Data center scaling in the age of AI:
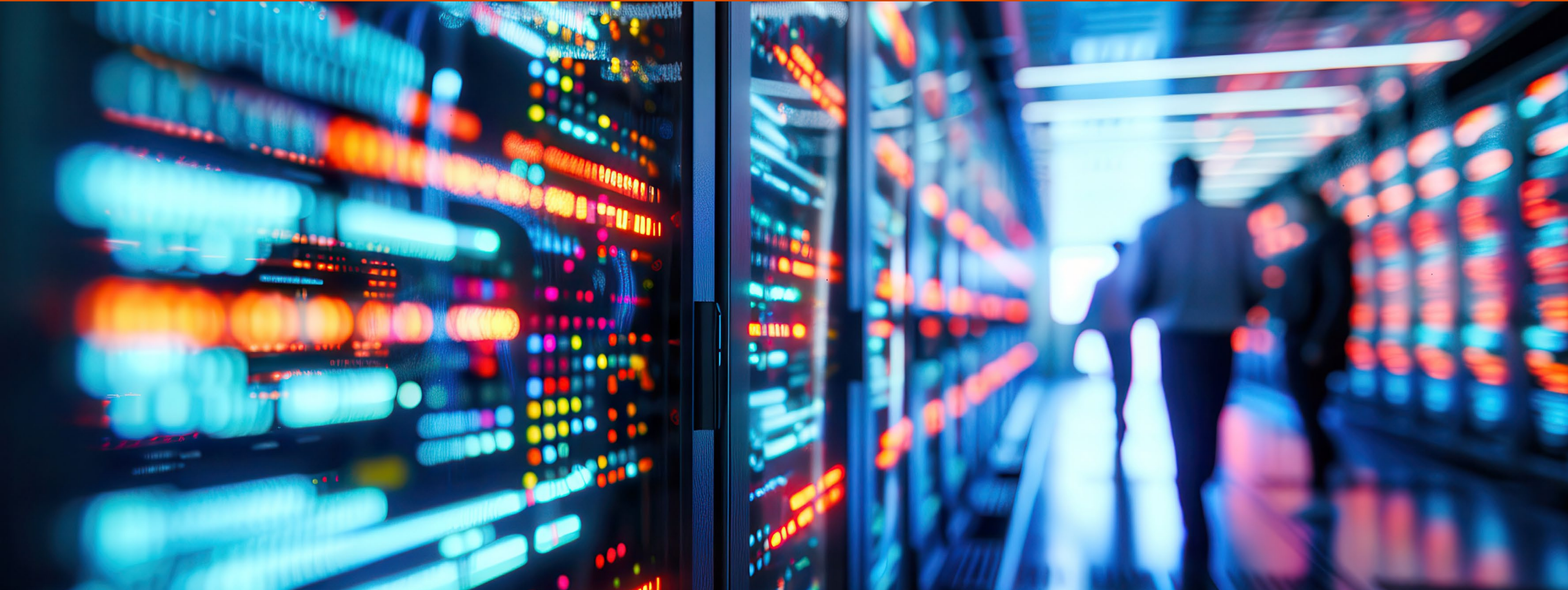
A blueprint for transforming data center challenges into opportunities

pwc

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The data center market is entering an era of unprecedented growth, driven by unbound demand for compute resources from hyperscalers as well as other AI providers. Overall global data center investment was $250 billion in 2023 and is projected to quadruple to $1 trillion by 2027.[1] This dramatic expansion reflects increased investments in scaling artificial intelligence (AI) capabilities and the rising need for advanced data storage and processing solutions. As AI fuels the pace of innovation, including the rise of agentic AI, the demand for compute power is growing exponentially.

1 "Data center capex could top $1 trillion by 2027 thanks to AI." Fierce Network. https://www.fierce-network.com/data-center/data-center-capex-could-top-1-trillion-2027-thanks-ai (Accessed 18 February 2025).

Annual spending on US data center construction is expected to exceed $50 billion by 2030 and could be further accelerated by major new projects announced in Q1 2025 in the data center market. This growth is fueled by the proliferation of cloud computing, AI, the Internet of Things (IoT) and emerging technologies like 5G, edge computing and physical AI. For example, a query on generative AI takes significantly more energy than one performed via a typical search engine. Historically, the global data center market has doubled approximately every five years driven by major technological and quality advancements. PwC analysis projects the US data center market will grow at ~17% CAGR, reaching ~54 GW of capacity in 2029.

The growth of the data center market is not uniform across regions. North America and Europe remain critical hubs for investment, benefiting from established infrastructure and robust digital economies. In contrast, the Asia-Pacific region is experiencing a rapid surge driven by rising digitization, urbanization and government-led initiatives. Meanwhile, emerging economies in Africa and Latin America are beginning to see increased activity, opening new opportunities for stakeholders eager to tap into underserved markets.

Moreover, the push for sustainability is reshaping the industry. Hyperscalers and data center operators are adopting renewable energy, innovative cooling technologies and energy-efficient designs to address operational demands while aligning with environmental goals. These initiatives are not merely reactive — they can serve as a competitive advantage.

The data center industry thrives on the collaboration of a diverse and interconnected ecosystem. Hyperscalers, operators, developers, energy and network providers, original equipment manufacturers (OEMs) and infrastructure investors (the data center ecosystem players) each play a critical role in sustaining growth.

- Hyperscalers are leading innovation by deploying AI-powered tools to optimize operational efficiency and reliability.

- Energy providers are collaborating with data centers to meet the sector's immense energy demands.

- OEMs are advancing server technology to address the processing demands of AI and machine learning applications.

These strategic business partnerships are pivotal in addressing the industry's core challenges — scalability, reliability and efficiency — while enabling continued delivery of innovative solutions.

For businesses, governments and consumers, the implications of this growth are transformative. Businesses are benefiting from enhanced AI capabilities, faster digital services and increased reliability. Governments are leveraging data center investments to bolster digital economies, attract foreign investment and improve national infrastructure. And consumers will enjoy enhanced experiences across industries, including healthcare, gaming and e-commerce.

For investors, the data center market presents a compelling opportunity. New markets, advancements in green technologies and infrastructure expansion provide avenues for significant ROI. As data centers become integral to the digital economy, they're increasingly recognized as a cornerstone of modern global infrastructure. The success of AI depends on the power to run it, and those energy demands are driving innovation and optimization across the ecosystem, from the chips to the data center operations to the power sources themselves. Given the relatively long lead times needed to develop a new data center or connect to the grid, it's critical to focus on leveraging existing data center infrastructure to gain energy efficiencies and source efficient hardware.

The pace of innovation presents incredible challenges, which brings incredible opportunities – requiring proactive and interconnected strategies to capitalize on these opportunities.

Our extensive experience serving stakeholders across the diverse data center ecosystem gives us unique insights into the challenges each stakeholder faces — and the strategies that help drive success.

By addressing both immediate challenges and long-term opportunities, PwC helps stakeholders navigate the dynamic and promising future of the data center market.

