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Evolving Landscape of Data Center Delivery in India

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Aerial view of
Yotta Noida Data Center Campus

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LEADER'S NOTE

The gush of data over the past five years has led to the tremendous demand for digital infrastructure to support the ongoing growth and sustain it as businesses achieve greater digital maturity. The digital landscape across industries and the public sector is witnessing a tectonic shift with increasing penetration and real-life use cases of novel technologies like Artificial Intelligence, Machine Learning, Big Data & Analytics, Internet of Things, and Blockchain among others. These are essentially bringing people closer to businesses and governments in a multitude of ways.

According to a Deloitte study, India's smartphone user base is expected to reach 1 billion (100 crores) by 2026, and interestingly this growth will be largely driven by the country's hinterlands. This indicates that the amount of user-generated data will only grow in the coming times. As more and more people get access to internet-enabled mobile devices, the uptake of digital platforms and internet-based services will witness a massive surge, thereby leading to the need for more data center capacities.

Further, the new wave of digital transformation among enterprises post-pandemic is already on the fast track. Starting in early 2020, businesses have been turning to third-party colocation facilities for their data center operations, further complemented by an increased shift towards a hybrid IT approach – leveraging the combined capabilities of hosted data centers and multi-cloud setups.

The much-awaited Infrastructure status for data centers is a landmark development that will provide a fillip to the industry. As India embarks on the next phase of the Digital India journey, the Government recognises data centers as the backbone of the country's digital infrastructure.

While the penetration of mobile internet has given us a glimpse of the power of connectivity through increased OTT and social media usage, a robust internet connectivity layer supported by data center presence will catalyse digital adoption at a larger scale. The push for data localisation will not just mandate data to be stored and processed in India, it will also result in a massive influx of Indian data that currently resides in overseas data centers.

Realising the market potential and abundance of opportunities, particularly with the shift towards the hybrid multi-cloud model, hyperscalers are ramping up their investments in India as they set up new availability zones. Their growing footprint is resulting in an environment of 'co-opetition' for domestic data center operators. This is because hyperscalers primarily need massive data center capacities, which can go up to several buildings and entire data center campuses. Data center operators are better placed to cater to these needs of hyperscalers through their infrastructure. Hyperscalers get the needed capacities to deliver their cloud services to enterprises, and it also saves them from huge CapEx and complexities of land acquisition, construction, and operations. Buying infrastructure further reduces the time to market, allowing them to seize more opportunities.

While infrastructure capacity forms their primary need, hyperscalers may also have custom infrastructure needs, as they cater to a range of domestic and global companies with diverse compliance and performance requirements. This is where they leverage the prowess of data center companies to build dedicated data center buildings and campuses as per the requirements - from selection of land, location, DC design, operational specifications, to connectivity, etc.

A robust amalgamation of all these drivers will continue to fuel the growth of data centers in India. To reiterate, 'hyperscale' is the keyword that will define future success. Efforts put by data center operators today will determine the success and scale of digital endeavours of the future.

Sunil Gupta,
Co-founder and CEO,
Yotta Infrastructure

Technology has become an integral part of today's lifestyle with more than 4.5 billion people i.e. 60% of the world's population having internet access through their devices. Ease of access is leading people to spend many hours in the virtual world. Technology is relying on cognitive human interaction, behaviours such as preference, response, interaction, and so on, to develop technologies like facial recognition, Internet of Things (IoT), Virtual and Augmented reality, cryptocurrencies, and robotics, among others, foreseeing the trend in Information Technology (IT). In addition, wireless spectrums such as 5G, 6G, and 7G will further increase the bandwidth for faster access to data thus increasing the amount of data transferred.

The rapid increase in data traffic is the major challenge for organisations to store, manage and retrieve the massively growing data. These machines are expected to generate data that will outpace any other commercial data. As per a report by Applied Materials, by 2023, more than 90% of data will be generated by machines. As all these businesses grow, their need for reliable and scalable space to colocate/hold IT infrastructure also increases. Any data downtime can have crippling effects on a business in the form of decreased productivity, customer churn, and lost revenues. The rise in smart data sparking, highspeed internet, clouding of apps, data localisation bills, and remote working in conjunction with the fast digitalisation rate driven by Covid-19 fuelled an overwhelming expansion of in data centers in India. The Covid-19 pandemic has pushed Indian businesses, both big and small, to use digital platforms and cloud computing to reduce operational expenditure.

Hyperscale providers had been working in India initially through colocation agreements with third-party providers before looking to commence constructing their data centers in India. The elaborate process of designing and developing data centers can be complicated by major challenges such as changes in technologies, physical structures, and end-user requirements, each of which includes a series of requirements and moving targets that further leads to unpredictability in project cost and program.

It must be noted that the data center construction industry is still in a nascent stage in India and not at the point where the costs are standardised like other asset classes. Hence owners need to be careful about setting up an initial project budget. The investments required for establishing a data center are considerably high which is due to the interdependencies on physical infrastructure and the fragile, ever-evolving nature of the IT technologies which get constantly upgraded. The idea of using reference cost per sq feet or cost per MW from historical project spending does not provide a clear barometer for benchmarking and owners need to understand the factors and drivers which trigger these variations in project costs.

Various types of development models will have impact on the timeline to complete the project and start operations. Like elsewhere, completing the projects on time is a major challenge especially in a post-Covid world with supply chain constraints and increased transit period.

A greater focus on the total cost of ownership has forced organisations and their designers to be cognizant of the cost impact of design decisions. Trade-offs must be made, and decisions tailored for a given business, its needs, and the IT infrastructure supporting it. Local market knowledge helps in designing an efficient and a balanced solution. With more than 850 MW of IT project experience in India, Gleeds believes that complex projects such as data centers need to be structured the right way from the beginning, based on the organisation's inherent strengths and ability to deliver. Based on this approach, design, procurement, and construction functions could be defined which will have an impact on project cost and time criteria.

Vishal Shah,
Executive Director,
Gleeds India

INDIAN DATA CENTER INDUSTRY CURRENT CAPACITY, FUTURE PROJECTIONS

India's data center growth story is recent and still evolving. It started only about 7 years ago when digital transformation became a buzzword among enterprises. The growth of third-party colocation facilities has been driven by an increased shift towards cloud which led to the influx of hyperscalers, who in turn, needed data center capacities for expanding their availability zones. Another major factor has been the increased adoption of colocation among enterprises, as they started moving away from captive data centers and revamped their digital infrastructure for public and private cloud spaces.

However, despite significant growth in these years, India's data center supply doesn't meet the scale of demand. The country needs 7 to 10 times more data center capacity to cater to the burgeoning demand and match the size and scale of mature global data center markets.

