by 4-5X of current size driven by several tailwinds

PRELIMINARY

India DC market to grow 3-4x by 2030…



…Driven by several factors

Rising adoption of cloud and AI

- **Public cloud market** to grow at **CAGR 20-25%** from 2023-27 with investment **commitments from AWS, Microsoft, Google** in budling DC to support enterprise demands
- India's **GenAI market** to accelerate at **CAGR 25-35%** from 2023-30 leading to **strong DC demand for AI workloads**

Higher data consumption

- **Increase in data consumption / computation heavy use-cases** across industries such as BFSI, Media, Healthcare
- **Rollout of 5G** enabling high speed, low latency applications (e.g., OTT streaming, gaming, etc.)

Regulations favoring data localization

- **Digital Personal Data Protection Act** (DPDP) 2023, **mandating digital storage** and processing of all PII to be within India – across industries esp. BFSI, Healthcare, Consumer
- **SEBI 2023 framework for regulated entities** – to store and process all data within India
- **Sustainability targets** for enterprise to be met by enterprises via outsourcing DC services

Note: Total DC market includes captive consumption (20% currently) and 100-150MW greenfield of hyperscalers;
Source: JLL - Booming Data Centre Industry in India A Golden Opportunity, IDC, CBRE, Market participants, Lit search

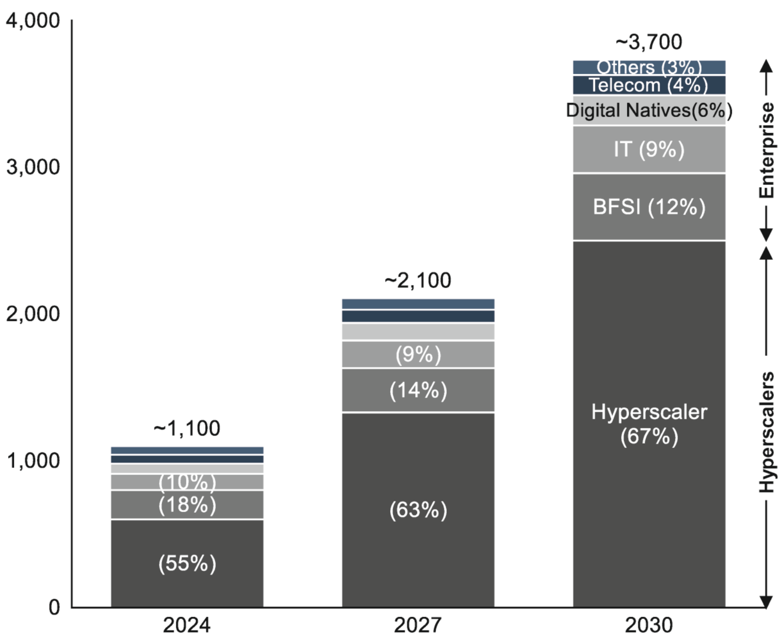
WORLD ENERGY COUNCIL INDIA

3P data center market: 3P CoLo market ~1100MW with Hyperscalers comprising 60-70% of total demand; To continue to be the fastest growing segment

PRELIMINARY

Demand likely to grow by 20-25%

India 3P Served Demand - excludes greenfield (in MW)



Note: Digital native players include Ecommerce and Media players; Hyperscaler include self-owned and leased capacity
Source: JLL - Booming Data Centre Industry in India A Golden Opportunity, IDC, CBRE, Market participants, Lit search,

Key drivers

Hyperscalers

- **Increasing adoption of public cloud**, esp. since it is more cost effective for AI
- **Move of hyperscaler workloads from Singapore / US to India** to due to localization needs
- **Digital transformation** resulting in more compute
- **Note: limited threat from greenfield DCs;** Land parcels being purchased by hyperscalers (2-3x RoI vs. renting), however, permits, lack of robust vendor ecosystem, power supply challenges continue to make CoLo relevant

BFSI

- **Digital Personal Data Protection Act (DPDPA)** resulting in need for data localization
- Growth in **overall volume of data**
- **Higher outsourcing given** DC management not core for a bank

IT / ITeS

- **More E2E apps and infra deals for** global customers– buying colo / hosting space in India for cost saving
- **Lift and shift of workloads of Indian clients** from captive DCs to CoLos

Digital natives

- Relatively slower growth of CoLo market due **to move to public cloud**

Healthcare

- Gradually **moving from on prem to colo model** - investment by colo players in HIPAA compliance

Demand deep dive – by customer segment

Hyperscalers demand

Enterprise customer demand

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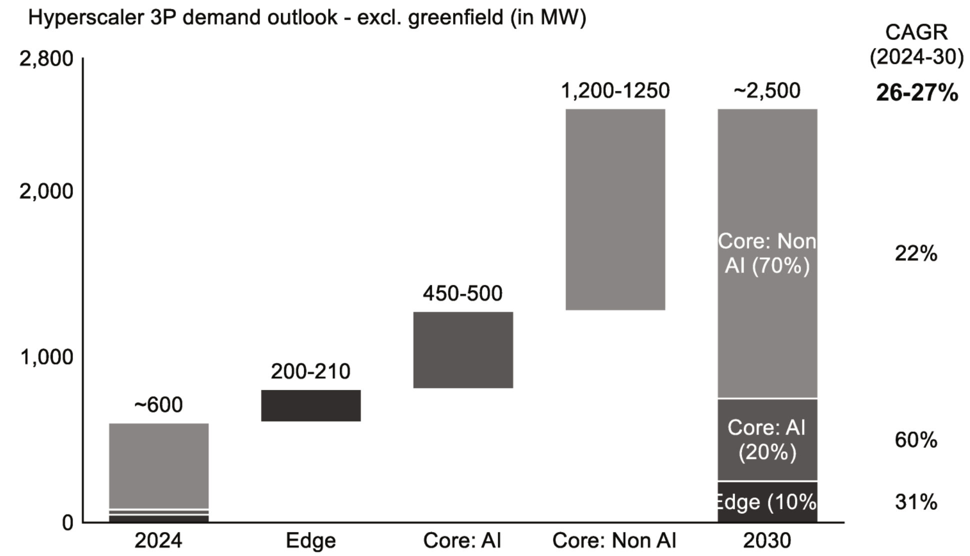
Hyperscalers market overview: While hyperscalers are expanding capacity for AI workloads, non- AI core also growing due to adoption of public cloud

PRELIMINARY

Hyperscaler workloads for 3P DC



Greenfield %	20%	30-40%

aws
- 40-50% share, i.e., 350MW + capacity, incl. 100MW greenfield
- Greenfield expansion in core (Mumbai, Hyd)

Azure
- ~200 MW capacity (25-30%) currently all CoLo
- Greenfield expansions in Hyd, Pune planned

Google Cloud
- Smallest currently, with 100-150 MW capacity, all CoLo
- Greenfield expansions planned in Mumbai, NCR

Key drivers

Edge
- **Edge locations to be added** as hyperscalers aim to reduce latency for customers
- **To grow broadly at same rate as** overall capacity addition; not differential focus area given current investments in AI

AI
- **AI workloads expected to be 15-20%** of total workloads (from <5% currently)
- **Given demand uncertainty,** hyperscalers investing in making AI ready infrastructure which can accommodate high density racks (i.e., power, cooling, building standards needed to run high compute, dense racks)

Sovereign – *not current focus*
- **Sovereign cloud (i.e., private cloud for public** sector clients) not a priority currently in India –
- **Most govt. entities prefer captive, o**n prem data centers

Source: JLL - Booming Data Centre Industry in India A Golden Opportunity, IDC, Market participants, Lit search

What customers need:
Key pain points of hyperscalers and potential avenues to differentiate

PRELIMINARY

What hyperscalers are looking for

- **Managing complex requirements for monitoring of AI workloads**

"Monitoring of AI workloads has a lot more complexity – these high density racks have multiple sensors and need a much lower response time even for L1-L2-L3 troubleshooting of physical hardware, which in turn implies there is need for automation. In addition to this, mgmt of an AI workload needs overall support beyond the infra layer all the way to the service (S3 / EC2), platform (Bedrock), and application layer for which we rely on GSIs"

AWS

- **Support in design / architecture of AI data centers**

"Hyperscalers till now have been very prescriptive in terms of the exact design for their data centers. However, AI data centers typically have different design needs to ensure high GPU utilization, PUE optimization etc."

Google

- **Development of industry specific use cases on top of the GenAI platform of hyperscalers** (e.g., Bedrock, Vertex)

"All hyperscalers are already trying to figure implications of high density / high compute on their core products (e.g., database architecture needed to support caching needs), however we need partners who could develop solutions on top of our platforms"

AWS

Potential differentiators for a CoLo player

1 Advanced monitoring services for AI workloads

- **Advanced managed services solving specific challenges** associated with AI workloads, incl. latency, availability, security
- **To also be enabled with AI** for self resolution, predictive maintenance

2 Advisory & project mgmt services for AI data centers

- Initial architecture (network topology etc.), design optimization for low latency, energy efficiency etc.
- Management of 3P infra / network providers
- Consulting on local data laws & regulatory requirements

3 Vertical specific use case development *– via digital services business arm or SI partnerships*

- Development of vertical specific AI use cases, with a specific focus **on i) edge AI use cases, ii) agentic AI use cases**
  - Agentic use cases- e.g., in banking, insurance, healthcare for customer support
  - Edge use cases in manufacturing / med devices segment

Note: PUE – Power Usage Effectiveness;
Source: Market participant interviews

Location preferences: From a location standpoint, hyperscalers continuing to double down on metros – with several cities expanding as edge locations

PRELIMINARY

- Hyperscalers typically **have 2-3 core locations, with several others as edge for** local processing / caching for lower latency
- Mostly **edge centers set up where end customer** is, via CoLo - relatively less strategic, smaller (each 300-400 kW up to 1 MW)

Preferred location		AWS		Azure		GCP	
		Current	Future	Current	Future	Current	Future
Metros	**Mumbai**	Core: customer proximity	Core: continue expansion in core	Core: Landing zone for cable	Core: continue expansion in core	Core: customer proximity	Core: continue expansion in core
	NCR	Edge location	Edge: additional focus	Edge location		Core: customer proximity	Core: continue expansion in core
	Bangalore	Edge location					
	Chennai	Edge location		Core: Landing zone for SE Asia cable; local customers	Core: continue expansion in core	Edge location	
	Hyderabad	Core: Talent availability, subsidies	Core: continue expansion in core	Edge location	Core: subsidies from govt, main dev center	Edge location	Core: likely to invest in location
Tier 2	**Jaipur**	Edge location	Edge: additional focus			Edge location	
	Lucknow	Edge location	Edge: additional focus			Edge location	
	Kochi		Edge: additional focus				
	Ahmedabad	Edge location				Edge location	
	Pune	Edge location		Core: proximity to customers (Azure services launched from Pune)	Core: continue expansion in core	Edge location	
	Kolkata	Edge location				Edge location	Edge: additional focus
	Bhopal		Edge: additional focus				
	Chandigarh		Edge: additional focus				
	Coimbatore		Edge: additional focus				