US data center capacity
GW, 2024E-2029F

+17% CAGR

2024E	2025F	2026F	2027F	2028F	2029F
24.6	29.2	34.3	40.2	46.8	54.3
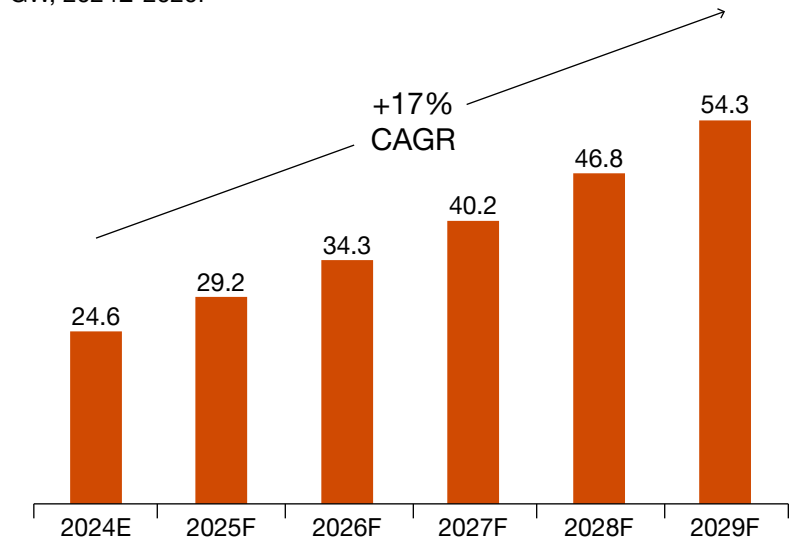
Source: Internal PwC analysis

Powering data centers

Addressing energy demands with sustainable and efficient solutions

Powering data centers is one of the most critical challenges facing the industry today. Data centers are massive energy consumers, accounting for 1% to 1.5% of global electricity use in 2023, according to the International Energy Agency (IEA).[2] To put this energy consumption into context, one new 100-megawatt capacity data center uses as much power as 80,000 new homes.[3] Typically, energy providers have years to plan for this level of growth. Data center demand is immediate. While advances in computing performance and cooling systems have improved energy efficiency, the demand for data centers — and the energy they require — is expected to grow exponentially.

Emerging technologies are driving this growth, with the IEA projecting global data center electricity consumption to double from 2022 to 2026, reaching approximately 1,000 TWh — equivalent to Japan's annual total electricity consumption in 2021.[4] The rising power demands are forcing the industry to explore the optimal solution — from considering nuclear energy to onsite power generation models. In the United States there are eight leading small modular reactor (SMR) developers, though only one has approval from the Nuclear Regulatory Commission (NRC), and 17 sites are planned for future SMR deployments with large data center operators among those signing memorandums of understanding.

Meeting contracted service levels, such as achieving "five nines" (99.999% uptime), requires a reliable and sustainable power supply while also striving to reach clean energy targets. Accordingly, data center ecosystem players face several interrelated challenges.

Competition for energy: Accessing the limited supply of energy is highly competitive, and even when procured, permitting delays and grid connection backlogs create bottlenecks and directly impact project economics. In the US, the amount of time from a transmission interconnection request to operation has grown from around 20 months pre-2010 to nearly 60 months in 2024.

Regional constraints: These issues are especially pronounced in regions with high data center density, such as Virginia, Texas and California. To highlight the concentrated distribution of data centers across the US, 15 states account for 80% of the national data center load. Ireland is another example of high concentration where data center energy consumption represents 20% of its annual power demand.

Climate risks: Increasing heat and humidity elevate energy requirements for cooling, while extreme weather events — like heat waves and hurricanes — can lead to grid blackouts, brownouts or forced shutdowns to prevent equipment damage.

Water scarcity: Liquid cooling technologies have improved energy efficiency, but the significant water volume they require poses risks in water-stressed regions like Arizona and Nevada, exacerbating resource conflicts with agriculture, industry and local communities.

Increasing costs: Multiple factors will likely drive energy costs higher, including the broader implementation of carbon taxation arrangements and ongoing geopolitical crises that create supply uncertainty and impact markets. Continued supply constraints on critical energy components such as transformers will also slow project development and increase costs, especially in regions with high data center concentration.

These challenges underscore the need for innovative strategies to support reliable, sustainable and cost-effective energy supply for data centers.

US transmission interconnection delays

Median duration of months from request to operation, 2005-2022
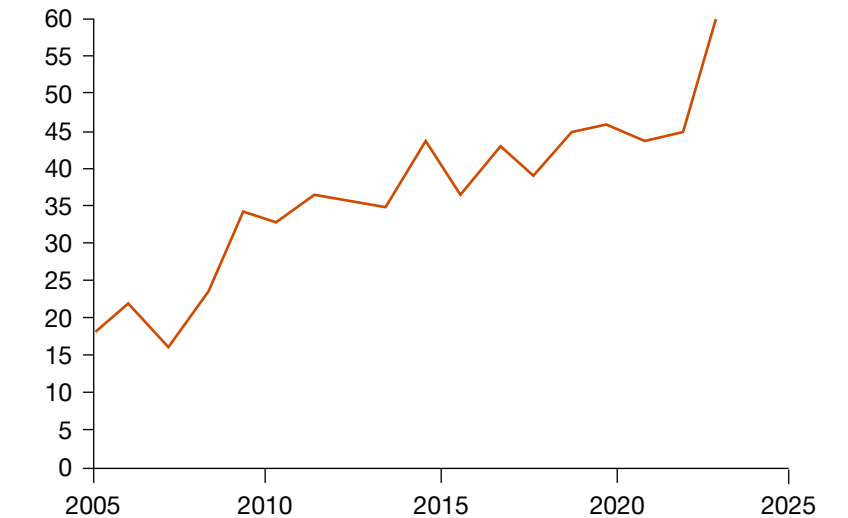
Source: Berkeley Lab, Utility Drive, PwC Strategy& Interviews and Analysis

2 "Data Centres and Data Transmission Networks." International Energy Agency. https://www.iea.org/energy-system/buildings/data-centres-and-data-transmission-networks (Accessed 18 February 2025).

3 "Data centers and servers." U.S. Department of Energy. https://www.energy.gov/eere/buildings/data-centers-and-servers (Accessed 19 February 2025).

4 "Electricity 2024." International Energy Agency. https://www.iea.org/reports/electricity-2024/executive-summary (Accessed 19 February 2025).

Practical strategies

PwC is uniquely positioned to help data center ecosystem players tackle these energy challenges with tailored, actionable strategies that address both immediate needs and long-term goals.

Holistic market, utility and site feasibility studies

- Assess the viability of sites by balancing regulatory requirements, electric and gas network capacity and local climate risks.

- Conduct energy audits to identify inefficiencies and recommend scalable solutions, such as on-site energy generation (e.g., microgrids, fuel cells.

- Streamline permitting processes while maintaining compliance with environmental regulations.