Data centers in India today

India is among the major players in the data center sector in the APAC region. Data centers are sector is critical for national security, internet infrastructure, and economic output. In India, data center infrastructure is growing exponentially, with greater preference for the Cloud, as well as data consumption and generation by half a billion digital users.

Indian data centers occupy over **8 million sq.ft.** area, consuming over **750 MW** power.

More than **8 million sq.ft.** and **870 MW** capacity is under construction

Industry is expected to grow exponentially to **1,007 MW** by **2023**, up from **447 MW**

Real estate demand is set to rise by **15-18 million Sq.ft.** by 2025. (As per Arizton Advisory & Intelligence)

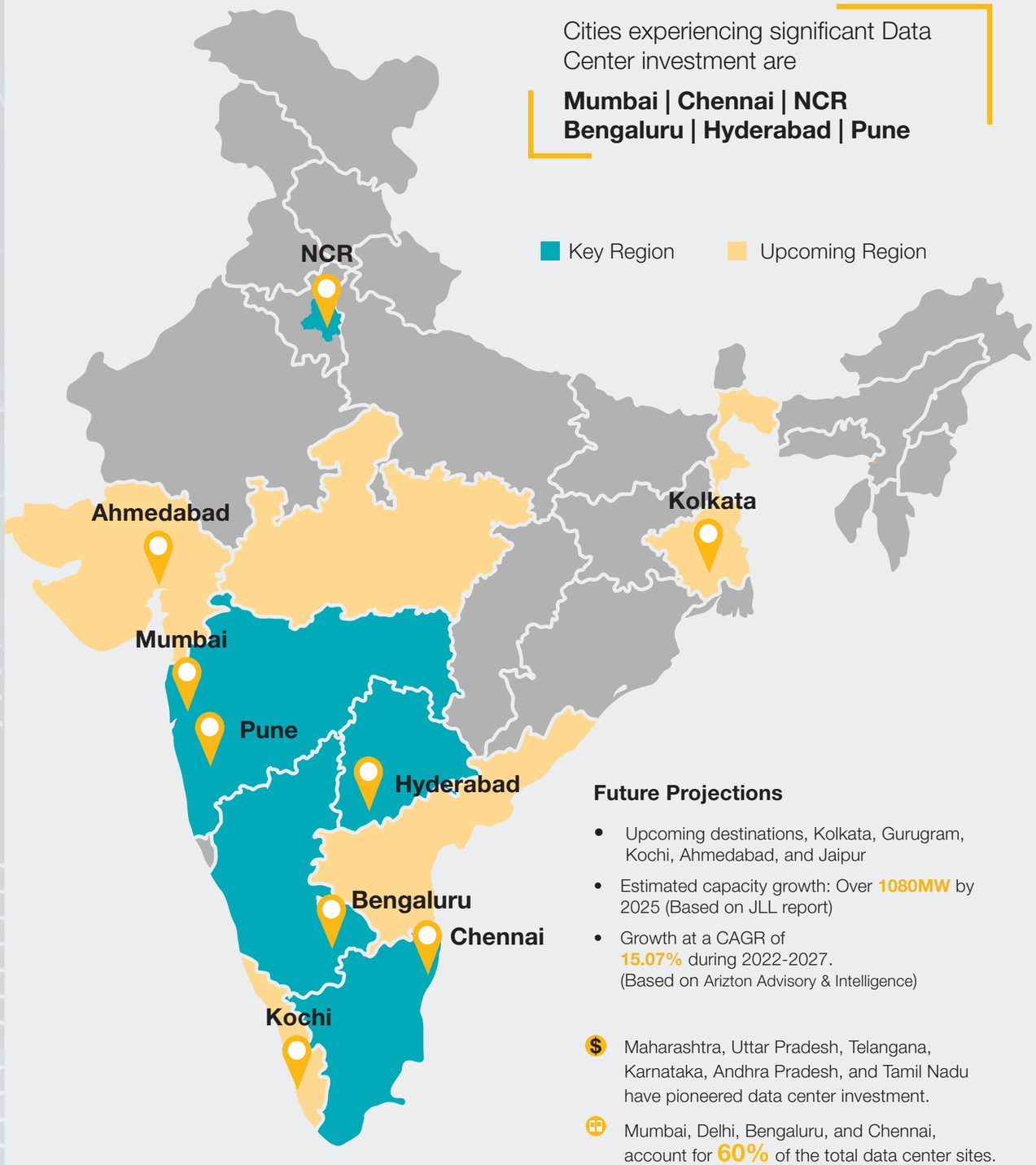
Market growth will witness investments of **$10.09 billion** by 2027 (As per Arizton Advisory & Intelligence)

Total capacity: Around **500 MW** as of 2021. (Based on JLL report)

Submarine Cables

- As of 2021, TeleGeography has reported more than **1.3 million km** of submarine cables in service worldwide.
- **India** is expected to experience the **fastest growth** in the Asia Pacific submarine cable industry.
- **Mumbai** and **Chennai** are two of the most significant data center markets, driven by their proximity to subsea cable entry into India.
- **Kochi**, **Trivandrum** and **Tuticorin** are the other locations for subsea cables.

Sources: Economic Times, Techwireasia, Construction Week Online, Arizton Advisory and Intelligence, Daily Host News



Future Projections

- Upcoming destinations, Kolkata, Gurugram, Kochi, Ahmedabad, and Jaipur
- Estimated capacity growth: Over **1080MW** by 2025 (Based on JLL report)
- Growth at a CAGR of **15.07%** during 2022-2027. (Based on Arizton Advisory & Intelligence)

Maharashtra, Uttar Pradesh, Telangana, Karnataka, Andhra Pradesh, and Tamil Nadu have pioneered data center investment.

Mumbai, Delhi, Bengaluru, and Chennai, account for **60%** of the total data center sites.

The demand for third-party data center facilities will continue to be on the rise as digital environments today require flexibility, scalability, and high uptime, while maintaining IT spending. Shedding the burden of on-premises data centers, enterprises are increasingly opting for Tier III and Tier IV facilities that help them meet the requirements of their evolving workloads. An amalgamation of these growth drivers will steer the Indian data center industry in the next 5 to 7 years.

GROWTH OF DATA IN INDIA, DRIVERS OF MARKET GROWTH AND EXPECTATIONS

Overview

As the people of India get increasingly connected to the internet economy, the greater will be the data generated and consumed by them. The resultant impact will be on businesses and government as they will have a vast data pool to store and process, thereby leading to robust data infrastructure needs.

1. The growth of data explosion, itself, can be determined by the estimated increase in internet userbase, which is said to cross **900 million** by 2025.