Demand deep dive – by customer segment

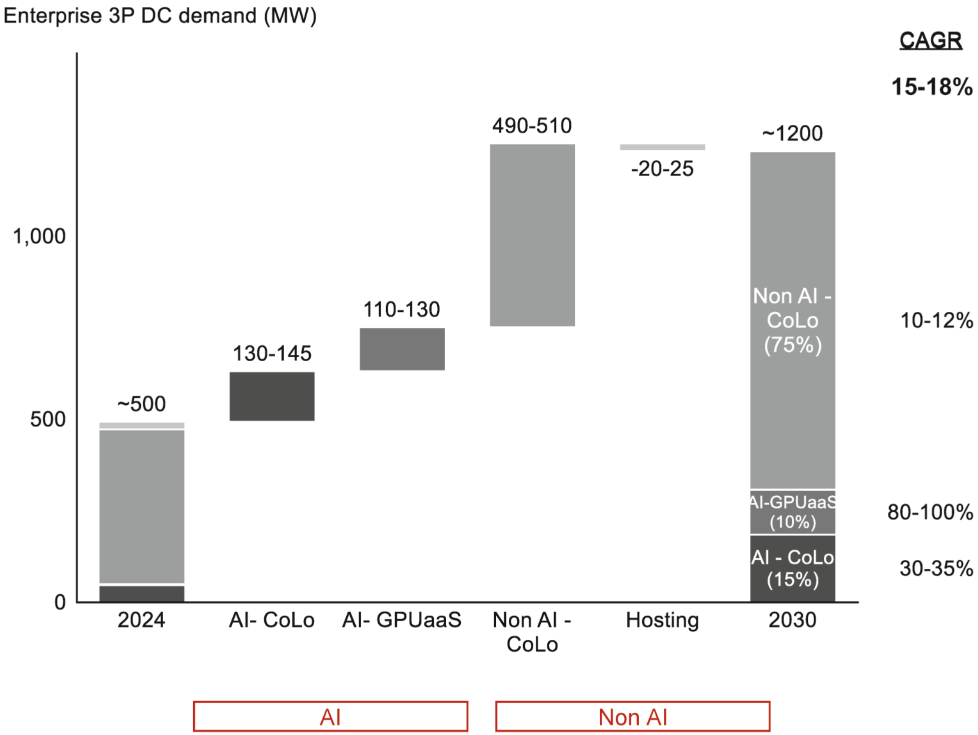
Hyperscalers demand

Enterprise customer demand

Enterprise market overview: Most growth in enterprise demand is from increasing data and need for outsourcing – AI to also contribute to significant share

PRELIMINARY

Enterprise workloads for 3P DC



Source: IDC, JLL - Booming Data Centre Industry in India A Golden Opportunity; NASSCOM, CBRE; market participant interviews

Key drivers

AI workloads

GPUaaS / AI Cloud

- Need for GPU on 'as-a-service' model for AI workloads
- Several players already entering into partnerships with NVIDIA (e.g., Digital Connexion, Yotta, NTT Data, CtrlS)

CoLo

- Includes growth of CPU powered AI workloads – mostly being run on a CoLo model

Non-AI workloads

Hosting

- Dedicated hosting declining business – have higher lock in resulting in customer preference shifting towards public cloud

CoLo

- Growth of non AI workloads continue to be bulk of the workloads - with growth driven by increasing compute / storage needs, and outsourcing of captive DC (e.g., BFSI, HC)

What customers need (1/2):
Key pain points of enterprise customers and potential avenues to differentiate

PRELIMINARY

What enterprises are looking for

AI related

- **Procurement of GPUs from NVIDIA for AI model grounding**

"Procurement of GPUs on our own, esp. when these are in acute shortage is a challenge. Hence, we would truly value a model where our co lo provider also has the sourcing engine for GPUs"

EVP, Kotak Mahindra Bank

- **Optimizing cost of operations of AI-powered DCs,** which need to run at high utilization to be cost efficient

"Managing GPU infrastructure for a bank is a costly and complex process, requiring significant investment with low yield especially during initial phases of deployment where AI workloads will be limited"

Head Data Center Operations, HDFC Bank

Others

- **Vertical specific tech stack, customized to need of the enterprise on a "as-a-service" model**

"Industry solutions built with the right vertical ISV partners (enterprise solutions, and delivered on an as-a-service model with end to end SLAs) can be a real differentiator."

VP, Products, Axis Bank

Source: Market participant interviews

Potential differentiators for a CoLo player

1 AI Cloud: E2E lifecycle of AI apps (buy, build, train, provision, monitor)

Example(s) YOTTA — Several AI focused solutions incl. GPUaaS, AI workspace as service (with dev tools), inferencing as service (via API endpoints, serverless)

2 Implementation / managed services of AI data centers

Migration services and lifecycle management for workloads run in AI data centers

3 Vertical specific, DC-as-a-service model combining compute, storage, apps as a service

Example(s):

CtrlS
- **Bank-in-a-box for running core banking** applications
  - Core apps (FIS, Finacle) provided on as-a-service model combining apps and infra hardware

YOTTA YottaPlex
- **YottaPlex OTT as a service:** E2E cloud-based over-the-top (OTT) content delivery

What customers need (2/2):
Key pain points of enterprise customers and potential avenues to differentiate

PRELIMINARY

What enterprises are looking for

Others

- **Real-time asset monitoring and on-demand reporting of data center metrics (e.g., SLA adherence) with single dashboard**

"... My team has to sit with all of our three colocation service vendors, gather monthly MIS reports from them in excel format, and then standardize them for processing by other teams (e.g., energy insights for ESG team)..... These vendors also do not share any insights on energy efficiency & space optimization unless explicitly asked "

VP, Global Procurement, Kotak Mahindra Bank

- **Capacity planning advisory services & tools in partnership with SI**

" Today, data center capacity planning is done manually. I have less visibility on my requirements say four or three years down the line.... I depend on individual function owners from server, storage, and network teams to give me an estimate and then need to reconcile these inputs, which is a time-consuming exercise"

Former EVP, Kotak Mahindra Bank

Potential differentiators for a CoLo player

4 AI enabled data center operations management

Example(s): nxtra by airtel

Offers AI-powered SmartSense platform with smart capabilities such as predictive maintenance, fault detection & diagnostics, streamlined automation of operations, and optimized capex utilization to improve asset life span and reduce power consumption

5 Capacity planning advisory services & tools in partnership with SI

- Assessment of current data estate and forecasting of resource requirements (servers, network devices, storage) both for AI and non-AI workloads
- Scenario analysis for cost estimation & optimization

Source: Market participant interviews

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Location preferences: Enterprises prefer metros because of perceived need to be in the same location as the headquarter

PRELIMINARY

- **Typically, enterprises prefer to be where HQ is –** due to availability of local IT teams on ground / access to talent
- Have **redundancy built across India, not within** city – mostly have 1-2 locations (primary / secondary DC) and 1 disaster recovery site

Preferred location		BFSI	IT / ITeS	Digital natives
Metros	Mumbai	Primary site for legacy companies like HDFC, Kotak *(Offers proximity to business headquarters)*	Primary campus for large ITeS/ IT companies *(Lower cost to add customers due to existing DC capacity on lease, core delivery talent)*	Primary site for start-ups, e-commerce and OTT giants *(Offers proximity to business headquarters & end users)*
	NCR	Not as preferred *(Higher seismic risk zone)*		
	Bangalore	Primary site for new-age fin-techs *(Offers proximity to business headquarters)*	Primary campus for large ITeS/ IT companies *(Offers skilled talent – core delivery teams)*	Primary site for start-ups, e-commerce and OTT giants *(Offers proximity to business headquarters & end users)*
	Chennai	Disaster recovery (DR) site for most BFSI companies *(Different seismic zone vs. primary site in Mumbai; however higher risk zone vs Hyderabad)*	Secondary campus/ DR site *(Different seismic zone vs. Mumbai; offers large DC capacity)*	
	Hyderabad	DR site for legacy BFSI companies *(Different seismic zone vs Mumbai)* | Primary site for BFSI players with large operations in Southern India	Upcoming campuses *(Gaining traction due to government subsidies)*	
Tier 2	Jaipur	*Tier 2 cities typically not preferred by enterprises for CoLo model*		
	Lucknow			
	..			

A G E N D A

Outlook on demand – customers, workloads

Supply overview – key players, capacity, locations

Deep dive on critical DC infra, esp. power

Green data centers – and policy implications

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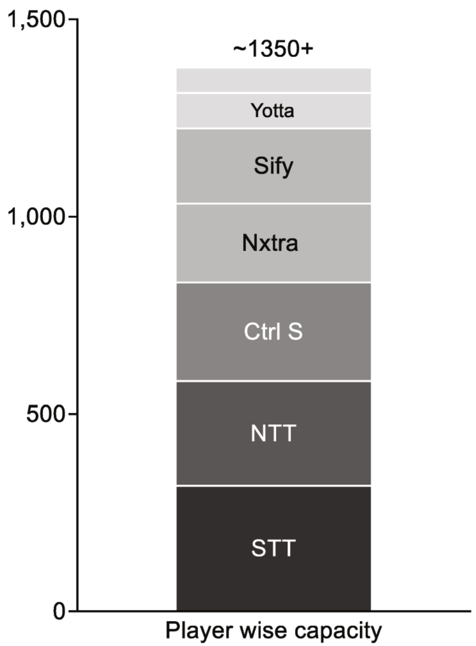
Vendor landscape: India 3P data center market has 5-6 main players today – offering several services and models

PRELIMINARY

3P Colo players

Total installed capacity 2024 (MW)



		STTelemedia	NTT DATA	CtrlS	nxtra by airtel	sify
Financials	FY24 revenue[1] (3P DC business)	~INR 2,040 Cr.	~INR 2,800 Cr. (~INR 625 Cr. 3P DC rev.)	~INR 1,400 Cr.	~INR 1,900 Cr. (~INR 570 Cr. 3P DC rev.)	~INR 1,100 Cr
Scale of business	3P DC capacity (in MW, 2024)	~318 MW	~265 MW	~250 MW	~200 MW	~190 MW
	# of core DCs	19	13	9	12	11
Catalogue	CoLo / Cloud	✓	✓	✓	✓	✓
	Managed Services	✓ Majorly IMS	✓ Majorly IMS	✓ Majorly IMS	✓ Majorly IMS	✓ IMS + AMS
	GPU-aaS	✓ Firmus Tech partner		✓ NVIDIA partner		✓ Offering called 'CloudInfinit+^{AI}')
Key differentiator		**80% SOW of Azure Colo today** **Strongest DC footprint across metro cities** in India; partnering with Firmus to offer Nvidia A100 and H100 GPUs hosted in STT DCs to offer compute-intensive AI cloud services to customers	Only DC provider to provide services **in all zones in Mumbai** (Hyperscalers prefer to have DCs in each zone for business continuity purposes) Strong global **network services,** benefiting customers **hosting data centers across continents**	**Leveraging hyperscaler relationships** of Cloud4C with AWS, Azure, Google and Oracle partnerships India's **largest Tier-4 DC provider** **Vertical specific solutions** such as bank-in-a-box	**Leverages Airtel's relationship with enterprise customers** to cross-sell DC services; Wide Edge DC infra (spread across ~65 cities) AI integrated in datacenter ops to offer **smart capabilities** like predictive maintenance	**Fiber / connectivity capability** **Wide service portfolio** offering its own digital services (e.g., app modernization, digital asset mgmt.), enterprise cloud services, and hyperscale partner cloud services

Source: IDC, JLL, market participant interviews

Capacity addition (1/2): Based on current estimates, 4.7-5.4 GW capacity addition (incl. captive demand) has been planned across players over the next 5-6 years

PRELIMINARY

		Capacity (2024)	Total Addition	Timeline	Comments
Incumbents	STTelemedia	318 MW	550 MW	2029-30	• Plans to invest **$3.2B** in India over the **next 5-6 years** • **80 MW capacity expansion** by **2026 at STT Navi Mumbai 11.3-acre air cooled campus**
	NTT	265 MW	300-400 MW	2028-30	• **Plan to setup 53 MW capacity in Delhi NCR (Noida) by 2025 –** to leverage advanced liquid cooling, high level of automation to optimize performance and resource like power and water
	nxtra by airtel	200 MW	200 MW	2027	• **~200 MW addition** planned in the next 3 years across Pune, Mumbai, Kolkata, Bangalore, Noida & Hyderabad • Partnering with AmpIn and Amplus Energy to **procure green energy;** setup captive solar (48 MW) and wind (24 MW) power plants • Deploying AI **for data center operations** – e.g. energy efficiency, predictive maintenance
	CtrlS	250 MW	750 MW	2030	• Additional capacity of **~300 MW each in Mumbai & Hyderabad, 60 MW, 27 MW each in Kolkata & Chennai**; plans to expand edge DCs in 20 Tier-II and Tier-III markets. • Kolkata facility to have provision for high-density racks, modern cooling tech, 9-zone security
	sify	190 MW	350 MW	2025	• **350MW capacity increase planned –** 3 greenfield projects (110 MW in total) underway with land acquisition already complete • Focus on **green energy sources (**200+ MW renewable energy contracted); leveraging AI/ML for real time visibility of assets, improving service efficiency
	YOTTA	90 MW	300-400 MW	2026-28	• **Expansion of Noida's DC park to 250 MW in progress** – spanning across 20-acres, planned for completion by 2026 • Navi Mumbai DC park to expand to 180 MW (current 46 MW) – with planned 5 buildings • Plans to source **energy from green sources, with** strong investment in **new age cooling technologies**