- Evaluate the economic impact of data center development and implications for local stakeholders.

Future-proofing energy costs and water availability

- Perform long-term scenario modeling to anticipate and mitigate risks associated with energy pricing volatility, climate risks and water scarcity.

- Evaluate energy cost structures to identify opportunities for cost savings through advanced technologies and innovative procurement models.

Energy efficiency, decarbonization and sustainability

- Develop and implement strategies to improve energy efficiency, reduce carbon footprints and meet corporate sustainability goals.

- Integrate renewable energy, zero carbon sources such as solar, wind hydro and nuclear to align with environmental targets and reduce reliance on traditional power sources while meeting 24/7 energy needs.

Climate risk assessment and mitigation

- Identify and assess relevant climate risks to inform design of resilient systems to withstand extreme weather conditions and climate disruptions.

- Utilize adaptive cooling technologies to minimize reliance on water in arid or water-stressed regions.

PwC's industry-leading experience helps data center operators navigate the complex energy landscape to aid sustainable growth while meeting operational and environmental goals. By aligning leading technologies with strategic foresight, we help companies stay ahead in an increasingly competitive market.

## How we've done it — a company success story

Challenge

A global developer of hyperscale data centers aimed to expand in a particular location by building a 1 GW IT load data center campus. The main challenge was navigating the capacity-constrained electricity market to secure reliable power supply for the expansion.

Solution

PwC developed comprehensive market and engineering frameworks to assess power supply solutions, engaged with local grid operators to evaluate energy and gas availability, and analyzed future transmission and distribution buildout plans. PwC also reviewed embedded generation solutions for technical and economic viability.

Impact

PwC's work accelerated the identification of viable power supply solutions, enabling the company to make go/no-go decisions on which technologies met local regulatory constraints, how much capital could be needed and what stakeholders to prioritize in subsequent waves of stakeholder engagement. This ultimately helped the company move forward confidently with its expansion plans in a critical and competitive market.

Delivering data centers

Optimizing project delivery timelines, costs and quality
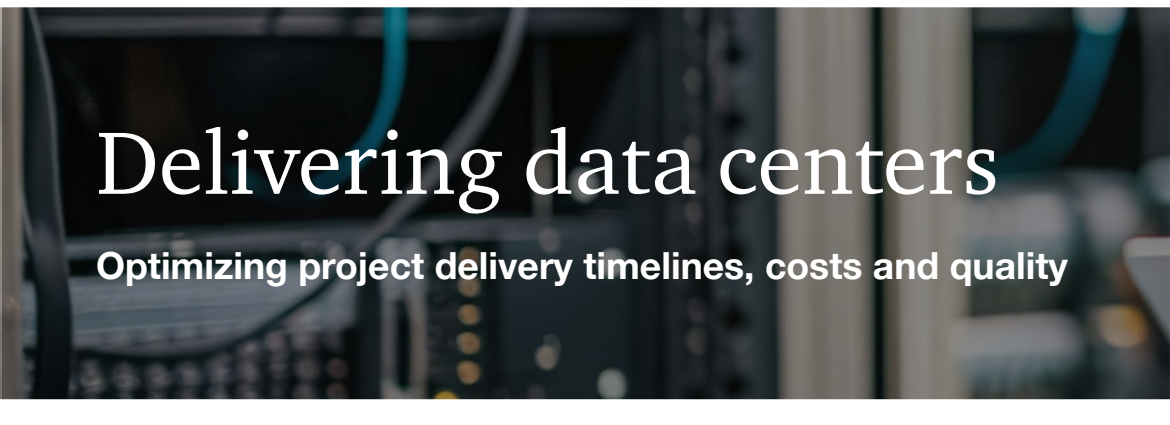
Delivering data centers requires meticulous coordination across a wide range of activities, from planning and design to construction and commissioning. The sheer complexity and scale of these projects present several challenges.

Coordinating stakeholders: Constructing data centers requires alignment of diverse stakeholders, including developers, utility providers and regulatory authorities, each with its own priorities and timelines. Despite emphasizing economic and societal benefits like job creation and local development, inconsistent communication and unclear roles can delay decisions, increase costs and disrupt timelines. A cohesive strategy is crucial to align interests, maintain momentum and enable on-time delivery.

Integrated project planning: Data center developers and general contractors have to integrate schedules and workflows across multiple solution providers and strategic business partners. Without unified planning, misaligned timelines, siloed operations and communication breakdowns frequently occur. Procurement delays, for instance, can disrupt construction and downstream tasks, obscuring critical paths and increasing risks of overruns, inefficiencies and bottlenecks, jeopardizing timely delivery.

Adapting to evolving design: Data centers require designs that balance modularity with adaptability to accommodate rapid technological advancements. Rigid designs hinder the integration of new technologies, leading to inefficiencies, delays and higher costs. Hyperscalers and data center developers often lack structured scope change management, resulting in ad-hoc updates that misalign stakeholders and disrupt project flow.

Scaling specialized talent: Delivering data centers in emerging or fast-developing markets requires a scalable, skilled workforce across areas such as program management, technical operations and IT support. Limited local expertise and tight timelines make it difficult to recruit and onboard cohesive teams, resulting in inefficiencies, delays and operational disruptions. This poses risks to both project delivery and long-term resiliency.

Streamlining delivery systems: Standardized systems for design, procurement, construction and project management are critical for hyperscalers and data center owners/developers scaling their data center portfolios. Fragmented or outdated systems can lead to inefficiencies, miscommunication and delays, making it harder to scale operations efficiently and deliver projects on time. For example, using multiple CAD systems to design different data center products or systems creates challenges with consolidation, updating and traceability of design changes. Lack of integration between schedule management and supply planning tools limits visibility into equipment delivery timelines and can cause downstream schedule delays. Additionally, reliance on homegrown tools in lieu of commercial scalable tools with integration capabilities creates challenges with data handoffs between systems.

Optimizing cost: Data center operators face significant challenges to optimize costs, especially maintaining a low cost per megawatt (MW). Balancing capital expenditures (CapEx) and operating expenditures (OpEx) with timelines and design is challenging, such as choosing between standard modular design and costlier innovative designs. As the demand for more data processing power increases, so do the pressures to cut costs without sacrificing performance and reliability.

Practical strategies

PwC provides tailored solutions to address the key challenges of delivering data centers, improving efficiency, alignment and de-risking timely delivery across every phase of the project life cycle.

Aligning stakeholders

- Develop strategies to engage and align diverse stakeholders early in the planning process.

- Establish governance structures with clear roles, responsibilities and communication channels.

- Facilitate periodic updates, progress tracking and transparent reporting to reduce conflicts and delays.

- Communicate project value and economic benefits consistently to maintain stakeholder buy-in.

Streamlining project coordination

- Implement integrated scheduling systems and processes to consolidate timelines, tasks and dependencies into a unified platform.

- Establish governance frameworks for real-time visibility and accountability of project progress and risks.

- Conduct construction audits to maintain compliance with schedules and milestones.