2. Since 2017-18, the total consumption of wireless data has increased by more than 7x to **32,397** petabytes in **Q1 2021-22**, according to the Economic Survey of India.

3. From just **1.24 GB** per person five years ago, Indians now consume a whopping **14.1 GB** of wireless data per person per month.

4. Taking the government's efforts under the Bharat Net program and commercial roll-out of **5G** into account, India's data growth will witness a giant leap.

India's data center industry has also gained significantly from limitations within Singapore for data center development, making global enterprises turn to India to set up disaster recovery sites. Chennai, particularly, due to its long coastline that's base for cable landing stations, has been witnessing large investments by renowned data center operators.

Drivers of market growth

Digital India: Bullish on the Digital India initiative and making India a trillion-dollar digital economy, the Government's efforts are aimed at transforming healthcare, education, banking, agriculture, citizen services, and smart cities among other sectors. All of which will demand robust underlying digital infrastructure.

Enterprise digital transformation: Perhaps the most discussed topic in the business world, digital transformation with evolving technology use cases will witness a surge. As customer experiences, operational optimisation and business excellence gain higher priority in boardroom discussions, businesses will increasingly turn to AI, IoT, AR, and VR to innovate and realign themselves with the preferences of the digital-native consumer. The foundation of these new-age use cases will be built on high-performance computing and the cloud, giving a plethora of opportunities to data center players to cater.

Digital banking and payments: India's Unified Payments Interface (UPI) enabled digital payments adoption is a global case study. The country's largest retail payment system has processed transactions worth more than Rs. 76 trillion in 2021-22, compared to Rs. 41 trillion in 2020-21. The number is expected to clock Rs. 100 trillion, according to Reserve Bank of India (RBI) Governor Shaktikanta Das. This is complemented by the digitisation of core banking services and efforts to bring people from underserved regions on banking platforms with Aadhaar-led inclusion drive.

E-commerce and OTT: The Covid-induced lockdowns have played a great role in bringing more people to e-commerce and OTT platforms, and this trend is here to stay. The online retail market is expected to enjoy a 37% share of the total organised retail market by 2030, reiterating the scale of transactions that e-commerce platforms will witness and how data centers and cloud will be at the helm of supporting it.

Data localisation: A major contributor to the growth of data in the times to come, localisation of Indian data within the country's boundaries will lead to enormous storage and processing capabilities, thus demanding the development of hyperscale data center clusters across the country.

Expectations ahead

Businesses and public institutions are equipping themselves to keep pace with digital advancements. The ball is now in the courts of data center players to seize the opportunities and build more capacity to address the needs.

DATA CENTER POLICY

The Ministry of Electronics and Information Technology (MeitY), in November 2020, released the draft Data Center Policy for the evolution of data center infrastructure within India, necessitated by the data localisation provisions of the Data Protection Bill. The Policy emphasises its vision of making India a global data center hub, promoting investment in the sector, propelling digital economy growth, and enabling the provisioning of trusted hosting infrastructure to meet the country's growing demand.

- India offers various tax incentives for data center investment across states.
- Incentives are conditional on the usage of domestic IT hardware and non-IT equipment such as MEP major equipment.

Maharashtra

- Stamp duty exemption on land acquisition for data center development
- VAT refund
- The state's IT Policy 2015 provides for an exemption from electricity duty

Telangana

- Sales tax and building fee rebates, as well as land at subsidised costs
- Dual power grid network availability to ensure uninterrupted supply
- Availability of renewable energy under open access system
- Subsidised power supply and fuel prices for eligible DC projects

Tamil Nadu

- Electricity duty exemption
- Stamp duty and fiscal incentives on land/building
- Car parking provisions and multi-level stacking of generators
- Promotes investments in Tier II and Tier III cities
- Incentives to be provided for green building data centers
- Incentives will be provided on power and connectivity

Gujarat

- Incentives to be provided in allotment of land
- Development of data center parks
- Stamp duty concession
- Electricity duty exemption

Uttar Pradesh

- Capital subsidy
- Interest subsidy
- Land subsidy
- Stamp duty exemption
- Electricity duty exemption
- Dual power grid supply
- Transmission and wheeling charges exemption

Karnataka and other states are still working on detailed data center policies, incentives, and tax benefits.

TYPES OF DATA CENTERS

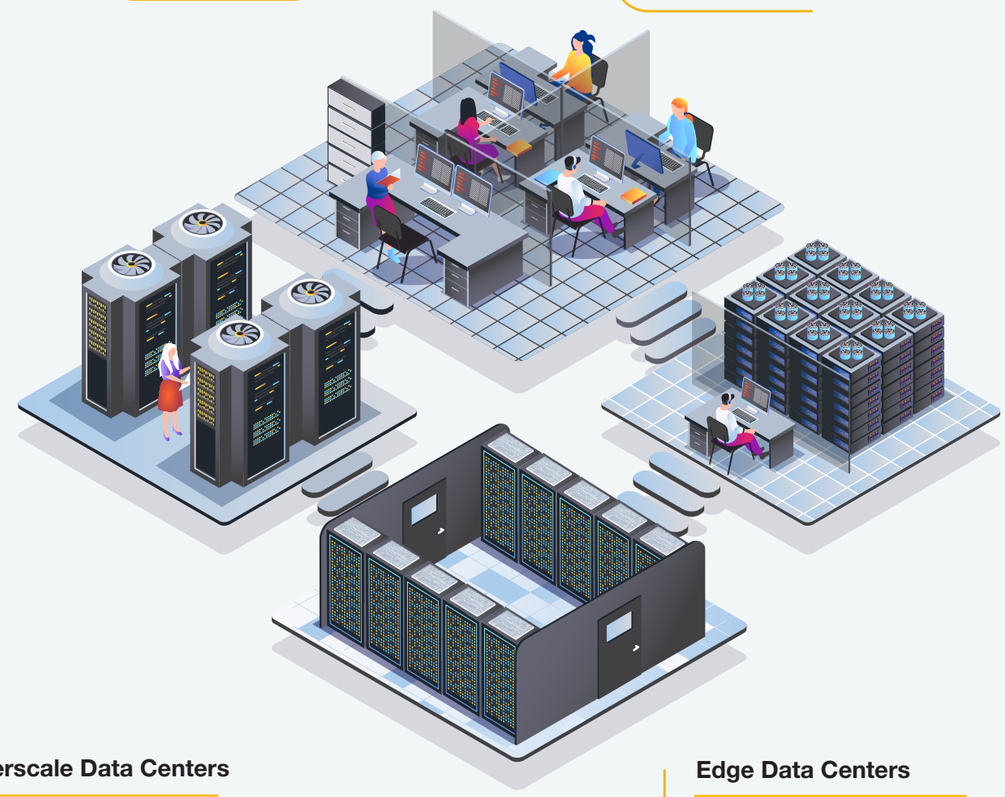
There are various types of data center and service models to choose from. Their classification is determined by whether they are owned by a single entity or a group of companies, the computing and storage technology they deploy, and even their energy efficiency. There are various types of data centers currently being developed globally.