Source: Company reporting, IDC, Analyst reports, Lit search

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Capacity addition (2/2): Based on current estimates, 4.7-5.4 GW capacity addition (incl. captive demand) has been planned across players over the next 5-6 years

PRELIMINARY

		Capacity (2024)	Total Addition	Timeline	Comments
Global leaders	EQUINIX	15-20 MW	50 MW	TBC	• **Entry in Mumbai/ Chennai** via acquisition of 2 DCs from GPX Global Systems in 2020; plans to add 2 more DCs • **DC in Chennai (CN1)** to have capacity of 24 MW+ on completion • Capacity **expansion planned in Mumbai** (land acquisition done)
Indian conglomerates	Reliance Industries Limited; DIGITAL CONNEXION (A Brookfield, Jio and Digital Realty Company)	–	1 GW	2030	• **Entry via JV with Brookfield and Digital Realty** to set up **'Connexion'** in Jul '23 – with an initial investment of Rs. 375 Cr; • Goal to set up **1GW capacity DC in Jamnagar** (Gujrat) by 2030 – focusing on AI workloads • In immediate term, plans to setup **140 MW capacity** (**100 MW in Chennai, 40 MW in Mumbai**) **powering Chennai** facility using on-site solar panels, • **Provides remote monitoring of** data centers for customers via 'ServiceFabric' platform
	adaniconnex DATA CENTERS	17 MW	1 – 1.5 GW	2026; initial plan by 2030	• **JV with EdgeConneX** in Jun '23 to enter the DC market in Delhi, Mumbai, Chennai, Hyd. • **210 MW** capacity in various stages in Noida, Chennai, Hyderabad, Mumbai, Pune, Vizag • Specializes in **built-to-suit datacenter projects** focusing on large hyperscalers; • Leveraging hybrid liquid cooling techniques such as direct-to-chip, and liquid immersion cooling
	L&T-Cloudfiniti	32 MW	180 MW	50% by 2026	• Set up **Cloudfiniti business -** with DCs in Chennai, Mumbai • Partnering with E2E Networks for AI cloud
Total		**1.3-1.4 GW**	**4.7-5.4 GW**		

Note – Some capacity addition of Indian conglomerates likely to be leveraged for captive demand, hence not part of 3P DC market supply

Source: Company reporting, IDC, Analyst reports, Lit search

WORLD ENERGY COUNCIL INDIA

DC locations: 4 factors drive location choices for CoLo providers

PRELIMINARY

Customer preference

- For hyperscaler business segment, CoLo vendors choose location **based on roadmap defined by hyperscalers**
- Within enterprise segment**, lighthouse accounts identified** before finalizing any new location by colo players

Fiber connectivity

- **Cable landing stations key favorable criteria for choice of location**; Example –
  - Chennai, Mumbai core locations for most hyperscalers
  - Consequently, also largest colo markets due to international cable landing station;
- **Carrier capacity important consideration** for edge locations of hyperscalers – need high bandwidth, dedicated network (dark fiber) between core and edge

Infra/ land

- **Availability of land** – esp. for AI data centers which are likely to require more space vs. traditional data centers (80-100 MW vs. <50 MW on avg.)
- **Edge data centers** for hyperscalers relatively smaller (300-400 kW up to 1MW), hence land availability not as critical a factor

City risk assessment

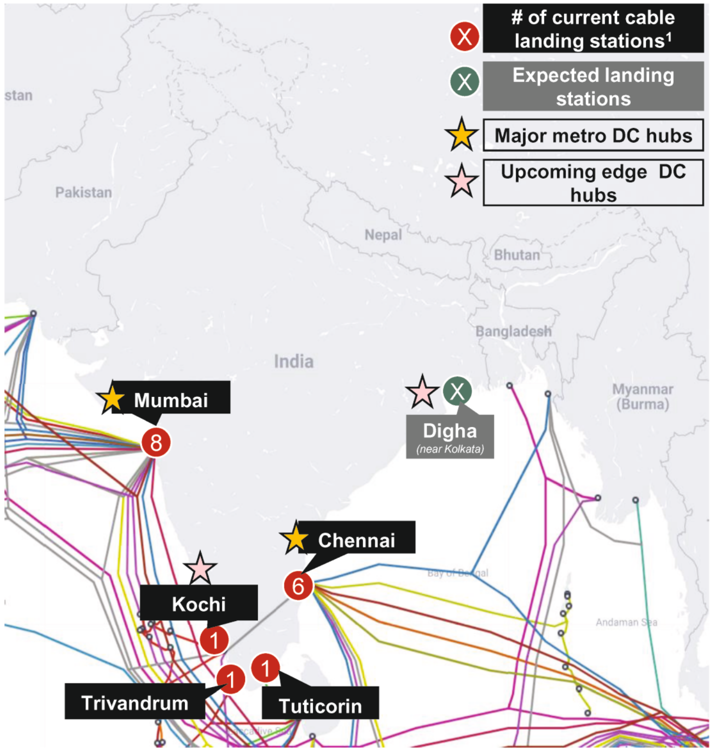
- **Geospatial factors / risk of natural disasters** critical consideration
- **Example** – Chennai considered prone to cyclones, which is a deterrent for some customers

← Discussed previously →

Location deep dive – Cable landing stations important factor driving choice of locations like Mumbai, Chennai, with Kolkata likely to benefit going forward

PRELIMINARY

Overview: 17 intl. subsea cables in 17 distinct cable landing stations



Current state

- There are **17 international subsea cables** landing in **17 distinct cable landing stations** in **5 cities** across India, in **Mumbai, Kochi, Trivandrum, Tuticorin, Chennai**
- There are **2 domestic subsea cables** in India:
  - **Chennai-Andaman and Nicobar Island Cable (CANI)** connecting Port Blair along with seven other Islands of Andaman & Nicobar
  - **Kochi-Lakshadweep Island (KLI) cable system** for a direct communication link through a dedicated submarine optical fiber cable between Kochi and 11 Islands of Lakshadweep

Recent developments

- **New cable landing station in Digha (W Bengal)** – to become operational by 2026
- **5 new submarine cables are also expected to rollout between 2025-26:**
  - **SEA-ME-WE 6** connecting Southeast Asia, the Middle East, and Western Europe
  - **2Africa** connecting Africa, Europe, Middle East and Asia
  - **India-Europe-Express (IEX)** connecting India to Europe
  - **Blue Raman** connecting India & France
  - **TEAS** connecting with India, Middle East and Europe

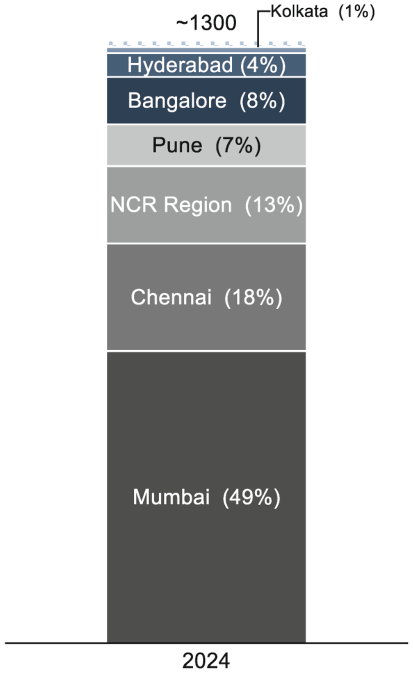
Source: Submarine networks website, Submarine Cable Map; Cloudscene, JLL 2024 India Data Centre outlook, Lit Search; Notes: 1) As of 2023

Consequently, looking ahead we see a continued preference for existing metro cities, along with a few edge locations for hyperscalers

NON EXHAUSTIVE / **PRELIMINARY**

Current DC footprint

Total Capacity (2024) - Core 3P DCs (in MW)



Future outlook on locations

Locations		Location preference: Hyperscalers	Location preference: Enterprises	Outlook on supply <> demand mismatch	
Metros	Mumbai	Core center for all hyperscalers; landing zone for intl. cable	Primary location – close to HQ	✓	Strongest market – most capacity addition expected to be utilized
	NCR	Core center for GCP		✓	Most capacity added utilized
	Bangalore		Preferred by tech customers	✓	Not too much capacity planned – whatever added monetized
	Chennai	Core for Azure – landing zone for intl. cable	Preferred for capacity - but risk of natural calamities	?	Lot of capacity set up – preferred by hyperscalers, not always by enterprises
	Hyderabad	Currently edge – but priority for Azure, GCP	Emerging due to govt. subsidies- IT / BFSI	✓	Most capacity addition expected to be utilized – preferred for low seismic activity
Tier 2	Jaipur	Edge location		?	
	Ahmedabad	Edge location; govt incentives and reliable power		?	Emerging market – customer base needs to be set up
	Kochi	Upcoming edge location due to cable landing		?	
	Pune	Core center for Azure		?	Weaker enterprise market – most capacity currently consumed by Azure
	Kolkata	Edge: Likely to scale due to new fiber landing station		?	Emerging market – customer base needs to be set up

Source: CRBE report, JLL report

AGENDA

Outlook on demand – customers, workloads

Supply overview – key players, capacity, locations

Deep dive on critical DC infra, esp. power

Green data centers – and policy implications

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Overview - The physical data center infrastructure consists of several important elements across servers, cooling and power

ILLUSTRATIVE

IT Infra

- Critical Infra. for data processing & storage
- Consists of servers, storage & networking equipment

Server rooms (incl. **storage**)

House clusters of interconnected servers in a secure, climate-controlled room. Servers are essentially a computer without a monitor or keyboard. They store and process data and connect to a network for input/ output

Heat exchangers

Located on the roof, they release the hot air from inside the building

Concrete and steel construction

Built to protect servers in the event of natural disasters

Cooling Infra

- Critical for running a data center to prevent the IT Infrastructure from overheating
- Consists of the heat exchangers (outdoor), cooling distribution units and air conditioning inside (incl. fans, distribution lines)

Backup generators

Run on diesel and automatically turn on in the event of a power outage

Air conditioning

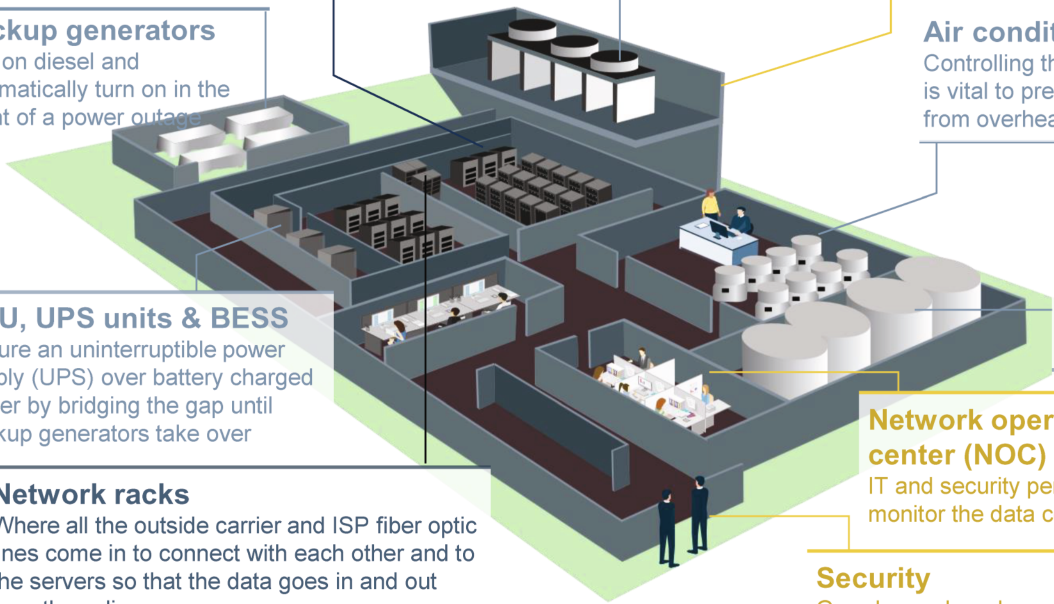
Controlling the temperature is vital to prevent equipment from overheating

Transformer & switchgear

Connect the data center to the grid & ensure power supply

CDU

Dissipate the heat absorbed by the A/C units and release it outside or recycle it as cold air. Also provide a backup cooling source