- Enable rapid response to changes, reducing disruptions to the project timeline.

Enabling adaptive designs

- Provide a structured change management framework to efficiently manage scope changes.

- Establish protocols for assessing the feasibility and impact of design updates to reduce costly rework.

- Facilitate the integration of new technologies, while maintaining modularity and innovation.

- Support hyperscalers and data center operators/developers in delivering future-proof, adaptable data center designs.

Scaling skilled talent

- Conduct detailed analyses of local labor markets to identify expertise and capacity gaps.

- Develop strategies for global resource augmentation and local talent development.

- Deliver tailored training programs to equip professionals for hyperscale data center demands.

- Utilize managed services for project management, to supplement company capacity, or to deliver on an increasing portfolio of data center projects.

Building delivery systems

- Assess, design and implement systems to support scalable data center delivery.

- Utilize managed services for IT support to implement and maintain third-party and in-house applications.

- Enable consistent and efficient processes for design, procurement and project management.

Optimizing cost through cost audits and benchmarking

- Conduct CapEx and OpEx cost benchmarks.

- Conduct cost audits—review construction costs and invoices to identify cost-saving opportunities.

- Implement contract management practices to reduce disallowable costs.

- Use scenario analysis to forecast economic conditions and adjust budgets accordingly.

- Perform detailed cost audits on third-party contracts to uncover hidden expenses or unfavorable terms, allowing operators to renegotiate contracts or seek alternative vendors.

How we've done it — a company success story

Challenge

A global data center developer for hyperscalers was building 200 MW of capacity in a new developing market. The company faced significant challenges in managing project progress due to reliance on spreadsheets, unstructured risk and issue tracking, and a lack of reliable, real-time reporting. This led to delays, misaligned updates across stakeholders and difficulties securing additional funding.

Solution

PwC worked with the company to establish robust program oversight. We performed monthly schedule analyses to identify delays, implemented integrated risk management frameworks and developed streamlined reporting across four sites in the new market. Our team introduced processes to improve cost and schedule forecasting, enabling better alignment among stakeholders.

Impact

PwC's support improved cost forecasting accuracy by over 10% and enhanced schedule forecasting accuracy. This enabled the company to scale its program management capabilities and concurrently manage nearly ~$250 million worth of projects, setting the foundation for continued growth in a challenging market.

Enabling robust supply chains

Managing complexities in sourcing and logistics amid volatility

The supply chain for mechanical, thermal and electrical components in data center projects faces complex challenges that impact cost, delivery velocity and reliability. These challenges align to several themes.

Capacity constraints in the supply chain: Simultaneous surge in demand across the entire industry has created significant bottlenecks, delaying timelines and increasing costs. In addition, critical suppliers, such as in power generation, face capacity constraints increasing lead time. Addressing these challenges requires not only accurate forecasting, but also strategic initiatives to enhance supplier readiness, scalability and flexibility to respond to evolving requirements.

Design and product development process challenges: Data center design has inherent challenges in coordinating the increasingly rapid component level product innovations, driven by independent component manufacturers, into a unified data center design. This is further exacerbated by the speed to market needs which require incorporating the latest design innovations in site level design, which can result in late-stage design changes. This disrupts procurement cycles, escalates costs and delays project timelines.

Nascent sourcing processes: The high-mix low volume nature of data center construction forces the sourcing processes to lag the process maturity for high volume sourcing. This is further exacerbated by limited standardization of components, and bill of materials and suppliers, which impact negotiation leverage for lead time or cost.

Suboptimal planning processes: Project-level inventory reservations are very common in the industry, resulting in fragmented inventory buffers and stranded inventory across several projects. Lack of component commonality also impedes component reuse across projects. These planning inefficiencies reduce responsiveness and limit the ability to adapt quickly to evolving project needs.

Practical strategies

PwC helps hyperscalers and data center operators/developers overcome supply chain obstacles by implementing integrated strategies that improve product development coordination, streamline sourcing and improve planning efficiencies. Our solutions are designed to address inefficiencies, improve scalability and build resilient supply chains for data center projects.

Address capacity constraints in the supply chain through integrated business planning

- Define an integrated business planning (IBP) framework as a common forum to resolve constraints.

- Include key decision makers from capital expenses, demand planning, data center delivery and the technology supply chain.

- Use the IBP forum to resolve capital constraints, deployment capacity and supply constraints to meet demand.

- Develop dashboard views and a standard set of scenario models to facilitate decision making.

Product development integration

- Implement structured stage-gate methodologies to align product development with site-level planning and procurement.

- Involve cross-functional teams to identify design changes early, minimizing cost overruns and delivery delays.

- Standardize critical commodities, such as generators and fiber cables, and adopt modular design principles to facilitate component reuse, reduce costs and improve operational efficiency.

- Establish early alignment between product development and procurement to create predictable schedules and reduce late-cycle surprises.

Sourcing solutions, supplier relationship and risk management

- Establish approved supplier and vendor lists (ASL/AVL) with clear qualification criteria and regular performance reviews and risk assessments to improve negotiation leverage.

- Implement e-procurement and third-party risk management systems and supplier portals to automate compliance, mitigate potential risk and improve sourcing transparency and efficiency.

Demand and supply planning

- Develop robust demand forecasting processes to provide suppliers with visibility into future requirements.

- Facilitate close collaboration with critical suppliers, such as chipmakers and equipment manufacturers, to align production with forecasted demand.

- Implement common pool buffers and hard allocation of components to projects.

By integrating demand forecasting into supplier management practices and addressing the responsiveness of critical suppliers, PwC enables data center ecosystem players to build a supply chain that is agile, cost-efficient and resilient to the demands of hyperscale construction and operations. This holistic approach makes sure projects are delivered on time, within budget and at the quality levels required to meet industry expectations.

How we've done it — a company success story

Challenge

The company, a hyperscaler, needed to rapidly scale its data center operations to meet increasing demand. Its supply chain processes, however, were not optimized for speed or efficiency, resulting in delays and bottlenecks. Critical projects were hindered by vendor capability limitations, and the company lacked streamlined processes for procurement, fulfillment and deployment of materials across their data centers.

Solution

PwC conducted a holistic assessment of the company's supply chain and implemented key changes. We streamlined procurement and fulfillment operations to reduce lead times, supported a key module manufacturer in transitioning from one-off builds to an assembly line flow and optimized the operating model by outsourcing non-core competencies. We also revamped the move order management process to align material readiness with data center deployment timelines.

Impact

PwC's solutions reduced procurement and fulfillment lead times by over 20%. We unlocked the company's ability to scale vendor capabilities and recover timelines on four critical data center projects. By outsourcing non-core processes, the company freed up headcount and resources, enabling it to accelerate the growth needed for the AI-driven demand and focus on strategic investments.

Delivering value

**Boosting ROI for investors and stakeholders
throughout the data center life cycle**

Exponential growth in data generation and processing is intensifying the demand for data centers, which creates obstacles for securing real estate, competing with private equity and choosing sustainable business models. Hyperscalers, developers and investors need to overcome many challenges as they balance site selection, power access, land costs and infrastructure while making sure their strategic acquisitions support growth.