Enterprise Data Centers

Built, owned, and operated by companies and optimised for their end-users, most often on the corporate campus or off site.

Colocation Data Centers

Colocation data centers consist of one data center owner selling space, power and cooling to multiple customers at a specific location, often providing technical advice to inexperienced customers.



Hyperscale Data Centers

Data and applications are hosted by a cloud service provider located in an off-site facility offering robust, scalable applications and storage including Big Data usually with ultra-high speed and minimum numbers of servers.

Edge Data Centers

Edge data centers are smaller and nimbler facilities that are designed to complement and augment existing cloud deployments to selected local area users.

DEVELOPMENT DRIVERS AND CHALLENGES

The boom of data centers in the last few years has attracted investment from developers and private equity players. The growth of data centers across the country, especially in fiber landing cities such as Mumbai and Chennai as well as leading information technology hubs such as Pune, Hyderabad, and National Capital Region (Delhi, Gurgaon and Noida) has been tremendous, leading to increase in mergers and acquisitions as well as exponential rise in land prices for prime plots.

With demographic and demand drivers, The next few years are expected to fuel the development of edge, colocation and hyperscale data centers across India. However, there are several factors that govern the growth and success of the data center.

Lack of geographic distribution

- The massive costs involved in laying inland fiber optic cables from the nearest paths make establishing data centers in multiple cities prohibitively expensive. As a result, most of the current demand is concentrated in cities such as Mumbai, Chennai, Noida, and Hyderabad, followed by Bengaluru, Pune, and Kolkata. The key challenge in these cities is land acquisition.
- The technical criteria used to evaluate data center are extremely stringent. Some of the factors are proximity to a power substation, fiber path, soil and air quality, natural disaster risks, distance from oil terminals or mass rapid transit systems, distance from residential areas, and so on. Satisfying some of these criteria can be extremely challenging in India.
- Local regulatory approvals can take time and cause bottlenecks in data center commissioning timelines. A simplified single-window clearance to expedite permissions can go a long way toward increasing global trust.

Local authority regulations and policies

In terms of local approval, there are no specific data center regulations and policies. Major roadblocks adversely impacting project delivery are:

- **Car Park Policy**

  Currently, data center developments are classified under commercial or industrial buildings standards, and parking requirements are determined accordingly. As basements are typically not preferred, most projects would require on-grade parking spaces as per the directives of local authorities. The National Data Center Policy, which is currently under consultation, could assist as most data centers have limited car parking requirements and a clear direction would help to avoid a longer permitting period.

- **Fire Fighting**

  Data center buildings should have their firefighting code as the number of employees, means of escape requirements, nature and scope of sprinkler systems, and other factors differ considerably from those found in typical commercial or industrial buildings.

Lack of trained manpower with local/international experience

- Extremely high demand for designers, quality assurance professionals, testing and commissioning teams, and purchasing experts subject to new industry steep learning curves.
- Lack of technical staff to meet current and future demand forecast to 2025, including mechanical and electrical engineers, strategy and operations resources, and all types of control and monitoring professionals.
- There is a cost-risk and knowledge gap for local/international equipment, materials, and procurement that could be tapped into for optimum value for money during the complete project lifecycle.

Supply chain immaturity for certain products

- The building of a data center requires the use of specialised products that are not readily available in many investment locations. Supply chains are therefore constrained and would depend on international manufacturers to fulfill the demand. This has an adverse impact on delivery, time, and cost.

Lack of experienced general contractors

- The Indian market expects the general contractor to be proactive in data center project delivery. Preparation of shop drawings, clash detection and sourcing local or international products that match the intended specifications is only possible with an experienced general contractor on board. If that is not fulfilled, data center developers would need to enhance their project delivery teams to manage the expectations and in a way proceed with the trade package breakdown of procurement, which is not an ideal situation for a complex structure like data center.

VARIOUS DEVELOPMENT ROUTES FOR PROJECT DELIVERY: BUILT-TO-SUIT, COLOCATION, SELF-DEVELOPED

Built-to-Suit

Built-to-suit data centers are highly specialised facilities that are tailored to the needs of the customer. They are typically designed, built, and maintained by organisations that provide a wide range of data center products and operational services.

Key qualities to look for in a built-to-suit data center:

- Enables an enterprise to choose the ideal geographic location that meets its business continuity parameters
- Investment strategies for new construction and improvements
- Advanced security and safety protocols
- The ability to use efficiencies to reduce build times while keeping costs low
- Allowing customers to take over ownership and/or operation after construction.

Colocation

Colocation facilities provide scalability, continuity, and security for applications, data, and systems, as well as access to the most advanced data center technology, while eliminating the need to build, staff, and manage in-house server rooms or data centers, allowing clients to focus on their business.

Key qualities to look for in colocation data center:

- A model of predictable operational expenditure
- Flexibility and scalability that allows for the scaling up of capacity (space, power, and bandwidth) quickly
- Get experienced data center management professionals to manage your infrastructure
- Modern facility infrastructure responds to changes in cooling, power, and the environment
- Data integrity is ensured by a secure facility.

Self-developed

Self-developed data centers are typically constructed and used by a single organisation for its own purpose. Physical computing equipment such as servers, network systems, and storage devices are housed here, along with supporting infrastructure such as power, cooling, and environmental monitoring systems.

Key qualities to look for in a self-developed data center:

- An on-premises environment provides organisations with direct access to their servers as well as greater control over their infrastructure.
- Increased visibility
- Compliance assurance
- Software compatibility

DEVELOPMENT
COST DRIVERS

One of the major challenges faced by project stakeholders during the early stage is to determine the project budget. Being a sunrise sector, there is limited information available to make an informed decision on project costs. The idea of using analogous estimating methods i.e., cost per square feet or cost per MW comes with considerable risk when establishing project budgets for the significant costs that data center projects demand. Typical “abnormal” that creates cost differentials should be identified and assessed. Also, due to complex nature of the projects and phasing requirements, the market trends considerations need be analysed carefully during the business case development.

The business case parameters would need to be considered and researched on the development environment surrounding the site and local bylaws, which will help in understanding the project viability and potential issues. Depending on building planning bylaws and land parcel size, a horizontal or vertical development would be planned.