PDU, UPS units & BESS

Ensure an uninterruptible power supply (UPS) over battery charged power by bridging the gap until backup generators take over

Power Infra

- Ensures power supply for the data center, connecting it to the grid & providing back-up power

Network racks

Where all the outside carrier and ISP fiber optic lines come in to connect with each other and to the servers so that the data goes in and out over these lines

Network operations center (NOC)

IT and security personnel monitor the data center 24/7

Other

- Building, construction & design of the DC
- Operational services (e.g., security)

Security

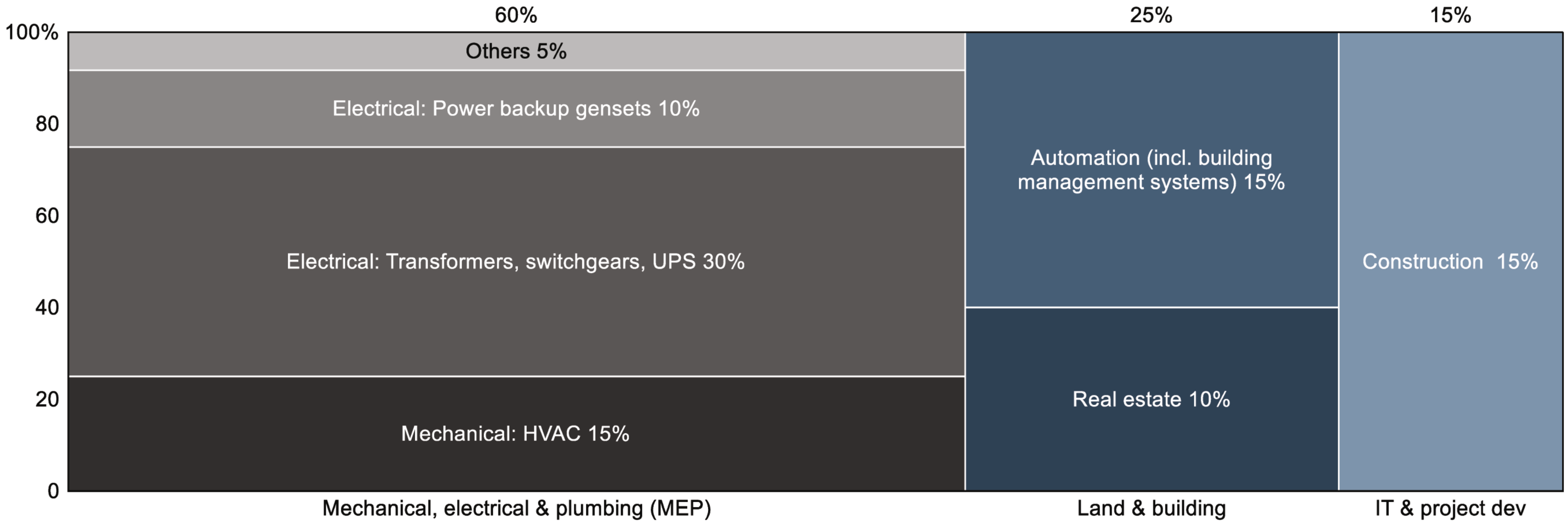
Guards, card readers, and cameras monitor the premises to provide 24/7 physical security

Note: 1) Refers to the %-share of an avg. DC equipment spend; ISP – Internet Service Provider
Source: Lit search

Capex drivers: Mechanical and electrical systems constitute 40%+ of CAPEX for data center operators (excl. IT infra capex)

CAPEX EXCL. SERVER, STORAGE, NETWORKS

Capex for India DC set up - Colocation provider - excl. server, storage, networks (%)



Key suppliers

Key suppliers

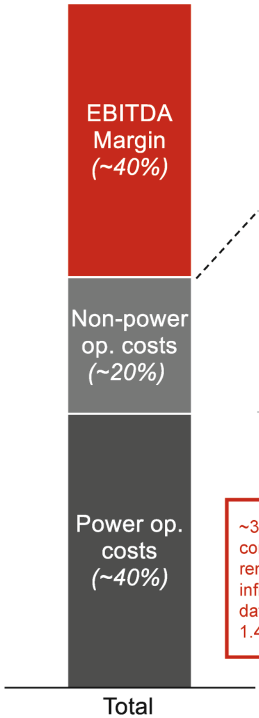
Typical capex INR 40-60 Cr per MW (i.e., $7-12 Mn per MW)

Source: Analyst reports – Spark, Jefferies

Opex drivers: Power contributes to 60-70% of the total opex for data centers

DIRECTIONAL

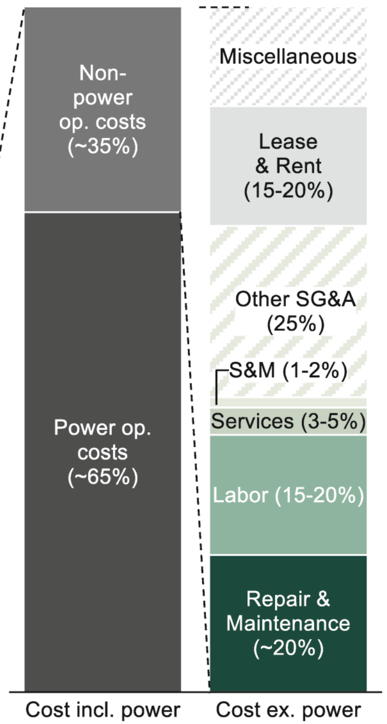
DC providers typically experience ~40%[1] EBITDA margins



Component	Description
EBITDA margin	• Price realization typically driven by – **Mix of services –** low value-add (co-location, hosting) vs. high value-add (cloud) – **SLAs**
Non-power costs	• Includes **rental property** operating & maintenance, **general & administrative** and other costs (e.g., property taxes, insurance, professional services etc.)
Power costs	• Includes **power consumed** by customer servers and cooling power for the data center • **Passes through to customer** so typically split out from OPEX

~30-40% of power consumption for cooling (vs remaining 60-70% from IT infrastructure) for average data center with PUE from 1.4-1.6

Data center non-power op. costs[2] largely driven by labor, repairs, and rental expenses



	Component	Description
	Miscellaneous	• Incl. provisions for bad debt, any charitable/ political contributions, one-off adjustments (e.g., loss on sale of property) etc.
	Lease and rent	• Rent for **land and buildings**
SG&A	Other G&A	• **Insurance, security charges, rates & taxes** (e.g., municipal charges) and other IT expenses
SG&A	S&M	• **Selling** (incl. commissions) & **advertisement expenses**
SG&A	External Services	• **Legal & professional services** (e.g., auditors), **outsourced services** (e.g., Managed IT)
SG&A	Labor	• **Salaries & wages** of employees managing data center ops, IT and other support functions (e.g., HR)
SG&A	Repair & maintenance	• **Upkeep of buildings, equipment and IT infrastructure** (e.g., HVAC, server rack, monitoring & control systems)

Note: 1) Directional; 2) Sify, Nxtra and STT OPEX breakdown used as references | Source: Company websites & annual reports

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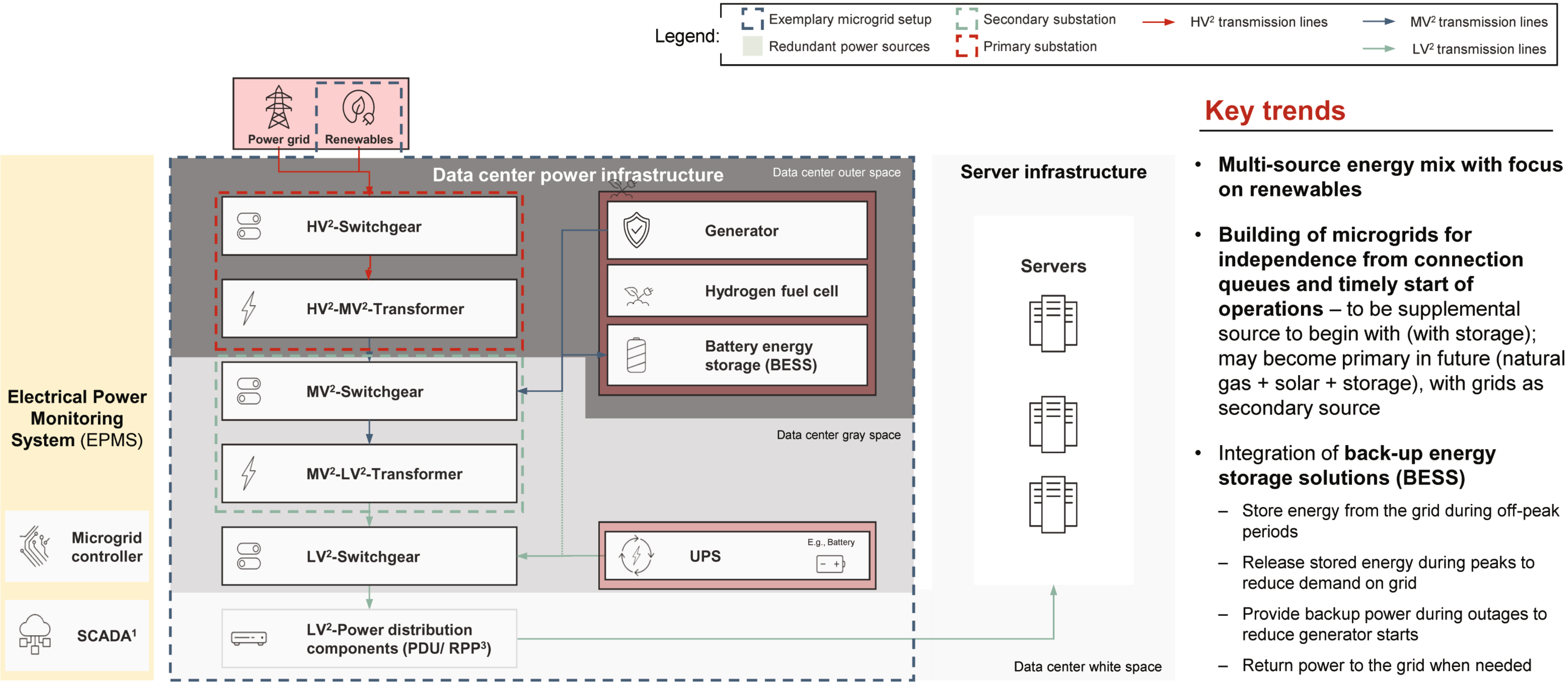
Going forward, several trends will impact power needs (both opex/ capex requirements) driven by AI workloads

PRELIMINARY

Key trends and implication on power

Trend	Key trends and implication on power
Higher density racks & larger DC campus	• **Next-gen AI racks (e.g., NVIDIA Blackwell etc.) re**quire high density compute with upto 120-140kW per rack • Higher **overall capacity of Data centers** (100MW+ DC campuses)
Need for flexible scaling	• **Preference for modular structure of power (UPS)** for faster design, execution and phased scalability • Optimization of **redundancies to be built within the data** center • **Localization of the faults to reduce** overall downtime risk
Rapid oscillation in power needs for GPUs	• AI **workloads swing from near-idle to full load within few ms** – demanding rapid power response, real time load prediction; • Fluctuations in **power demanded also impacts grid stability**
Higher energy efficiency	• **Higher focus on better efficiency due to rapid increase in power requirement for** AI workloads (traditional double-conversion UPS adds ~3% losses due to multiple AC/DC conversions)
More energy sources – incl. renewables	• **Focus on alternative power sources (e.g., renewables, on-site power sources)** to reduce reliance on utility grids • **Bi-directional grid interface** to reduce peak loads and benefit from grid price arbitrage
Lower switchover time	• **Zero-delay switchover (<4ms) to avoid thermal runaway during outage** *(already being addressed across vendors)*

Consequently, modern data center power systems will evolve to include newer sources of supply (incl. micro grids) with battery storage



Key trends

- **Multi-source energy mix with focus on renewables**
- **Building of microgrids for independence from connection queues and timely start of operations** – to be supplemental source to begin with (with storage); may become primary in future (natural gas + solar + storage), with grids as secondary source
- Integration of **back-up energy storage solutions (BESS)**
  - Store energy from the grid during off-peak periods
  - Release stored energy during peaks to reduce demand on grid
  - Provide backup power during outages to reduce generator starts
  - Return power to the grid when needed
  - Store energy generated by solar and other alternative sources, transforming intermittent power sources into continuous data center power