Increasing complexity in finding the right sites: Real estate scarcity in high-demand markets and escalating competition from private equity investment are major hurdles. In the most-connected sub-markets of Tier 1 data center markets — such as Northern Virginia's Data Center Alley, downtown Chicago, the Infomart in Dallas and 60 Hudson in NYC — real estate scarcity remains a prominent challenge. When it comes to site selection, hyperscalers and data center operators/developers are shifting away from a connectivity-first approach. Instead, they're prioritizing power availability and cost-efficient resources which broadens the geographic scope for data center development and requires deeper market assessments. As a result, nearly any location where power can be built or delivered now has the potential to be an attractive site for data centers. However, developing in new markets requires a holistic evaluation of infrastructure readiness, resource availability, risk considerations and regulatory compliance. Compounding these issues is the influx of private equity capital into data center real estate, increasing land prices and making strategic site selection more complex. The opportunities to capture market share and value through strategic acquisitions in the value chain are expected to increase in the form of direct investments or strategic business relationships, as well as traditional M&A. Investors will need to assess an acquisition target's feasibility, including energy constraints, CapEx assumptions and OpEx projections.

Uncertainty in market entry and target assessment: Private equity investors are looking to make bets in the data center industry. Take, for example, a private equity firm that wanted to become a leader in owning and developing infrastructure that can support AI. It's now among the largest data center providers in the world through acquiring a portfolio consisting of billions of dollars' worth of data centers, including facilities under construction, and over $100 billion in prospective development pipeline. As investors are looking to evaluate these targets, they're often faced with questions around whether the target's plans are possible. Is the pipeline of potential data center builds realistic in the context of energy constraints? Are their assumptions around CapEx and OpEx reasonable?

Complexities in business model and post-deal integration strategy: Investors and other players in the infrastructure ecosystem are also working to identify the right data center strategies and business model fit to realize the most benefit going to market by building directly, or via a strategic relationship with third parties, via joint ventures or through strategic sales of assets. Different business models offer varying levels of benefit, cost and risk. We see this with traditional network providers that have historically moved away from a real estate focus and are now reconsidering their existing properties as a means to capitalize on the growing demand for compute and storage.

Practical strategies

PwC provides end-to-end support to help hyperscalers, data center operators/developers and infrastructure investors navigate real estate and power scarcity while successfully expanding into new markets. Our solutions address the full life cycle of real estate acquisition and development, supporting a strategic and efficient approach to securing critical locations and building state-of-the-art facilities.

Data center strategy development

- Develop holistic business models and strategic business cases for data center investments.

- Evaluate and align investment strategies with evolving market demands and technology trends.

Market entry and deal strategy

- Identify promising new markets, assessing hyperscale and enterprise demand forecasts.

- Assess the current and future competitive landscape to inform site selection.

- Quantify and contextualize risk factors to enable informed decision-making.

Transaction structuring and execution

- Design optimal transaction structures to improve financial and operational feasibility.

- Facilitate stakeholder negotiations and maintain regulatory compliance.

- Implement risk mitigation strategies to enhance success.

Valuation and due diligence

- Conduct transparent asset assessments with thorough valuation exercises.

- Perform thorough risk evaluations through financial, commercial and operational due diligence.

Post-deal integration

- Support seamless integration of newly acquired assets, including operations, supply chain procurement and IT systems.

- Align leadership structures and operating models to drive efficiency and improve value.

- Enable cultural integration for long-term success and scalability.

We combine deep industry experience with data-driven insights to help navigate the complexities of real estate scarcity and market entry. Our holistic approach aligns strategy, execution and integration, empowering companies to secure strategic locations and achieve scalable, sustainable growth in an increasingly competitive landscape.

How we've done it — a company success story

Challenge

The company, a hyperscale-focused data center operator, wanted to explore expansion into the metro edge segment of the market. The company was interested in validating demand from hyperscalers for compute resources at the metro edge, conducting robust research on the size of the market opportunity, gathering market intelligence on the ideal metro markets for deployment and determining the required technical specifications for metro edge facilities. PwC's strategy support would be used to inform a decision on whether to allocate substantial capital toward land acquisition, facility design and engineering and metro edge facility construction.

Solution

As part of the strategic analysis, PwC conducted primary research with key market participants and decision-makers, created a data-driven, bottoms-up market size for metro edge demand and developed a go-to-market strategy for specific market selection and facility technical design. The work supported the company by:

- Determining the opportunities, challenges and risks associated with moving into a new segment of the market with different geographical and technical requirements.

- Understanding go-to-market factors, including strategy, business model, M&A and financing, along with specific requirements for market entry, facility needs, site selection, pricing and organizational support.

Impact

PwC's work supported the decision by the company to allocate significant investment toward site acquisition, facility design and site construction of several metro edge facilities as the first phase toward a full entry into the metro edge segment of the market.

Risk management and cybersecurity

Enhancing risk management and cybersecurity, maintaining compliance and building operational resilience

Expanding into new geographies presents significant growth opportunities for hyperscalers and data center operators/developers, but it also introduces complex security, resiliency and regulatory challenges. Navigating these risks effectively is critical to supporting seamless global operations.

Managing risk across portfolios: Expanding global data center portfolios introduces complex risks across the life cycle, from site selection to operations. Fragmented governance, limited visibility and insufficient oversight often hinder the ability to identify and mitigate risks effectively. Without a holistic strategy, projects face delays, cost overruns and operational disruptions, compromising long-term success.

Regulatory pressures and compliance: Entering new regions often exposes hyperscalers and data center operators/developers to heightened security, operational resiliency and privacy regulatory demands. Many non-US geographies have stricter regulatory frameworks driven by individual privacy rights, safety and security requirements and government control over technology infrastructure. These rapidly evolving regulatory agendas can be daunting.

Expansion comes with increased security and resilience risks: Rapid infrastructure growth and the increased use of operational technology (e.g., cooling systems, security controls and robotics) in data centers, along with the complexity of supply chains and third-party suppliers surrounding these data centers, inherently increase the attack surface and thus amplify the security risk. While automation can address some challenges, large-scale expansion demands focused attention on vulnerabilities, particularly in physical security, supply chain and insider threats. These areas are often overlooked in data center expansion but represent significant risks as new facilities and teams are added.

Practical strategies

PwC provides tailored solutions to address regulatory and security challenges associated with global expansion. These challenges can be addressed through proactive and focused strategies.

Strengthening risk management

- Implement a portfolio-level risk management framework with centralized governance and advanced reporting.

- Develop a unified risk repository to foster consistent practices across projects.

- Embed transparency, accountability and collaboration to enable proactive issue mitigation.

- Align risk management with enterprise goals to enhance resilience and competitive positioning.

Regulatory compliance and governance

- Assess current and emerging regulations across geographies to identify and address compliance requirements and gaps.

- Design and implement governance structures and controls that enable adherence to diverse regional regulatory requirements.