Type of end user

- The design requirements for a colocation provider, a hyperscale provider, or an enterprise user differ dramatically.

Location

- Land, power, OFC, and labour costs vary significantly in urban, sub-urban or rural locations. The location of the project may require additional costs for connecting infrastructure such as fiber networks, roads and power. Detailed technical due diligence for the site selection process is highly recommended to identify risks associated with environmental catastrophes, terrorism threat potential and the nature of surroundings, businesses and so on. Congested and narrow connecting/internal roads would lead to operational issues in the future, making it less a attractive site for development.

Scale

- Most systems do not initially run at full capacity, so scaling the infrastructure defers capital expenditure, enhancing the business case, while improving efficiency.

Flexibility

- With the flexibility of layout and floor loading to facilitate quick and agile configurations, day 1/day 2 scenarios may require more resilience to maximise cost-effectiveness, avoiding higher future reworking costs. Floor and load flexibility may require the usage of steel frame-based construction which would lead to additional costs and a limited contractor pool in a market such as India. The need to refresh IT servers, often on 3 to 5-year cycles, introduce a design requirement and consequential cost impact.

Existing site conditions

- Site topography, soil conditions, previous use, existing structures and below ground utilities may increase the cost as well as time for excavation and levelling at the start of the project. In addition, maintained sound levels affect the cost of acoustic containers for backup power generator sets.

Space, planning and design

- Different operators such as hyperscale/colocation providers have different internal space requirements. Server space or server hall space, plant space, storage and IT assembly areas, reception/corridors, or swing space, aid the effective long-term operation of a facility and project costs. Adequate and well-planned space ensures that operating costs are minimised and balanced with overall capital costs.
- Recent space requirements with a cost impact also include overnight stay facilities for critical staff, security room, area for building services equipment and configuration.

Type of foundations

- Foundation type will be project specific with the potential to have a significant impact on building costs.

Type of frame and construction methodology

- Depending on the type of frame selected such as concrete based or steel frame, the costs can vary significantly. Structural steel buildings however provide advantages in terms of better quality control and faster construction. Similar to that, pre-cast and pre-fabricated elements would assist in fast tracking the work on ground but would have cost impact.

Floor-to-floor heights

- In general, the higher the floor-to-floor height, the higher the construction costs. Aspects such as additional stage requirements, additional wall construction, wall covering, additional façade/ performance louvre requirements, additional volume of air conditioning, and the resulting electrical works must be considered.
- The cooling strategy, server rack heights, operational costs and fireproofing methods will impact the floor-to-floor heights.

Level of finishes

- Depending on the requirements of false flooring, soft and hard furnishing items, open/closed ceiling requirements, type of flooring finishes and branded products will create cost impact.

Power and heat load density

- The cost of building services is not only dependent on the functional design of the data center facility and Power Use Effectiveness (PUE) but also the rack density.
- For cabinets/racks with cooling loads up to 30 KW, additional high-density provisions apply with consequential cost impact on MEP systems.

Energy efficiency

- Operational costs account for 80% of the total data center infrastructure lifecycle cost. Power Use Effectiveness (PUE) which relates to overall power consumed by facility to power consumed for IT equipment, is one of the important ratios which governs the design. However, it must be set up considering local issues and design requirements.
- Investing in cutting-edge MEP design and the latest equipment to optimise power usage will have long term benefits and support funders/investors ESG requirements.

Electrical

Multiple cost drivers are associated with location and specifications. Operating cost benefits should also be considered such as:

- Optimum cable lengths to major equipment
- Safety and security services such as water leak detection, fuel leak detection system, rodent control, and access control
- The selection of aluminium vs copper
- Zinc-coated trays vs GI trays
- UPS ratings along with the type of batteries

Mechanical

Multiple cost drivers associated with specification choice. Operating cost benefits should be considered sush as:

- The selection of fire suppression systems, use of a pre-action system (dry-type sprinkler) vs gas suppression
- Fire sprinkler fittings (welded or grooved)
- MEP suspended services hangers/supports, type of seismic supports (suspended or floor mounted) or rigid support
- Water mists systems for DG and AHU areas

Data center monitoring, control, and system integration

- Potential significant cost depends on the level of system integration, and the extent of the information that is being generated and managed.
- Future-proofing design aspects such as sensors based on the Internet of Things (IoT) monitoring.

IT infrastructure equipment

- Careful consideration of the costs related to active IT and networking, fiber paths and connecting rooms, racking system servers and testing and commissioning costs need to be considered as part of the overall development costs.

Procurement

- Predominantly driven by the owner’s appetite for risk and those best placed to manage them, procurement routes can have significant cost impact on data center projects.
- Contracting arrangements such as Design & Build, Design–Bid–Build, Guaranteed Maximum Price (GMP), Item rate contracts, EPCM routes have considerable cost difference between each other which will impact overall costs.
- Considerations such as local vs international vendors, local construction law and licencing, market conditions, sector maturity and the availability of skilled resources, etc will also impact the project costs.

Project schedule

- One of the major requirements for data center construction currently is a faster go-to-market timeline. Due to ever expanding data traffic needs, longer approval processes, time for construction and delivery needs to be optimised and reduced. Methods and means in selection of construction methodology can increase project costs. A crashed schedule to achieve target data would need acceleration costs to be allowed as the project budget.

Local taxations and law

- Investment decisions and choice of location are heavily influenced by tax breaks, deferred payments/corporate taxation levels.

Import duties

- The cost impact of Import duties and tariffs on overseas products, storage, insurance and transportation to site.

Local market expertise

- Premium costs necessary to secure the technical capability required to design, construct, and operate data center facilities are driven by the sector infancy in India.

Owner’s requirements

- Premium costs associated with the owner requirements including specific design aspects (minimum targeted design PUE, uptime Tier level/redundancy), required insurance levels, approved and specific products/brands amongst others.

Owner’s costs

- Careful consideration of all costs related to in-house or external design and project consultancy costs, liasoning, management and overseeing costs, operational costs need to be considered as part of the overall development costs.

MAJOR FACTORS IN DEVELOPING DATA CENTERS IN INDIA

As one can imagine, developing a data center is a capital and time-intensive process. From selection of suitable land parcels, securing complex permits to commence the work, developing designs, vendor procurement and project execution, it takes tremendous efforts from all stakeholders. Furthermore, in an ever-changing technology environment, the design must be adaptable, scalable, agile, and future-ready.

Before the foray of hyperscalers in the Indian market, particularly for expanding their availability zones, server spaces were provided by third-party data center operators that didn't possess real estate prowess but managed to grow in their infrastructure footprint over years, in a substantial manner.