Note: 1) SCADA: Supervisory Control and Data Acquisition; 2) HV/ MV/ LV: High, medium and low voltage; 3) PDU: Power distribution unit, RPP: Remote Power Panel
Source: Market participant interviews; Market reports

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Power alternatives for DCs: A range of innovations are poised to help solve the power capacity constraints, esp. micro grids

BASED ON GLOBAL LEARNINGS

		Description	Use Today (global)	Challenges	Potential
Near-term	**Onsite Generation and microgrids**	• Natural gas plants, or renewable based generation (paired with storage systems) built at/or near data centers provide supplemental or backup power	• Fossil fuel based common as backup; rare for primary use. – In 2023, Microsoft was granted permission to build a 170MW power plant alongside their data center development in Dublin for back-up generation given high grid constraints on Ireland	• **For fossil fuel based: emissions, permitting, space requirements**. – In 2024, Amazon withdrew its plans to deploy natural gas-powered fuel cells from Bloom Energy at its Oregon DC facility due to environmental pressures.	• Provides reliable capacity in power-constrained markets. – Microsoft's vice president of Energy said in March of 2025 that it would consider natural gas with carbon capture as a power solution for its data centers
Near-term	**Nuclear Restarts and Life Extensions**	• Restarting previously shut down nuclear reactors or prolong life of power nuclear power plants	• Hyperscalers are investing in NPPs restarts (e.g. Three Mile Island, Palisades, Clinton Illinois) • Other utilities are evaluating or moving forward with NPPs restarts to meet growing electricity demand.	• There are **few candidates for 80-year life extensions** • Out of the 92 operating NPP in the US: – All NPP above 30 years, 23, have applied for 20+ licenses to operate for 60y – But only 6 have been granted licenses to operate for 80y so far	• NPP extensions costs are lower cost than new NPP and have competitive LCOEs with other generation technologies • Enhances grid stability, provides large-scale carbon-free baseload power, and has highest capacity factor among generation technologies
Near-term	**Long-term renewable PPAs**	• Agreements for power from wind or solar farms to offset electricity use or feed co-located loads	• Widely used by hyperscalers (e.g. Google, Microsoft) to meet environmental goals – According to Data Center Dynamics, U.S. DC operators had contracted approximately **50GW** of clean energy through PPAs	• Many renewable projects can't connect due to **interconnection backlogs.** – **Renewable projects are often far from load**, requiring complex wheeling and REC tracking.	• Will continue to be a key tool for sustainability goals of companies and off-site capacity sourcing
Near-term	**Energy-as-a-service models**	• Third parties finance, build, and operate on-site or distributed energy systems	• Growing among large enterprise users – In West Texas, Five Point Infrastructure launched PowerBridge, a $1B initiative to integrate energy solutions to DC campuses	• **Complex contracts**, less control over systems	• Can accelerate adoption by removing upfront cost and operational burden
Long-term	**Batteries / BESS**	• On-site energy storage (often lithium-ion) to shift loads or to provide short-duration backup	• Used for backup and UPS systems*. But utility scale batteries (BESS) are rarely used as part of a microgrid, or part of contractual agreement with utilities to increase grid support	• **On-site batteries have limited duration** (4–6 hrs typical). **BESS** are still high-cost, but **increasingly cheaper**	• BESS could provide a solution to load shifting, grid support, and hybrid microgrid models.
Long-term	**Fuel Cells**	• Hydrogen or natural gas-fed systems that generate electricity on-site with lower emissions than diesel	• Emerging pilots (Google, Microsoft) – Microsoft has pioneered the use of hydrogen fuel cells in data centers by successfully running a pilot project that powered server racks for 48 consecutive hours using a hydrogen fuel cell system	• **High costs**, hydrogen availability, costs, safety codes, maintenance	• Promising for cleaner 24/7 on-site power, esp. in sustainability-sensitive markets
Long-term	**SMRs (Small Modular Reactors)**	• Compact nuclear reactors designed to safely generate stable baseload power at industrial or edge locations	• Not in commercial use yet but first models to start operations between 2028-30. • Tech companies are investing in SMR developers: – Amazon is investing in X-Energy, Microsoft is supporting Terra Power. Google is supporting energy purchases from Kairos Power.	• **Untested technology**, regulatory constraints, expected higher price in early stages of deployment	• Could unlock massive clean baseload for large-scale data center campuses

Note: UPS Systems = Uninterruptible Power Supply these are systems are devices that provide instantaneous backup power to equipment. NPP = Nuclear Power Plants
Source: IP on Construction of Data Centers; Data Center Dynamics (Jun 2024; Jan 2025); EIA Analysis (Mar 2025); Global Energy Monitor (Jul 2024); CNBC (Mar 2025); New York Times (Oct 2024)

Global case study: How global players are solving challenges around power

PRELIMINARY

	Wind	Solar	Natural gas	Nuclear fission	Nuclear SMR[1]
Power output	• [Onshore] 100-300 MW per farm, scalable • [Offshore] 100-1GW+, scalable	• Wide range, up to 2GW+ for largest power stations	• 500-1000 MW per plant, scalable	• 1GW+ per reactor	• Up to 300 MW per reactor, highly scalable
Cost to build (/kW)	• [Onshore] $800-2.5K • [Offshore] $1-4K	• $1K-4K, decreasing as tech improves	• $450-1.2K	• $8K-14K+	• $2.5-10K+
Time to build	• [Onshore] 6 months to multiple years • [Offshore] 2-10+ years	• 8 months to multiple years (at least 6 years at scale)	• 2-3 years	• 10-15 years	• 7-10 years
Examples	Meta and Broad Reach Power conducted a **yearlong pilot of 9.9 MW energy storage projects** at three sites in Texas for wind and solar power	Initiative to stimulate **development of reliable, low- or zero-carbon electricity generation tech** (advanced nuclear, next-gen geothermal, clean hydrogen, LDES, etc.)	**Microsoft** and **Helion Energy** announced **PPA** electricity deal from 2028 from **Helion** first fusion power plan, accelerating the **commercial viability of new nuclear**		**AWS acquired 960MW DC campus** adjacent to Talen's 2.5GW nuclear power station with a **10-year PPA for Talen to supply electricity** to the DC

Note: 1. Small modular reactor; PPA = power purchase agreements

India case study (1/2): Most Colocation providers in India are investing in renewable energy currently

PRELIMINARY

CoLo vendor	Customer focus	Portfolio mix	Renewable Energy	Cooling	Location
STTelemedia	• **Hyperscalers:** ~80% SoW for Azure • **Strong enterprise presence:** ~1,000 cust.	• **AI clusters via partnership** (TataCom, SMC AI Infra) • Design & engg services	• **Partnered with O2 Renewable Energy and Avaada:** ~50% green energy use in DCs	***Direct to chip liquid & liquid immersion*** *for AI workloads* *(similar capabilities across incumbents)*	• **Strongest DC footprint** across 10 cities (incl. all metros) – although low in Mum
NTT	• **Strong enterprise presence** esp. across BFSI customers	• **AI Cloud** via strategic investment in **Neysa** • **Network services**	• Invested in **renewable energy projects** – e.g., 20MW wind & solar captive plant for Bangalore		• **Has most exhaustive footprint in Mumbai;** present in 3 other metros
CtrlS	• Serve top **Hyperscalers** • **Strong enterprise presence:** 6/10 top banks, 3/ 5 top IT Cos	• **GPU via PaaS-** in process • **Vertical specific solutions** offered through Cloud4C to SMBs (e.g., Bank in a Box)	• Invested in **own solar power plant** (goal to be 100% renewable by 2030)		• Present in **4 Metros, with** majority (~70%) capacity concentrated Mumbai
nxtra by airtel	• **Hyperscalers:** MSFT, AWS, Google • **Relatively low presence** in Enterprises (aim to leverage Airtel customers)	• No offering for AI infrastructure • Network services – via Airtel	• Investment in **14 green energy companies:** >40% DC power is from green energy sources		• Present in top **4 Metros** with a wide Edge DC infra – but small Mumbai footprint
sify	• **Strong enterprise presence:** 600+ clients, incl. top 5 banks, Public sector & PSU clients	• **GPUaaS** • **Wide service portfolio incl.** app modernization, SAP managed services etc. • **Network services**	• Signed **power purchase agreements for green energy:** >40% DC power is from green energy sources		• Present in **5 Metros with large** capacity concentrated in Mumbai, NCR and Hyderabad
YOTTA	• **Steadily growing however small base** – current logos include CARE, Essar & Telangana government	• **AI Cloud:** offers E2E services e.g., **workspace as a service, GPUaaS** etc. • **Vertical specific solutions** (e.g., OTT as a service)	• **~30%** DC power is from green energy sources		• **Relatively smaller DC footprint**; currently present in only **2 metros** (Mumbai and Noida)

Source: Company websites; IDC; Lit search; Market participant interviews;

India case study (2/2): Ctrl S specifically has the lowest power cost driven by – i) lowest PUE achieved via advanced cooling techniques, ii) captive solar power

PRELIMINARY

Lower power cost driven by best-in class PUE, …

CtrlS	sify	NTT DATA	STTelemedia
1.3 – 1.4	1.5 – 1.7	1.5 – 1.6	1.5 – 1.7

80+ energy efficiency innovations implemented to achieve industry-low PUE of 1.35 and LEED Platinum certification

Advanced cooling system
- **Advanced direct liquid** cooling for 40% reduction in energy costs
- **Liquid immersion cooling** – reduced upto 95% of cooling energy requirements

AI-based tools
- **AI tools** in collaboration with new-age startups to **enhance energy optimization** across the facility

Other initiatives in past 3-5 years
- **Variable cooling** plants, upgrade from **PAC[1] to PAHU[2]** cooling
- Upgradation to **higher efficiency UPS**, **cold aisle containment** in server halls, etc.

Note – 1. PAC – Precision Air Conditioning, 2. PAHU – Precision Air Handling Unit
Source: Company reporting, market participants

… Captive solar plants to offset high power cost

- Only datacenter company to invest in **own solar power plants**
- **Able to achieve price differential of 40-50%** compared to contracted power
- **Latest solar panels** (N-type / HJT) for long-term durability and **enhanced efficiency**
- **50 MW of captive solar power live** in Nagpur powering Mumbai DC

Future commitments

- **50 MW** captive solar plant in Nagpur (Phase 2) to **go live in 2025** to power Mumbai campus (reaching 60% renewable)
- **Additional 100MW** project over net **18-24 months** with aim of **1GW** of solar capacity **by 2030**

Key implication

Competitive pricing

30-40% lower power cost can be transferred to hyperscaler for competitive pricing compared to other vendors

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AGENDA

Outlook on demand – customers, workloads

Supply overview – key players, capacity, locations

Deep dive on critical DC infra, esp. power

Green data centers – and policy implications

Context for green DCs: DCs account for >2% of total global emissions – with a focus on green DCs driven by regulations, cost considerations

NON-EXHAUSTIVE

Data centers leave a significant footprint in energy, resource usage and emissions…

	Energy	Emissions	Water	Waste	Land & Biodiversity
Category Importance	• Data centers consume **1-2%** of global energy • Energy consumption can be reduced by improvement in operational efficiency. Switch to renewable energy will lead to reduction in GHG emissions	• Global carbon footprint for data centers accounts for more than **2%** of global carbon emissions	• **1MW** data center with traditional cooling method uses **25 million liters** of water per year • Water usage for electricity generation is **4x** greater than onsite cooling water usage	• Enterprises working with authorized recycling services fell **14% YOY**, while businesses recycling own hardware dropped by **5%**[1] • Companies need to minimize waste generation and divert waste out of landfills through reuse and recycle	• Data centers have a direct impact on the land on which they are built and an indirect impact on the ecosystem • Dedicated solar and wind farms to power DCs can generate significant impacts on land and biodiversity. It is important to measure these impacts and report them
Commonly tracked metrics	- Total energy consumed - Power usage effectiveness (PUE) - Renewable energy factor (REF) - Energy intensity (per $1M revenue or per sq. ft)	- Scope 1 direct emissions - Scope 2 indirect emissions - Scope 3 emissions - Carbon usage effectiveness (CUE) - Carbon intensity (per $1M revenue or per kWh)	- Water usage effectiveness (WUE) - Total site water usage - Water intensity (per $1,000 revenue or per sq. ft)	- Total waste generated - Waste landfilled - Waste diversion rate - Material usage effectiveness (MUE)	- Mean species abundance (MSA) - Facilities with improved habitat