- Leverage the PwC global network and localized insights to anticipate and adapt to evolving regulatory demands effectively.

Security risk management

- Conduct holistic security risk assessments to identify vulnerabilities across digital and physical infrastructure.

- Develop and implement strategies to address insider threats and enhance physical security measures.

- Build scalable, resilient cybersecurity frameworks aligned with growth objectives to safeguard critical assets.

Integrated cybersecurity strategy

- Provide industry-specific experience in developing robust cybersecurity strategies that address both operational and regulatory risks. Adopt advanced technologies and practices to fortify security posture during expansion.

- Embed security and data protection throughout the supply chain by designing and implementing efficient and effective supply chain risk management programs.

Resilience and crisis response

- Assess and increase resilience posture — strategic, operational and financial — to build agility into the data center strategy, maintain critical operations and maintain capital and cash flow during disruptive events.

- Develop a crisis management capability that provides a flexible and dynamic approach to manage the impacts of disruptive events that exceed tolerances, enabling the organization to continue delivering its data center strategy and return to a viable operating state during times of crisis

- Cultivate supplier base resilience through supply chain risk management practices that assess, mitigate and monitor the risks that threaten supply chain integrity — including concentration, operational, financial, compliance and strategic risks.

PwC combines global regulatory insights, advanced cybersecurity experience and industry-specific knowledge to empower hyperscalers and data center operators/developers to manage the complexities of global expansion. From navigating regulatory challenges to fortifying security, PwC serves as a trusted advisor in fostering sustainable and secure growth worldwide.

How we've done it — a company success story

Challenge

The company, a hyperscaler with a portfolio of numerous data centers, sought to establish a portfolio risk management framework. The goal was to consistently measure, monitor, communicate and mitigate risks across their portfolio of data centers. Without a formal framework, the company struggled to identify risks, stay on schedule, prevent financial losses and proactively detect cross-portfolio risk signals.

Solution

PwC supported the company by developing and implementing portfolio risk management processes and governance structures to improve risk mitigation and management. We reviewed and validated portfolio and project-level risks for completeness, quality and accuracy, supporting robust oversight. Additionally, we established risk reporting tools, including dashboards tailored for executives as well as project leaders, to streamline communication and decision-making.

Impact

PwC helped the company identify and mitigate critical risks across multiple projects, enabling on-time completion and avoiding potential damages worth millions of dollars. The implementation of a new framework provided greater visibility and control over their expanding portfolio, enhancing both operational efficiency and project outcomes.
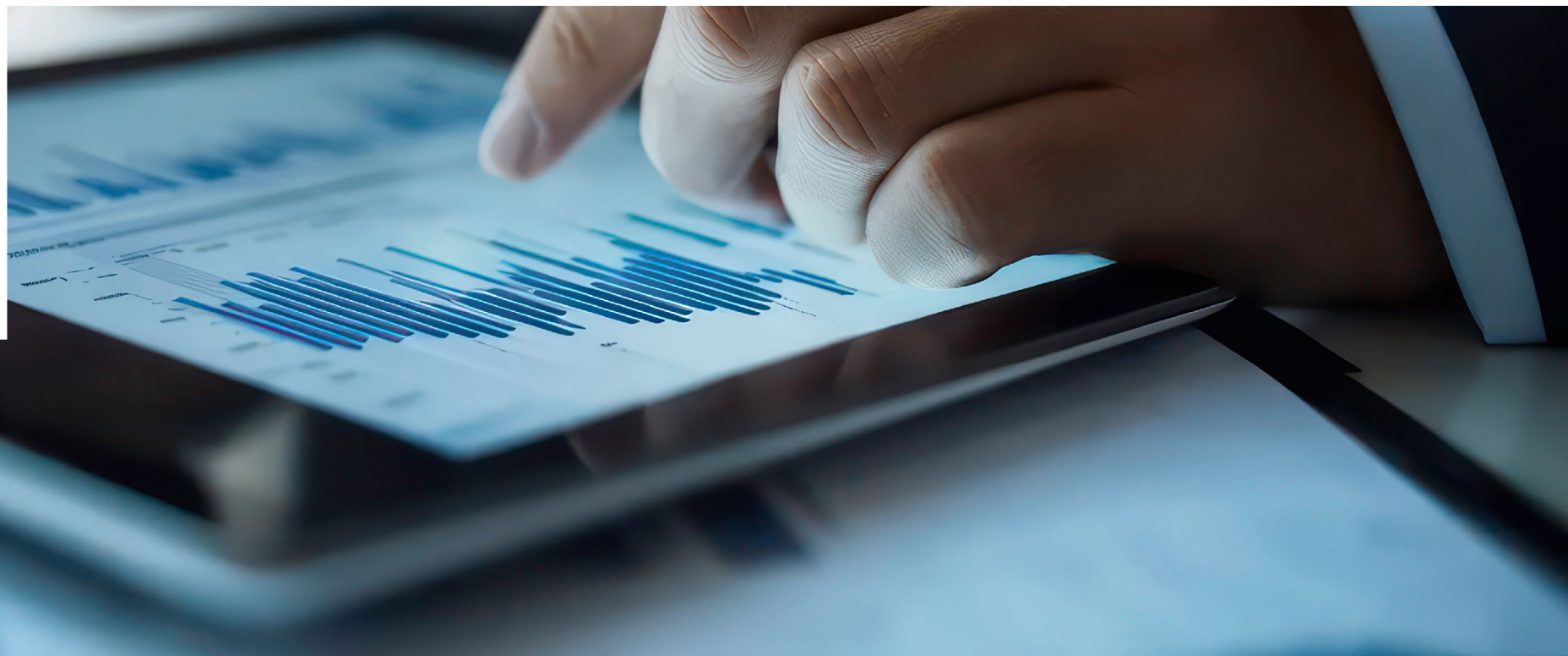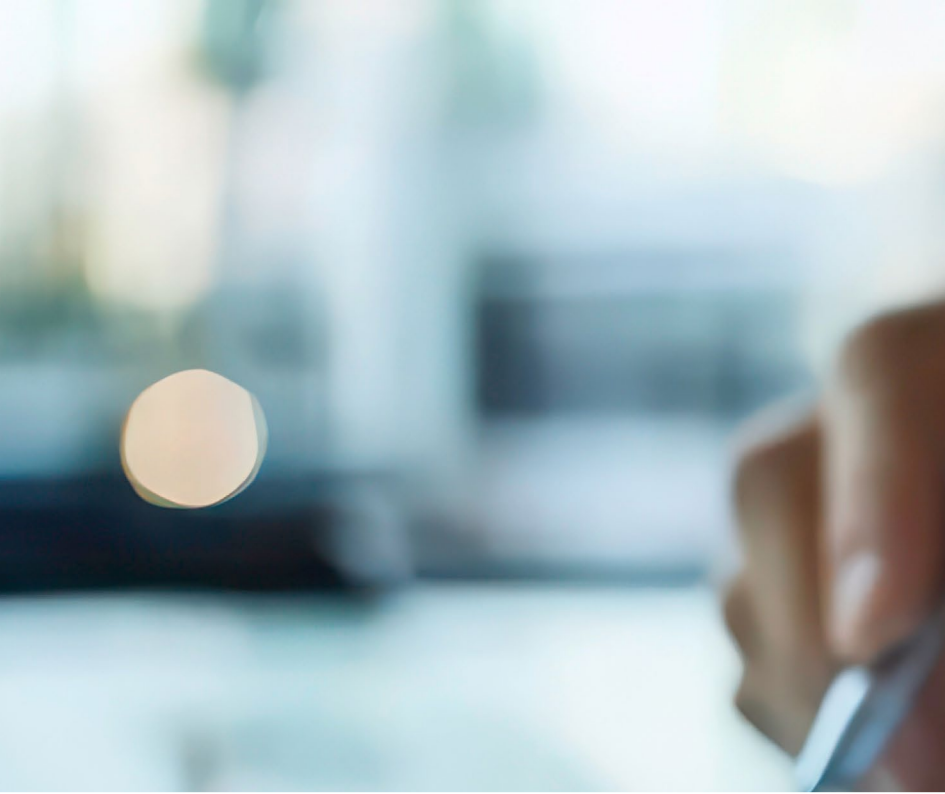
Tax strategies