Realising the immense market opportunities, traditional real estate developers marked their entry into this space in recent years either as colocation providers or built-to-suit developers for data center operators. Owing to hyperscalers' need for setting up captive data centers in India, some major addressable challenges include time-to-market (TAM), capital investment and operating costs, liaisoning and land ownership transfer, and finding the right procurement routes.

Time

Time is of paramount importance for data center operators, especially for expansion in new regions like India. Optimum utilisation of the existing colocation server space and anticipating new traffic as per sectoral growth would require data center operators to run against the clock to hand over the data center. The typical process involves search and identification of available land parcels in required geography along with fiber connectivity, power availability, processing it through the Government or private sector as the case may be, completing technical due diligence and taking hand-over of the land, carrying out design and procurement from excavation/shore piling, constructing the data center, arranging prior approvals during and after the construction process, providing the first server space / whitehall (pods), and completing the detailed testing and balancing to commence operations. For a 20 MW IT load facility, the end-to-end process could span 2.5 years to 3.5 years, depending on various delivery factors.

Capital Costs

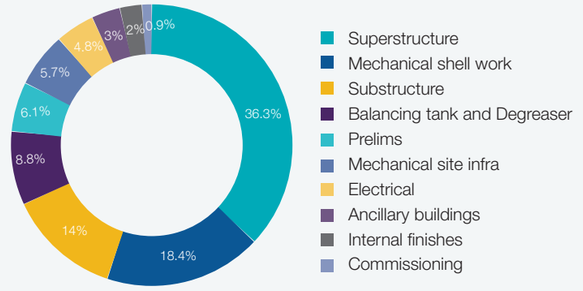
Generally, the data center industry considers Cost/MW capacity as a critical matrix to understand and structure the overall project feasibility. While Cost/MW is a correct matrix to compare, there are multiple aspects as seen in the cost drivers which can affect the final costs. Hence, it is recommended to break down the costs in the following manner for a better evaluation:

- Construction Costs per Sq. Feet or Sq. Meter
- Interior fitout for server space (pods / white hall) / MW IT load

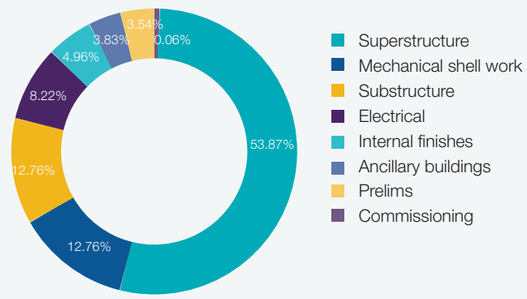
At large sites with huge infrastructure development, it is recommended to break down the external development / site infrastructure on a per-user basis. It is also recommended to remove long lead equipment such as chillers, generators, panels, etc and compare them separately as costs for the same may vary due to the make, origin and procurement strategies. While there are many cost drivers in a data center, based on Gleeds' experience of working on close to 850 MW of various grades of data centers, procurement route, types of clients, the cost has been in the range of 4.5 Million USD/MW to 6 Million USD/MW. These include all construction, fitout and equipment costs, except costs of substation construction.

Typical break down consists of the following

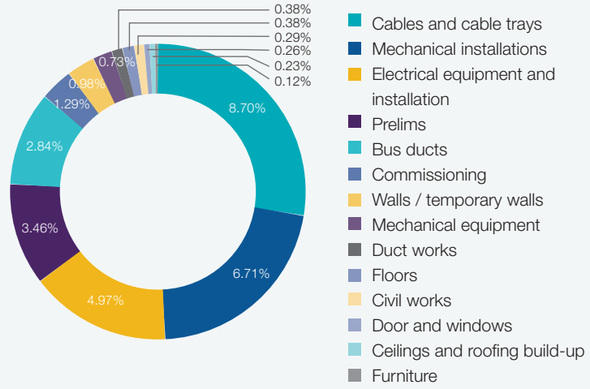
Shell Work – Low Range



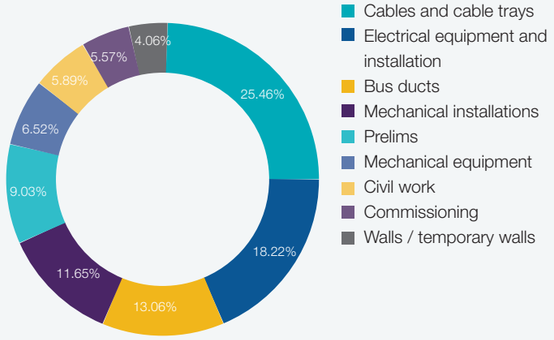
Shell Work – High Range



Interior Fit-out – Low Range



Interior Fit-out – High Range



Assumptions and exclusions

- The site will be levelled and ready to commence building works
- Tier III/Tier IV rating requirements would be fulfilled
- Costs for security such as man-trap, CCTV, BMS, access control, NOC room and IT-related costs are excluded, however, containment for systems included
- The range is for multi-storey DC buildings in an urban location. The cost range may vary for semi urban locations with large external development and low-rise data center buildings
- Multi-storey buildings include steel or concrete structure for diesel generators
- Costs exclude GST and labour cess – approximately 18% and 1% respectively as currently levied
- LLE costs are based on the average quality of products, however actual costs depend on the owner/designer of the data center along with a range of factors such as brand, type of model, country of origin, etc.
- Racking system costs are excluded
- Procurement route would vary based on the item rate contract, design, build or guaranteed maximum price which has a cost delta of 10%-15%
- All costs related to fiber connectivity at the site
- Substation costs are excluded, which will be dependent on the type of substation and its capacity/ratings
- Forex rate has been considered as 1 USD = 74 INR

It must be noted that cost ranges listed above are for informational purposes only. It is not intended to serve as a comprehensive analysis of data center costs. At various stages of the project, owners should conduct specific cost and risk planning. As Gleeds is unaware of the owner's specific project location and timeline, labour, materials, equipment, and inflation, the actual conditions may vary depending on the time of development. As a result, the cost range provided here is solely based on the industry practices and Gleeds' assessment of the current market conditions.

Lifecycle Costs

The lifecycle costs (LCC) of assets are widely acknowledged as a better indicator of value for money than the initial acquisition/construction costs alone. For example, the ratio of costs of ownership and occupation of a facility over a period is significant in terms maintenance and operations. It is, therefore, evident that a greater focus on the maintenance and operating costs of assets than capital expenditure alone, can deliver substantial long-term financial and environmental benefits.

LCC is also a key element in the assessment of environmental sustainability in construction. It provides a tool for the economic evaluation of alternative sustainability options, exhibiting different capital, operating costs, or resource usage. It also provides methods for evaluating the cost benefits of incorporating more sustainable options into constructed assets.