…several factors driving move to green

1. Push from **government regulations** – push for DC Cos to transform their operation to be green/ requiring new DCs to meet certain ESG requirements becoming more stringent, globally
2. Growing **awareness** among DCs & clients of DC contribution to energy consumption & global emissions
3. Strong **returns on investment** – several DCs have reported lower OpEx & CapEx resulting from a move to green
   – e.g. Fujitsu ~48% reduction in energy consumption & $230k saving in yearly electricity costs

*"Going green is not top of mind for every government or DC, but in **regions where sustainability is a priority** e.g. NAM, APAC, there is a **regulatory pressure pushing DCs to meet certain ESG targets**. Alongside **cost benefits** from going green & **pressure from society (i.e. clients)** to demonstrate ESG awareness, the topic of "green" in the DC space is certainly going to continue **increasing in importance**. "*

Former Head of Global Sales Enablement, DC colo

Source: 'Schneider's Guide to environmental sustainability metrics for data centers; Lit. search

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Data center players need to act across a spectrum of ESG metrics

PRELIMINARY

	Metric	Description	Value chain relevance					
			Component manufacturing	Design & compliance	Construction & fit-out	Computing installation	Operations	Value added services
Energy Efficiency (1)	Power use effectiveness (PUE)	Metric to describe **energy usage of a data center**, determined by dividing the total amount of power entering a DC by the power used to run the IT equip.	✓	✓	(✓)	(✓)	✓	(✓)
GHG emissions (2)	Carbon usage effectiveness (CUE)	Metric to measure **DC sustainability** in terms of **carbon emissions**, determined as ratio of total C02 emissions caused by total DC energy consumption to the energy consumption of the IT equip.	✓	✓	(✓)	✗	✓	(✓)
Water (3)	Water usage effectiveness (WUE)	Metric to measure **water usage & its relation to energy consumption** by DC, determined as ratio between water use in DC systems by energy consumption of the IT equip.	✓	✓	✗	(✓)	✓	✗
Waste (4)	Waste diversion rate	Metric measuring **how much waste produced** by DC is **diverted from the facility** without burn (incineration) or buy (landfill)	✓	✓	✓	✓	✓	(✓)
Land & biodiversity (5)	Biodiversity GRI metrics reported	Reporting standards that hold DCs accountable for their **impact on natural world/ ecosystems**	✓	✓	✓	✗	✓	✗
Renewables (6)	Renewable energy factor (REF)	Metric to **monitor use of RE**, quantifies the **actual use of RE** in the form of electricity in a data center	✓	✓	✓	✓	✓	(✓)

Source: Company websites, ESG & annual reports; Market participant interviews; Lit. search

Renewables deep dive: Data center usage of renewable energy scales from carbon offsetting to own onsite RE generation

PRELIMINARY

	Grid supplied electricity	Carbon offsetting	Green PPAs[2] (Physical / Virtual)	Direct connection to 'RE-heavy' grid	On-site RE generation
Description	Energy supply based on electric grid	Purchasing of carbon credits from third party registries	Contract energy from renewables sources to match total energy consumption, even if sources are elsewhere on the grid	Electricity sourced directly from high % renewable grids – may involve green PPAs for RE sources that feed directly into local grid	On-premise generation of renewable energy e.g. solar/ wind farm connected to DC
Environmental impact	• **No guarantee** of **certain RE %** – **Non-renewables** still comprise **large portion of electricity** mix • Some progress in cleaning up the grid (varies by region)	• **Purchasing offsets** by making payments to projects to **match total emissions** • Impact based on **type of offset** e.g. **removal offset[2] higher**, avoidance offset lower	• Buying RE to **match all of energy usage** • Strong **alignment with RE sources**	• **Directly connecting** to grid that **guarantees a high % of RE** in electricity mix • Lower impact vs. on prem RE due to **transmission & distribution losses**	• Set up of **100% RE source** on site for **direct connection/ powering of DC** • Highest control over **RE use optimization** • Mitigates transmission losses
Required capabilities (investment)	• Strong working **relationship with local grid operator** • Understanding of **regulatory landscape** related to grid connection	• Resource team with understanding of **carbon markets/ available credits** • Ability to **negotiate** w/ trader to secure optimal price/ volume • Appropriate **budget allocation**	• **Negotiation capability** • Understanding of **RE market**, types of **RE projects** (& their credibility), & **available PPA suppliers**	• Appropriate site selection/ **proximity to RE sources** • Working relationship with **local grid owner**, agreement on RE source thresholds (may involve green PPAs) • **Network & cabling work**	• Design team w/ **expertise** in integration of onsite power gen. into distribution system • Investment into **infrastructure** to support on site generation • **Licensing** for on site gen.
Cost impact	• **Limited** – key costs incl. payment for grid connection, potential licenses needed for connection	• **Moderate** – key costs incl. budget & team dedicated to purchasing offsets, & potential reputation risk associated with varying offset credibility	• **Moderate to high** – key costs incl. cost of PPA, longer-term cost that can range from lower to higher based on MGW volume negotiated	• **High** – key costs incl. potential green PPA payments, network & cabling to connect lines to grid, new site selection for RE proximity	• **High** – initial investments in design, infrastructure & licensing, long-term cost savings depend on LCOE

Note: 1) Removal offsets generated from activities that sequester carbon out of atmosphere, Avoidance offsets generated from activities that reduce emissions by preventing their release into atmosphere; 2) Power Purchase Agreement
Source: Market participant interviews; Lit. search

Indonesia case study (1/2): Government supporting reduced GHG emissions, supply of renewables for DC sector, with caps on renewable tariffs

Key: No impact / focus … Significant impact / focus

	Definition	Regulatory / structural push
Energy efficiency	• Energy efficiency of complete DC operations	• **National industrial energy efficiency policy** requires all companies with annual energy consumption >6,000toe to take several measures, including develop an energy conservation plan and auditing and reporting consumption • The **ASEAN Plan of Action for Energy Cooperation** outlines the region's plan to reduce energy intensity by 32% in '25 (vs. '05), and encourage energy conservation
Renewables	• Use of renewable energy to power DC	• The **Electricity supply business plan 2021-2030** from PLN (government owned monopolistic electricity supplier) details plans to be net zero by 2060, with over half of new additions in the period to be renewable – An increasingly green grid may in fact **reduce ability for green DCs to differentiate** as the majority will already use green energy via the grid • The government has set targets to achieve a 23% share of renewable energy in the grid by 2025, and to reduce greenhouse gas emissions by 29-41% by 2030; the government has also **publicly supported the supply of renewables specifically for the ICT/ DC sector**, as well as **capping renewable tariffs**
Water	• Responsible use and release of uncontaminated water	• Indonesia has several active regulations in place for water management, centered around the law on Water Resources. There are several implications for businesses, including DCs around monitored water use, with the government supporting efficient use of water in the ICT industry
Waste	• Minimised waste creation and responsible waste management	• Indonesia has **some active policies in place around waste management** which apply to DCs through e-waste, however these are **not yet well enforced, nor a significant focus on DCs**
Land & biodiversity	• Minimised impact on the local natural environment through operations	• Government environmental policy is increasingly focusing on minimising deforestation, however DCs are generally built in already industrialised spaces, and therefore this **does not materially impact their businesses yet**

In combination, energy efficiency + use of renewable energy tackle GHG emission intensity of DCs

Note: Toe = ton of oil equivalent
Source: Vision Invest Market assessment & entry strategy - Green Data centers (2023); Market participant interviews, Lit. search, LSE, IEA

Indonesia case study (2/2): Providers focus on stable energy supply, hence rely mostly on grid supplied electricity today

Key No impact → Significant impact

	Grid		Renewables		Post-fact footprint mgmt.
	Grid supplied electricity	**Direct connection to 'renewables-heavy' grid**	**Green PPAs[1]** (Physical / Virtual)	**On-site RE generation**	**Carbon offsetting**
Description	Energy supply based on **non-renewable electric grid** (e.g. coal or gas or oil powered)	Electricity sourced directly from **high % renewable grids** – may involve green PPAs for RE sources that feed directly into local grid	**Contract energy from renewables sources** to match total energy consumption, even if sources are elsewhere on the grid	**On-premise generation of renewable energy** e.g. solar/ wind farm connected to DC	**Purchasing of carbon credits** from third party registries
% of DC power source	**~90-95%** **~5-10% on-site generators**	n/a	**~0%**		**0% of local DCs,** Hyperscalers likely to carbon offset internationally (~40-50% of market)
Detail	• Monopoly position by **PLN** • Electricity supplied via the grid is **not wholly reliable**, particularly on more **remote islands / regions** in Indonesia; natural phenomena such a **floods often cause disruption** • Customers therefore rely on **backup liquid fuel generator on-site** to guarantee consistent electricity supply • Power generation in Indonesia is currently **~55% coal** and **~20% gas**	• Government **focus is primarily around providing a stable supply** of electricity; green is important, but not the top priority • Power generated in in Indonesia is **currently ~13% renewable**, with a **target of 23% by 2025** • Forecasts (Global Data) suggest **~15% renewable power generation by 2027**	• Renewables **PPAs are feasible** in the Indonesian market, however they are **not commonplace** e.g. Amazon signed the first offsite corporate PPA just ~6 months ago • The **PPA process is still tightly controlled**; all renewable projects must be procured by PLN through a "Direct Selection" process • There is an established **proportional tariff ceiling in place for renewables**	• It is still **very uncommon for DCs to have on-site renewable** generation in Indonesia • On-site renewable generation requires a **large piece of land, which can be difficult to obtain** without flood risk • **Tax incentives are in place** to stimulate private development of renewable energy generation	• Customer **awareness around carbon emissions is catching up to that in more developed neighbouring countries** (e.g. Singapore) • The **government is starting to enable and encourage offsetting** – for example coal powered power stations >100MW are now required to purchase offsets • Carbon offsetting is **available privately**, as a **voluntary measure** for companies in Indonesia
Impact on DC players	• **Almost all DCs use grid energy** in their operations • **No additional investment required** as current infrastructure to access grid electricity already in place	• **Minimal impact** given lack of availability	• **Quick** way to improve green credentials • **No additional infrastructure investment required** as current infrastructure in place to access grid • **Lack of availability of many options** for PPAs in Indonesia as yet	• Significant **investment in capability** required to generate own renewables • The **large amount of energy required for DCs** means that renewable energy onsite generation **may not be practical**	• Carbon offsets offer **immediate GHG remediation**, although not a long term reduction in GHG • **Hyperscalers (particularly global firms) are more likely to leverage carbon offsetting** than any other DCs, and they may do this either in-country, or via international carbon trading e.g. I-RECs

Notes: 1) PPA = Power Purchase Agreement | Source: Vision Invest Market assessment & entry strategy - Green Data centers (2023); Global Data, Market participant interviews, Lit. search

WORLD ENERGY COUNCIL INDIA

Thailand case study: Almost all power for DCs is derived from the grid, which benefits from biopower generation; carbon offsetting is not yet leveraged in DCs