Reduce inefficiencies, leverage incentives and align priorities for sustainable growth

The rapid global expansion of data centers presents significant tax challenges for stakeholders, including hyperscalers, operators, developers, energy and network providers, OEMs and infrastructure investors (the data center ecosystem players). These challenges impact project feasibility, returns and overall competitiveness in an increasingly crowded market.

Inefficient global tax structures: Poorly planned tax structures can result in substantial tax leakage during acquisition, holding and exit phases. This erosion of returns discourages strategic co-investors and hampers growth. Flexible, scalable tax frameworks are essential to support diverse investment strategies and foster sustainable expansion.

Missed tax exemptions and incentives: Many stakeholders fail to take full advantage of local tax incentives and exemptions, both in the US and globally. Missing these opportunities can directly affect project feasibility, reduce internal rate of return (IRR) and diminish shareholder value. As competition in the data center sector intensifies, the ability to optimize tax benefits has become a crucial differentiator.

Misalignment of tax, accounting and commercial goals: Discrepancies between tax, accounting and commercial objectives — such as timing mismatches in income recognition — create inefficiencies, delay implementation and reduce after-tax returns. These misalignments can complicate financial reporting, compliance and operational execution, adding layers of complexity to an already challenging environment.

Divergent stakeholder priorities: The diverse tax objectives of the varying data center ecosystem players — including developers, hyperscalers and investors — often conflict, leading to friction in structuring agreements. This misalignment can hinder collaboration, slow decision-making and reduce the overall efficiency of large-scale data center projects.

Addressing these challenges requires proactive, well-aligned tax strategies that optimize returns, enhance project feasibility and support collaboration across the ecosystem.

Practical strategies

PwC offers tailored tax solutions to help stakeholders address the complexities of global data center expansion. Our holistic approach optimizes tax strategies, reduces inefficiencies and fosters sustainable growth in a competitive market.

Implement a practical tax approach for global expansion

- Focus on key tax compliance requirements – the "must do's" - to enable smooth business expansion, support immediate compliance and avoid trailing liabilities.

- Prioritize indirect tax (VAT/GST) and customs/duties to facilitate the import of materials for capital buildouts.

- Establish a clear and practical tax approach from the outset to mitigate risks and enable long-term compliance.

Design efficient global tax structures

- Integrate US, international, transfer pricing, state, indirect, withholding and customs tax considerations into a cohesive framework.

- Develop scalable and flexible tax structures that reduce tax leakage during acquisition, holding and exit phases.

- Align tax frameworks with strategic co-investors and diverse stakeholder objectives to support long-term growth and design solutions that can adapt to the industry's rapid evolution.

Optimize tax structures to support investments

- Balance investor tax interests with operational goals and consider the complexity of establishing and maintaining structures such as REITs, JVs and other tax-efficient vehicles.

- Leverage real estate and partnership tax expertise to streamline co-investment structures and maintain compliance.

- Design tax-efficient operational models to reduce burdens and enhance financial sustainability.

Improve tax incentives and benefits

- Identify and secure local tax exemptions, credits and incentives to reduce costs and improve data center project feasibility.

- Enhance shareholder value and increase IRR through optimized tax incentive strategies.

- Develop an incentive-driven approach that strengthens financial performance and investment appeal.

Manage cash tax flows effectively

- Leverage tax expertise to address the challenges that come from the significant upfront investments required in data center expansion, which may cause misalignment between book and tax recognition of income and expenses, and acceleration of cash tax payments.

- Review contracts and model cash tax flows to identify opportunities for tax savings and improved capital allocation.

- Implement strategies to align tax liabilities with business cash flow cycles, allowing cash to be deployed for critical investments.

By integrating tax strategies into the broader operational and commercial framework, PwC helps stakeholders navigate the complexities of global expansion, optimize returns and maintain a competitive edge for long-term success.

How we've done it — a company success story

Challenge

A global data center developer sought to realign its legal entity structure to make it fit-for-growth while maintaining flexibility from a business and tax perspective. The company's existing structure limited its ability to enter into local joint ventures and optimize its tax arrangements, creating inefficiencies and hindering its ability to scale operations globally.

Solution

PwC worked with the company on the design and implementation of a new, regionally focused business model that enabled engagement in local joint ventures without incurring tax drag on investment. Additionally, PwC helped optimize global investments by aligning tax structures with business needs, introducing measures to reduce effective tax rates through targeted vehicles, tax holidays and incentives.

Impact

PwC's solution provided the company with a global platform that aligned tax, finance and legal functions, enabling efficient scaling and the ability to enter into local business relationships. The company achieved reduced tax costs, enhanced operational flexibility and a robust structure that supported growth ambitions while maintaining alignment with business objectives.

Tariffs and export controls

Mitigate risks, build optionality and optimize costs

Under the current global geopolitical landscape, the operation and expansion of data centers are increasingly influenced by the international tariffs landscape and stringent export controls. This is particularly relevant for advanced semiconductor technologies such as AI chips, high-bandwidth memories (HBM) and manufacturing equipment. The US tariff landscape is changing rapidly and requires a proactive approach to overcome risk mitigation, supply chain diversification and compliance strategies to maintain operational resilience.

Evolving tariff structures and rising costs: Recent tariff increases on semiconductor imports have disrupted global supply chains, raising procurement costs for data center operators. These changes necessitate a reassessment of sourcing strategies to mitigate financial impacts. Retaliatory tariffs from key trade partners can further complicate supply chain decisions, requiring businesses to explore alternative suppliers and optimize cost structures.