Typically, one of the major costs in data center operations, apart from that of personnel, includes utilities. The costs towards water, power, and diesel could wipe out all or any gains made during site selection and construction of the base building. Due to 24x7 operations and usage of utilities within the data center unlike a commercial building, the impact of design and equipment selection is crucial. Ideally, data center operators focus on Power Use Effectiveness (PUE), which is a ratio calculated by dividing the amount of power entering a data center by the power used to run the computer infrastructure within it. Closer to 1, the efficiency is better as more power is utilised for IT equipment. Depending on PUE, the operational costs of the data center vary from case to case. PUE also depends on the equipment brands and internal configurations. While one can spend additionally on equipment to achieve particular PUE targets, it is important to ensure that targets are based on local conditions and factors.

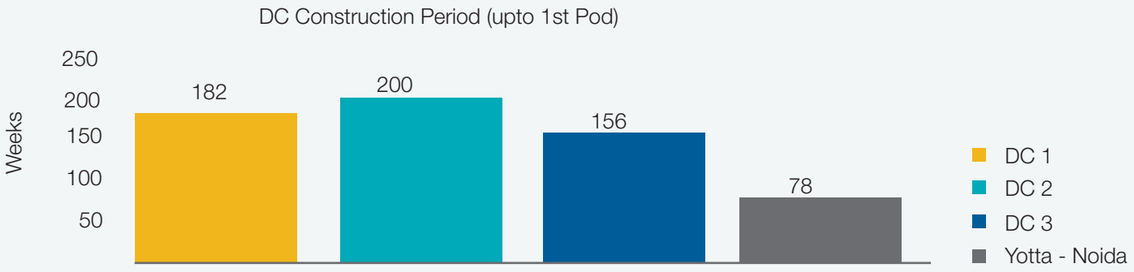
CLOSER LOOK AT **YOTTA** DATA CENTER – ND1

Yotta's Data Center Park at Greater Noida will house 6 data center buildings with a total capacity of 30,000 racks and an IT Load capacity of 160 MW. The first data center building, Yotta D1 is expected to go live in July 2022. With a 300,000 sq. ft. built-up area and 5,000 server racks, the building is based on Tier III / IV design certification and will carry 29 MW of IT Load with designed Power Usage Efficiency (PUE) of 1.4.

Time

Taking advantage of the technical due diligence period before land acquisition from October 2020 to December 2020, Yotta started with the design process and commenced procurement. With the current projection to complete and handover of the first server room by July 2022, the whole process was completed within just 18 to 20 months, which is a commendable feat considering the buildings feature reinforced concrete and are multi-storied. While the time for project development depends on multiple factors, the inherent capability of a developer helps in reducing the go-to-market period. Early completion brings a host of advantages, including early market penetration, reduced costs for finance, and overheads.

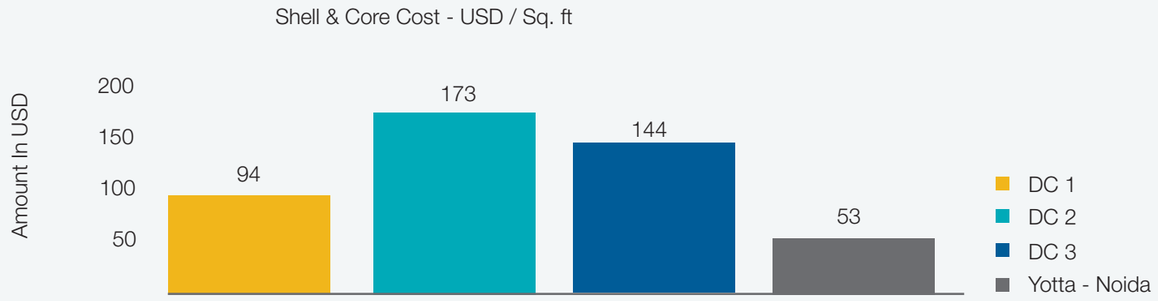
The below graph indicates the time taken from land acquisition to completion of the 1st pods at various projects.



Capital Costs

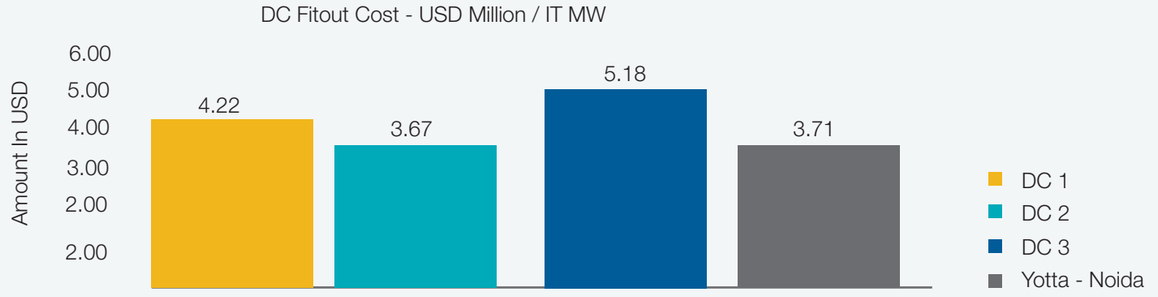
While multiple factors drive the costs and different data centers don't have identical on-ground conditions, one of the advantages that a developer-based data center construction partner brings, is the ability to navigate the construction and procurement process through the traditional Indian way. Typically, Indian organisations procure through re-measurement-based item rate contracting while most hyperscalers would prefer to go with guaranteed maximum price contracts. As the risk is transferred to contractors, the additional cost margins are required to be considered during pricing. Additionally, the selection of concrete frame, which is cheaper than steel frames, helped Yotta reduce the construction costs.

The below graph indicates the time taken from land acquisition to completion of the 1st pods at various projects.

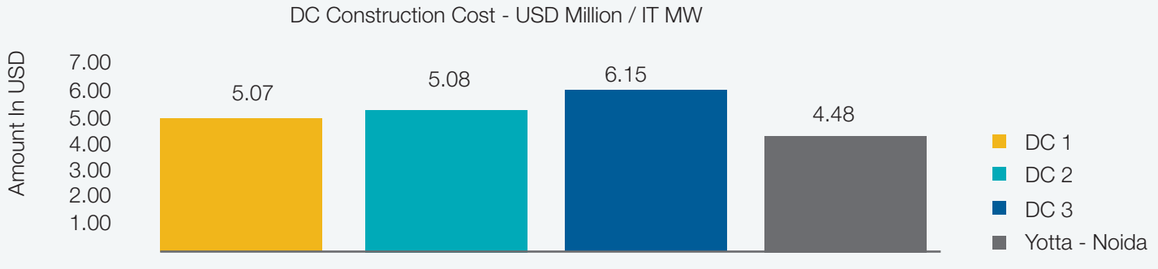


The contribution of shell and core costs is lower in data centers as major costs are towards building services and equipment for server rooms. Traditionally, hyperscalers have used highly efficient strategies to achieve target PUE of 1.35 or lower which does increase the capital costs. Comparing that to Yotta, which targets PUE of 1.4 and depending on selection, procurement process, below are the general ranges of fitout costs / MW of IT load.