Key No impact … Significant impact

	Grid	Renewables			Post-fact footprint mgmt.
	Grid supplied electricity	**Direct connection to 'renewables-heavy' grid**	**Green PPAs[1]** (Physical / Virtual)	**On-site RE generation**	**Carbon offsetting**
Description	Energy supply based on **non-renewable electric grid** (e.g. coal or gas or oil powered)	• Electricity sourced directly from **high % renewable grids** – may involve green PPAs for RE sources that feed directly into local grid	**Contract energy from renewables sources** to match total energy consumption, even if sources are elsewhere on the grid	**On-premise generation of renewable energy** e.g. solar/ wind farm connected to DC	**Purchasing of carbon credits** from third party registries
% of DC power source	**~80-90%** **~5-10% on-site generators**	n/a	**~5-10%**		**0% of local DCs,** Hyperscalers likely to carbon offset internationally (~15-25% of market)
Detail	• **EGAT** is the single (state owned) utility that controls regulation of power generation, transmission and bulk sale • Thailand has **relatively stable grid** electricity supply; customers do often on **backup liquid fuel generator on-site to guarantee consistent electricity supply** • Power generation in Egypt is currently **~64% gas powered**	• Government policy is supportive of green, but **balanced with economic growth overall** • The government **targets ~34%** of net national electrical energy from renewables by 2037 – Global Data forecasts **~19% renewable power generation by 2027,** suggesting either significant expansion to come, or a shortfall	• Renewable energy generation has been **deregulated in recent years** • There is a clear framework from EGAT for independent production of power • There is **increasing use of corporate PPAs** across Thailand, although this is not yet commonplace • **Solar power** has an LCOE[2] of ~USD0.05/kWh in Thailand, **much below** the ~USD0.11/kWh for **traditional** sources	• **Tax incentives are in place** to stimulate private development of renewable energy generation • Renewable energy generation has been **deregulated in recent years**, whilst there is a clear framework from EGAT in place, which illustrates the permitted models for decentralised solar and the role of a developer	• Thailand has an **active carbon trading market**, **although not widely adopted as yet.** For example, the FTIX was launched at the end of 2022, the first carbon credit exchange for the country • Participation in the carbon market is entirely **voluntary and privatised**
Impact on DC players	• **Almost all DCs use grid energy** in their operations • **No additional investment required** as current infrastructure to access grid electricity already in place	• Minimal impact given lack of growth in the short to medium term	• **Quick** way to improve green credentials • **No additional infrastructure investment required** as current infrastructure in place to access grid	• Significant **investment in capability** required to generate own renewables • The **large amount of energy required for DCs** means that renewable energy on-site generation **may not be practical** • Prime DC **land can be at a slight premium** due to competition	• Carbon offsets offer **immediate GHG remediation**, although not a long term reduction in GHG • **Hyperscalers (particularly global firms) are more likely to leverage carbon offsetting** than any other DCs, and they may do this either in-country, or via international carbon trading e.g. I-RECs

Notes: 1) PPA = Power Purchase Agreement. 2) LCOE = Levelized Cost of Energy
Source: Vision Invest Market assessment & entry strategy - Green Data centers (2023); Market participant interviews, Lit. search

WORLD ENERGY COUNCIL INDIA

Vietnam case study (1/2): Government policy supportive of renewables – leveraging more renewables / reducing GHG emissions

Key No impact / focus … Significant impact / focus

	Definition	Regulatory / structural push
Energy efficiency	• Energy efficiency of complete DC operations	• Energy efficiency **policies are in place for some industries / end markets,** for example with the government circular no. 25/2020 **requiring companies to release their energy efficiency plan** • The **ASEAN Plan of Action for Energy Cooperation** outlines the region's plan to reduce energy intensity by 32% in '25 (vs. '05), and encourage energy conservation
Renewables	• Use of renewable energy to power DC	• Leveraging renewables across the entire economy is **present on the government agenda**, with a **target of 15-20% renewables by 2030, and a reduction of GHG emissions by 9% by 2030** • Vietnam's **Green Growth Strategy for 2021-203** and Vision 2050 highlights the **importance of low-carbon growth**, but the govt also discusses the need for **international support** while to continue to **fuel economic development, sustainably** • There are **specific incentives in place for the development of renewable power**, which even **differentiate between grid renewables and decentralised** renewables
Water	• Responsible use and release of uncontaminated water	• Water management is covered through the Law on Environmental Protection and the Law on Water Resources, which **require registration, licensing and reporting for businesses heavily leveraging water resource**
Waste	• Minimised waste creation and responsible waste management	• Vietnam has **active policies in place** around waste management through the Law on Environmental Protection, including the management of hazardous waste (e-waste included)
Land & biodiversity	• Minimised impact on the local natural environment through operations	• Government environmental policy is increasingly focusing on deforestation and biodiversity in Vietnam, although given DCs are generally built in already industrial locations this **does not materially impact them yet**

In combination, energy efficiency + use of renewable energy tackle GHG emission intensity of DCs

No DC specific green regulations / policies are in place in Vietnam yet

Source: Vision Invest Market assessment & entry strategy - Green Data centers (2023); Market participant interviews, Lit. search

WORLD ENERGY COUNCIL INDIA

Vietnam case study (2/2): Renewable power generation is growing rapidly in Vietnam, which may drive adoption of PPAs; carbon offsetting not yet leveraged

Key No impact — Significant impact

	Grid		Renewables		Post-fact footprint mgmt.
	Grid supplied electricity	**Direct connection to 'renewables-heavy' grid**	**Green PPAs[1]** (Physical / Virtual)	**On-site RE generation**	**Carbon offsetting**
Description	Energy supply based on **non-renewable electric grid** (e.g. coal or gas or oil powered)	• Electricity sourced directly from **high % renewable grids** – may involve green PPAs for RE sources that feed directly into local grid	**Contract energy from renewables sources** to match total energy consumption, even if sources are elsewhere on the grid	**On-premise generation of renewable energy** e.g. solar/ wind farm connected to DC	**Purchasing of carbon credits** from third party registries
% of DC power source	**~90-95%** **~5-10% on-site generators**		**~0-5%**		**0% of local DCs,** Hyperscalers likely to carbon offset internationally (~5% of market)
Detail	• **EVN** is the largest (state owned) player; owns the grid • Electricity supplied via the grid is **not wholly reliable**, particularly in more **remote regions** • Customers therefore rely on **backup liquid fuel generator on-site** to guarantee consistent electricity supply • Power generation is currently **~40% coal** and **~10% gas**	• Government focus is primarily around providing sufficient energy to power economic growth, esp. given the large industrial focus of Vietnam's economy; green is important, but not the top priority • Power generated in Vietnam is **currently ~47% renewable**, largely due to sizeable hydro generation capabilities • Forecasts (Global Data) suggest **~43% renewable power generation by 2027**, moving backwards from current % driven by **focus on economic growth**	• **Corporate renewables PPAs are not yet feasible in Vietnam** – as these are direct power sales to the customer. IPPs may only sell power to EVNB • The **Ministry of Industry of Trade is working to enable PPAs** via wheeling set-ups on the grid, with a pilot scheme currently in place • This will be instrumental in Vietnam, where the **majority of renewables generation is in the central**; geographies, whilst **urban areas are in the North and South**	• It is still **very uncommon for DCs to have on-site renewable** generation in Vietnam • **Tax incentives are in place** to stimulate private development of renewable energy generation	• Vietnam has been implementing **three major carbon credit trade agreements** on a trial basis, for example the Emission Reductions Payment Agreement (**ERPA**) signed with the World Bank's Forest Carbon Partnership Facility (FCPF) in October 2020 • Carbon offsetting is **available privately**, as a **voluntary measure** for companies in Vietnam
Impact on DC players	• **Almost all DCs use grid energy** in their operations • **No additional investment required** as current infrastructure to access grid electricity already in place • The **grid in Vietnam is already reasonably green**, and hence DCs benefit from this. There is no increasing focus on green power in the short term, however		• **Quick** way to improve green credentials • **No additional infrastructure investment required** as current infrastructure in place to access grid	• Significant **investment in capability** required to generate own renewables • The **large amount of energy required for DCs** means that renewable energy on-site generation **may not be practical**	• Carbon offsets offer **immediate GHG remediation**, although not a long term reduction in GHG • **Hyperscalers (particularly global firms) are more likely to leverage carbon offsetting** than any other DCs, and they may do this either in-country, or via international carbon trading e.g. I-RECs

Notes: 1) PPA = Power Purchase Agreement | Source: Vision Invest Market assessment & entry strategy (2023); Market participant interviews, Lit. search

Select policy implications for India

PRELIMINARY

1 **Energy efficiency policies requiring data center operators to release their energy efficiency plan** – includes developing an energy conservation plan, auditing, and reporting consumption for DCs > X MW

2 **Simplification of Green Energy Power Purchase Agreements (PPA) for data center operators –**

- Data center (DC) categorization as a "priority consumer category" under Green Open Access (GOA) with capped approval timelines (≤15 days) and e-portals
- Provision for time block PPAs – i.e., for green power to be sourced in peak load hours when needed, than 24 x 7 (e.g., 16 x 5)
- Recognition of storage (BESS) as source of renewable power – i.e., battery charged with renewables recognized as renewable attribute in the actual hour used (high-impact, lower-cost path to decarbonize the hours that matter most)

3 **Provision of tax incentives to stimulate onsite renewable generation -**

- Extended depreciation of BESS/ onsite renewables; rationalization of GST for batteries / power equipment
- Lower cost of debt for onsite renewables by categorizing them as 'green infra'
- Single window clearance for hybrid on-site tech (e.g., solar + BESS + fuel cells); waste heat reuse (absorption chillers) treatment as energy efficiency measures, eligible for incentives

4 **Carbon offsetting arrangements for data centers (under the evolving carbon market, CCTS)**

- Direct DC participation in carbon exchanges, not only obligated entities with use-caps (e.g., ≤10–20% of gross emissions) to keep focus on real reductions
- Offsets/allowances: Residual emissions to be covered with trusted, high quality carbon credits under strict quality and usage caps
- Hourly RECs + storage: Renewable power measurement by hour, with batteries shifting green power to when needed without double counting

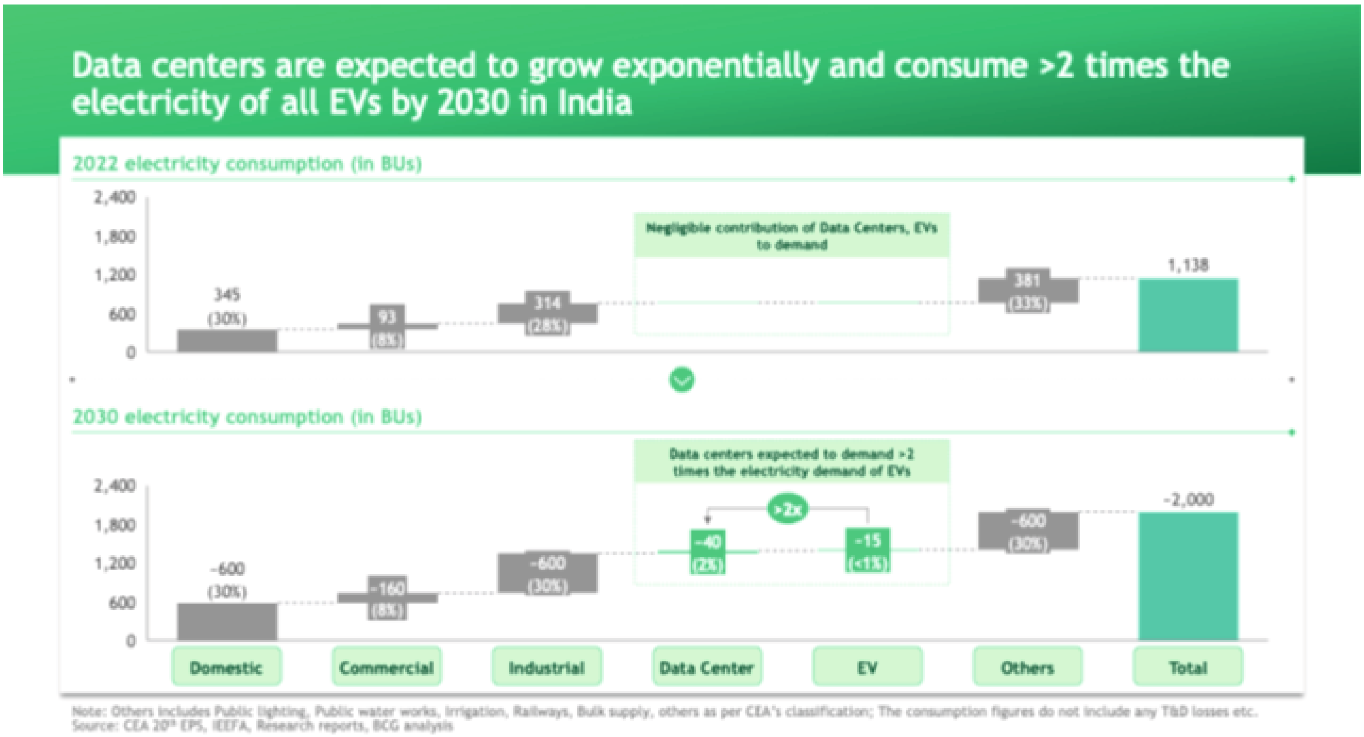
Note: REC - renewable energy certificate; CCTS – Carbon Credit Trading Scheme

WORLD ENERGY COUNCIL INDIA

BCG | Leveraging India's energy ecosystem to build data centers not only for India, but for the world

India's data-centre moment is arriving just as global power needs for digital infrastructure inflect. The IEA estimates data centres used roughly 1–1.5% of global electricity in 2024 and projects that demand could climb sharply this decade as AI workloads scale—even with further efficiency gains. It estimates that DC electricity demand could reach ~3% of global electricity demand by 2030 as AI workloads scale, even with continued efficiency gains. The demand is real, rising, and persistent.