Stricter export controls and compliance risks: Export controls on semiconductors, critical technologies and high-performance computing equipment are tightening, and companies that rely on international business relationships face complex requirements that may limit access to essential hardware and restrict cross-border collaboration. Failure to comply with these evolving regulations can result in substantial legal and financial penalties.

Supply chain disruptions and limited optionality: Heightened trade restrictions and unpredictable regulatory shifts contribute to increased supply chain vulnerabilities. Companies that rely heavily on imports from specific regions may face shortages, production delays and increased costs due to sudden regulatory changes. Limited supply chain flexibility makes it critical for data center operators to explore alternative procurement strategies and localized manufacturing solutions to enable continuity. Operational efficiency in managing import compliance leads to lower costs and better predictability.

Practical strategies

Understanding and complying with diverse customs and trade laws is crucial for mitigating risks and enabling seamless investments in data centers. PwC's customs and international trade and export control specialists help navigate these evolving challenges and maintain investment resilience.

Trade impact assessment and scenario planning

- Utilize impact assessment solutions to model the financial and operational impact of tariff and export control policies.

- Leverage customs data to identify cost risks and regulatory exposure.

- Develop scenario-based strategies to mitigate financial and operational disruptions.

Develop actionable compliance and mitigation plans

- Establish clear compliance frameworks to adapt to evolving regulatory requirements.

- Utilize PwC's global customs and trade network to design tailored action plans that minimize tariff exposure.

- Identify opportunities for tariff impact mitigation in the operating model and supply chain and take advantage of duty drawback programs to recover costs.

- Use managed services for customs management to leverage leading operations approaches to maximize compliance, mitigate risks and minimize costs.

Diversify supply chains and enhance optionality

- Identify and qualify alternative suppliers to reduce dependence on high-risk trade routes.

- Explore nearshoring and regionalized manufacturing options to increase supply chain resilience.

- Implement proactive risk management strategies to address supply chain vulnerabilities.

In an era of heightened trade volatility, proactive planning and strategic adaptability are essential for data center operators to navigate tariffs and export controls successfully. PwC's deep industry experience enables businesses to remain agile, compliant and competitive in an increasingly complex global market.

Sustainability

Reduce impact, boost efficiency and foster adaptability

Sustainability considerations are cross-cutting, with implications throughout a data center's life cycle from initial planning to design and construction to operations. Initiatives that support corporate sustainability goals can also reduce energy costs, payback periods and downtimes, improve supply chain resilience, community, employee and government relationships.

Key challenges include:

Balancing site selection and design with environmental impact: Selecting an optimal location for a data center requires balancing operational needs with environmental impact. The availability of land, access to renewable energy sources and the ecological footprint of the facility — its impact on local ecosystems, biodiversity and the natural resources to be relied upon — all play crucial roles. Sustainably designed data centers incorporate green building practices, such as using environmentally friendly materials and energy efficient designs. Without careful planning, data centers may face resource shortages, community resistance or regulatory hurdles that hinder long-term viability.

Enhancing energy efficiency and renewable integration: While the data center industry has significantly increased its reliance on renewable energy, with data center operators investing in new solar and wind farms as well as nuclear and novel battery storage, optimizing energy efficiency remains a challenge. From cooling mechanisms to load shifting to more power efficient chips, improvements are continuous to reduce carbon footprints. Without efficient energy strategies, data centers risk excessive operational costs and failure to meet sustainability targets.

Strengthening supply chain resilience: A sustainable data center supply chain requires reducing emissions and energy costs while mitigating climate and geopolitical risks. Many organizations struggle with supplier inconsistencies, reliance on high-emission materials and disruptions due to regulatory changes or environmental conditions. Addressing these risks is critical for maintaining a reliable and sustainable supply chain.

Navigating regulatory and reporting expectations: The increasing focus on environmental regulations and corporate sustainability commitments requires transparent reporting on energy usage, emissions and resource consumption. Compliance with evolving standards can be complex and time-consuming, and organizations that fail to meet expectations may face reputational and financial risks.

Practical strategies

PwC works closely with hyperscalers and data center operators/developers to provide sustainability tailored solutions that go beyond regulatory compliance, offering impact measurement, net zero transformation and climate and nature risk assessments to unlock value and mitigate risks within the data center value chain.

Integrate climate and risk assessments into site selection

- Conduct geospatial climate risk assessments to evaluate water and resource availability at potential sites.

- Use climate modeling to forecast future environmental risks, enhancing long-term viability.

- Implement biodiversity impact assessments to secure community support and regulatory approval.

- Use PwC's proprietary climate risk assessment application — Geospatial Climate Intelligence — to analyze:

  - The link between past and future weather data, and model how climate change will affect the frequency and severity of catastrophe perils that data centers and critical infrastructure face.

  - The impact of data centers on natural resources and their reliance on these resources to facilitate effective siting, design and operations.

Optimize energy efficiency and renewable energy utilization

- Develop energy-efficient data center designs, including advanced cooling solutions and optimized power distribution.

- Implement demand-response strategies, such as load shifting, to reduce peak energy consumption.

- Establish onsite renewable energy generation and microgrid strategies to improve resiliency and contribute to an overarching decarbonization strategy.

  - PwC supports development, implementation and capture of benefits from a company's decarbonization strategy, starting with emission foot-printing to business case development (technical economic and carbon) and ultimately developing and executing a decarbonization roadmap with an achievable transition and resilience plan.

Build a resilient and sustainable supply chain that creates value

- Implement supplier qualification frameworks to assess sustainability performance and emissions impact.

- Diversify sourcing strategies to reduce reliance on high-emission suppliers and mitigate geopolitical risks.

- Design and implement energy hubs and renewable energy strategies that incorporate onsite power generation, microgrid strategic assessments and backup power decarbonization.

- Adopt circular economy principles, such as component reuse and recycling, to minimize environmental impact.

Enhance compliance and sustainability reporting

- Develop transparent <u>sustainability reporting mechanisms</u> aligned with regulatory and investor expectations.

- Implement automated tracking systems for energy usage and carbon emissions across operations.

- Leverage data analytics to identify improvement opportunities and benchmark sustainability performance.

By proactively addressing these sustainability complexities, hyperscalers and data center operators/developers can improve efficiency, reduce costs and strengthen regulatory and community relationships while advancing their net-zero goals and navigating regulatory and reporting expectations.

The data center market is undergoing a significant transformation driven by escalating demands for computing power from hyperscale cloud providers and advancements in AI technology. This creates significant challenges for all players in the ecosystem. PwC offers a holistic suite of solutions to help stakeholders navigate these challenges. By leveraging our deep industry experience, PwC assists companies in addressing energy efficiency, optimizing project delivery, enhancing supply chain resilience, proactively managing risk and navigating evolving regulations. Through strategic collaboration and innovation, PwC empowers stakeholders to achieve sustainable growth and capitalize on the burgeoning opportunities within the data center ecosystem.

The pace of innovation presents incredible challenges that bring incredible opportunities – requiring proactive and interconnected strategies to capitalize on these opportunities.

Contact us

Ready to dive deeper? Reach out to our industry specialists listed below.

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