(Please refer to assumptions and exclusions list mentioned on Page 19 which needs to be read along with these figures)



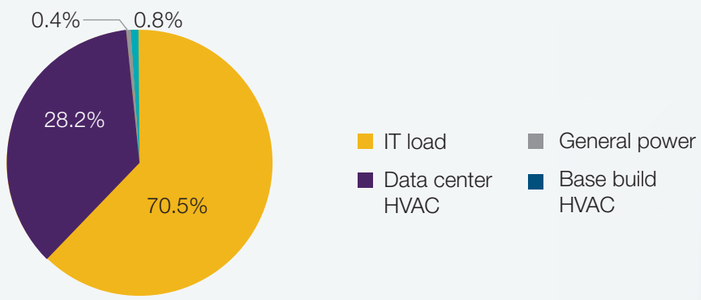
On overall front, Yotta Noida data center cost was around 12% lesser compared to other projects.



Operating Costs

High operating cost is one of the major concerns. As we know, a major contributor to the PUE factor is the heating, ventilation and air conditioning (HVAC) system within a data center.

Typical Annual PUE Break down



To understand the impact of lower annual operating running costs due to the design requirements of hyperscalers and their PUE targets, let's look at an example, assuming a data center with 25 MW IT Load.

Description	Yotta	Hyperscale
IT load KW	25,000	25,000
At 80% efficiency	20,000	20,000
Consumption of monthly units	14,400,000	14,400,000
Power charges Unit / Rs	8.5	8.5
Targeted design PUE	1.45	1.35
Total units consumption	20,880,000	19,440,000
Monthly power opex costs	17.748	16.524
Difference in opex per month in INR	1.224	
Difference in opex per year in INR	14.688	
Difference in opex per year in USD	1,984,864.86	
Per MW / Per year impact	0.079	

As seen above, assumed all other costs for maintenance, operations, security, etc are kept constant, major cost drivers include utility operations and PUE targets. The targeted PUE is generally achieved when all server spaces are utilised, which could take anywhere between 3 to 5 years from the initial investment. It must be also noted, while the project gets designed for a targeted PUE, due to local conditions, it is difficult to achieve aggressive PUE targets. Hence for this calculation, PUE has been reduced to 1.45 from the targeted design PUE of 1.4.

While higher PUE requirements demand additional costs, it would take close to 7 to 8 years to fully return the initial investment after the data center starts running on full load capacity. While hyperscale data center providers can offer optimised lifecycle costs. Considering the operational aspects, stakeholders must recognise that in case of colocation based or a Built-to-Suit / long lease scenario, the front-end costs are not payable and only when the data center is fully completed, the payment is made. This saves enormous capital and financing costs, as well as project risks.

Along with the advantage of early completion of the project and lower cost of construction, these development models can also assist in quicker deployment of a data center in an important market like India.

LESSONS LEARNT

Risks in Data Center Construction

The problems in construction resulting in poor data center performance can be attributed to:

1. **Poor integration of complex systems**
2. **Lack of thorough commissioning or compressed commissioning schedules**
3. **Later-day design changes**
4. **Substitution of materials or products**
5. **Site conditions and issues**

These issues arise during construction, commissioning, or even after operations have commenced and may impact cost, schedule, or IT operations. These construction problems often occur due to poor change management processes, inexperienced project teams, misaligned objectives of project participants, or lack of third-party verification.

Lapses in construction oversight, planning, and budget can mean that a new facility will fail to meet the owner's expectations of resiliency or require additional time or budget to address problems that become evident during commissioning or even afterwards.

ATTRIBUTES OF SUCCESSFUL DATA CENTER CONSTRUCTION DELIVERY

Important success factors and best practices that influence data center construction:

- Client briefing workshops / kick-off meetings to better understand and incorporate end-user expectations in the overall project
- Timely information for any potential changes in end-user requirements
- Clear and defined project sub-phases and integration of drawings and BIM models
- Formal risk workshops with all stakeholders to identify and mitigate risks on regular basis
- Front-end pioneering for site infrastructure and shell and core works
- Detailed roles and responsibility matrix for main or multiple trade package contractors and direct vendors, long lead equipment suppliers, active IT and security vendors
- Standardising design and equipment to facilitate economies of scale
- Selection of products based on life cycle costs and not just on CAPEX
- The selection of capable and experienced suppliers and vendor partners
- An integrated testing and commissioning plan developed during front-end design and implemented according to a detailed testing and commissioning schedule considering the inherent risks
- Smooth transfer of the equipment, operations and maintenance and crisis management training to the operating team.

Conclusion

Data centers are undoubtedly the booming sector of the present. Technology has reached new heights and data consumption is higher than it ever was. Considering the various drivers and the direction of digitisation, the primary takeaway for the data center industry is ‘scale’. It will be crucial to build massive capacities across the country, through a robust network of data center parks and edge data centers. The primary focus for data center operators will be ensuring the availability of data infrastructure wherever and whenever it is needed.

Much of the digitisation in 2022 and beyond will be focused on regions and market segments that were underserved until recently. This is evident in the banking space, where Fintechs, technology solution providers and small to medium-scale institutions are building synergies to help these institutions become part of the digital mainstream.

Digital transformation in India is expected a create an economic value of USD 1 trillion by 2025. The transformation is resolutely on its way to growth and will ride on the back of the data center industry. Similarly, it’s happening in the public sector with the Government’s push to foster digital inclusiveness by bringing connectivity closer to all, especially in Tier II and Tier III cities and rural regions. The sector is poised to benefit structurally from several factors, including data protection convergence, industry-friendly regulations, and the Government’s digital initiatives and investments.

The data center industry has its challenges and risks, but it is quickly addressing in order to meet the growing demand for data growth. Technological advancements such as artificial intelligence, sustainability and IoT, automation will be a vital part of the growth.

The market is now catching up on the demand and constructing data centers at fervent pace. Aggressive timelines and delivery challenges in India would require hyperscalers to look at innovative project delivery models. Synergy and symbiotic relationship between project developers and hyperscalers would act as a force multiplier in times to come.

For any further queries please contact us.

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