On India's own trajectory, given the rapid increase in operational DC assets, electricity consumptions is expected to be 2-3% of Indian electricity demand by 2030. For context, the Central Electricity Authority (CEA) expects EVs to add only ~3 GW of peak demand and ~15 BU of energy by FY30 which is less than half the projection of EVs and yet garners lot more attention in context of new electrification use cases. In short: DCs are becoming a first-class use case for India's power sector and should be planned as such in generation, transmission and distribution roadmaps.



India enters this cycle with **structural advantages** that many competing hubs lack. **India's ecosystem has been purpose-built to let large consumers buy clean power at scale and at speed.** This ecosystem of robust nation-wide grid connectivity, inter-regional corridors to move renewable power to load centres, green open access rules, easy availability of round-the-clock renewable energy at globally competitive rates and strong government push to integrate ~500 GW of non-fossil fuel capacity backed by inter-regional corridors to move renewable power to load centres by 2030 is a game-changer. Together, these make 24×7 clean power procurement more accessible and bankable for DC campuses.

Meanwhile, the government notes that the grid's average emission factor has fallen by ~9% between 2013-14 and 2022-23 as renewables scale, improving the decarbonisation pathway for data-centre electricity. And with the Digital Personal Data Protection Act, 2023 (DPDP) enacted, India has a modern privacy

Location and connectivity advantages are also strengthening. Mumbai, Pune and Bengaluru continue to lead deployment; Mumbai now ranks 6th globally for under-construction DC capacity in Cushman & Wakefield's 2025 benchmarking across 97 markets. New subsea systems are putting India directly on East-West routes essential for latency-sensitive AI/ML traffic: Airtel landed SEA-ME-WE-6 in Mumbai (Dec 2024) and Chennai (Feb 2025), while Reliance Jio's IAX/IEX systems connect India into key APAC and Europe hubs. This combination—scale metros plus fresh international capacity—reduces latency risk and offers diverse paths to major cloud regions.

Global majors are voting with their wallets. AWS plans $12+ billion in India cloud infrastructure investment by 2030, including an $8+ billion Maharashtra commitment. Microsoft has taken steps towards expanding its Hyderabad datacentre to expand its India cloud footprint. Google has also announced intent to develop 1 GW data centre in Andhra Pradesh. Nvidia and Jio have partnered to build a data centre in India, while Digital Realty, Brookfield and Reliance launched the MAA10 campus in Chennai to anchor a 100 MW site. OpenAI, the company behind ChatGPT, has also announced plans to launch a 1GW data centre in India.

Put together, India **should target not just "India for India," but "India for the world":** capturing overflow and diversification from tight or moratorium-prone hubs (e.g., Singapore, US etc.), while offering credible decarbonised energy paths and scale land-power-fibre packages. That is already how major site-selection frameworks rank and screen markets; India can win more often by standardising these advantages across multiple states.

To unlock this faster, we should look to act on three levels:

1. **At Government-to-Government (G2G) level:**

   a. **Green power firming at scale.** Establish bilateral/multilateral deals for 24×7 clean power enablement (green firming + cross-border RE certificates) to anchor hyperscale campuses serving global workloads (e.g., ITMOs under Article 6 of Paris Agreement)

   b. **Cables + corridors, planned together.** Treat subsea landing rights and inland power corridors as one programme: fast-track undersea cable landings and match them with dedicated grid upgrades to designated DC parks so compute, power and fibre scale in lockstep.

2. **At National level:**

   a **Recognize DCs as a distinct load class.** Direct central and state utilities to plan for DC clusters explicitly in resource adequacy and transmission planning; set national SLAs for interconnection timelines and queue transparency

   b. **Make 24×7 clean power turnkey.** Operationalise a "DC-RTC" track that bundles green open access, ToD, storage/ancillary services and grid-support requirements into a single template PPA; publish model contracts and clear green-attribution rules.

c. **Backbone build-out.** Keep executing the 500 GW non-fossil transmission plan with earmarked bays and substation capacity at DC parks; publish quarterly dashboards on corridor readiness so developers can time investments.

3. **At State level:**

a. **Implement transparent single-window.** Implement one-stop portals with defined SLAs vs. 30+ different clearances in many instances; publish checklists and status trackers so investors can plan with confidence. Some states have enacted regulations facilitating single-window approvals.

b. **Tariff and tax certainty.** Offer predictable, sunset-dated incentives (electricity-duty waivers, demand-charge holidays aligned to ToD signals) tied to RE-RTC adoption and local supply-chain commitments.

Why this matters

Treating data centres as a key grid demand centre is no longer optional. The demand is real and persistent; the policy and system groundwork in India is strong; and the market is already responding, from hyper scaler capex to fresh connectivity. If India now standardises the "land-fibre-economical and clean energy-convenience" package across multiple states, it can position itself as a global deployment platform—serving domestic digitalisation and anchoring world-scale AI and cloud programmes from Indian soil. That's a competitiveness play measured not just in megawatts, but in where the next decade's digital value chains choose to live.

Convergence and Divergence

Converging Themes

1. **Power and Sustainability**

   Power availability, cost, and carbon intensity continue to be the biggest challenges facing data centre expansion. At the same time, there is growing agreement that India's changing energy landscape—marked by large-scale renewable deployment, better grid connectivity, and greater access to clean power through market mechanisms—can become a real advantage rather than a limitation, provided it is planned and coordinated carefully.

2. **Alignment with Government Policy**

   The expansion of data centres in India is closely tied to recent government reforms in the power sector, which have made it easier to access reliable, affordable, and progressively cleaner electricity. Measures such as granting infrastructure status to data centres and introducing the Green Open Access Rules now allow operators to procure renewable power directly—through open-access PPAs, group-captive arrangements, and time-block power supply. This has helped reduce their reliance on a grid that is still largely coal-based, with fossil fuels accounting for around 70 per cent of generation.

   Special Economic Zones have also become attractive locations for data centre development. They offer more assured power supply, fiscal incentives, and faster regulatory approvals, including for green power procurement. At the state level, policies are further supporting grid-ready growth by enabling dual-grid connections, offering tariff incentives, recognising storage as part of the energy mix, and providing priority access to transmission corridors. These efforts are particularly visible in states such as Maharashtra, Tamil Nadu, Telangana, Karnataka, and Uttar Pradesh. Taken together, these measures are helping the sector move steadily toward round-the-clock, carbon-free operations.

3. **UrbanCentric but Shifting Geography**

   While data centre development in India is still largely concentrated in major cities, there is a clear shift underway. Growth is increasingly moving toward Tier II and Tier III locations, driven by rising demand closer to users and improvements in local infrastructure. Edge data centres are beginning to take shape in cities such as Jaipur, Kochi, Ahmedabad, and Pune. At the same time, large metro regions like Mumbai, Chennai, NCR, Hyderabad, and Bengaluru continue to anchor hyperscale capacity, supported by strong connectivity, mature ecosystems, and concentrated demand.

4. **AI and HighDensity Design**

   The rise of AI and GPU-heavy workloads is changing how data centres are designed and built. Higher rack densities are becoming the norm, along with advanced cooling solutions such as liquid-to-chip and immersion cooling. While these technologies significantly improve computing performance and efficiency, they also push up capital costs and energy use. As a result, they place even greater emphasis on the need for robust and well-prepared power systems.

5. **Data Centres as a Core Power-Sector Load**

   There is growing agreement that data centres can no longer be treated as a niche or secondary source of electricity demand. They are increasingly comparable to electric vehicles or other energy-intensive industries in terms of scale and impact. This shift calls for data centres to be explicitly factored into generation planning, transmission expansion, and distribution system design, rather than being viewed simply as IT infrastructure operating on the margins of the power system.

6. **Need for Unified Policy and Green Standards**
   As the sector scales, the need for clearer and more consistent sustainability standards has become increasingly evident. Metrics such as PUE, CUE, and WUE are gaining importance, along with simpler and more predictable regulatory processes. Credible green data centre certification frameworks will play a key role in supporting sustainable growth while ensuring transparency and accountability.

Diverging Themes

1. **Depth of Sustainability Pathways**
   While sustainability is widely recognised as essential, the way it is approached varies quite a bit. Some perspectives focus mainly on ESG compliance and disclosure, treating sustainability largely as a reporting requirement. Others take a more integrated view, arguing for end-to-end power-greening strategies that include round-the-clock renewable supply, participation in carbon markets, dedicated renewable corridors, and efforts to reduce grid-emission intensity.

2. **Forecast Ranges and Capacity Outlooks**
   Estimates of data-centre capacity by 2030 continue to differ significantly, typically ranging between 4 and 9 GW. These differences are largely driven by varying assumptions around AI adoption, capital costs, policy implementation, and the availability of firm renewable power. Increasingly, these forecasts are seen less as conflicting views and more as scenario-based outcomes.

3. **Policy and Market Realism**
   Approaches also differ on the policy front. Some analyses call for a fully integrated national framework with common regulations and financial incentives to support green infrastructure. Others place more emphasis on working within existing state-level PPAs, DISCOM structures, and regulatory realities. This divergence reflects the ongoing tension between national coordination and the practical limits of federal-level implementation.

4. **Energy Infrastructure and Finance Orientation**
   There is also a split in how infrastructure needs are framed. Several studies highlight grid readiness, inter-regional transmission expansion, and access to concessional finance as the key enablers of growth. Others prioritise distributed storage and on-site generation, arguing that these reduce dependence on the grid. At its core, the debate is about whether scaling should be led by system-level planning or facility-level solutions.

5. **AI Workloads and Design Evolution**
   Across most assessments, there is broad agreement that AI-driven changes in data-centre design are unavoidable. Where views differ is in how these changes are interpreted. Some see advanced cooling and high-density layouts as manageable upgrades that improve efficiency. Others point to their much larger impact on energy demand, cooling requirements, and capital costs, with implications that extend beyond individual facilities to the wider power system.

6. **Technology and Energy Mix Diversity**
There is no single view on what the future energy mix should look like. Many studies favour battery-backed hybrid renewable systems, largely because they are already proven and commercially viable. Others argue for keeping options open by exploring emerging solutions such as green hydrogen or small modular reactors (SMRs). These differences reflect uncertainty around future costs, reliability, and long-term feasibility.

7. **Benchmarking and Standardization**
Debate continues over how sustainability benchmarks should be applied. Some stakeholders support greater flexibility at the state level to reflect local conditions, while others argue for uniform national standards for metrics such as PUE, CUE, and WUE. The underlying issue is how to balance local adaptability with the need for consistent and comparable benchmarks across the country.

8. **Regional and Structural Priorities**
Finally, views differ on regional development strategies. Certain frameworks focus on further optimising Tier I hubs through grid strengthening and densification. Others advocate a more decentralised approach, shifting growth toward renewable-rich Tier II and Tier III locations to improve sustainability and overall system efficiency.

Conclusion

India's data centre sector isn't just growing; it's standing at a true **inflection point.** Over the next five years, the industry will determine whether the country steps up to become a **global powerhouse in digital infrastructure** or continues to rely on services hosted overseas.

The opportunity is massive: the market is projected to **quadruple by 2030**, fueled by unprecedented hyperscaler investments, the AI boom, widespread digitization, and the 5G rollout. But to seize this prize, India has to face its structural realities head-on. We must aggressively tackle bottlenecks like **power availability, land acquisition, connectivity, and policy gridlock**, all while embedding sustainability at the core of every new project.

Ultimately, the foundation for India's digital age won't be poured just in lines of code or new devices. It will be built in the **concrete, cables, and massive cooling towers** of its data centres. That infrastructure is the real test of our digital ambition.