

RETROFITTING DATA CENTERS: THE LOWER-RISK AND LOWER-IMPACT ALTERNATIVE TO GREENFIELD DEVELOPMENT

The data center industry sits at a crossroads of demand and sustainability pressure. On one hand, the rise of AI is driving unprecedented power density requirements. On the other hand, stakeholders are calling for greener operations, with [some jurisdictions](#) even mandating efficiency benchmarks. These twin forces mean many older data centers, built in an earlier era of lower densities and laxer environmental expectations, face a stark choice: either be replaced by new builds ('AI-ready') or be **retrofitted**^{1;2} to meet the new standards.

Retrofitting an aging data center is rarely straightforward. Unlike greenfield construction, retrofits must contend with the structural, spatial, and operational constraints of the existing facility. Many legacy data centers were not built with modern workloads in mind. They may lack the ceiling height for overhead containment, the floor strength to support GPU-intensive racks, or the electrical capacity. Integrating liquid cooling or AI-grade hardware into such environments often requires major HVAC and power upgrades. Making matters more complex, retrofits are frequently executed in live environments, where equipment must continue running 24/7 to preserve uptime and revenue.

Nonetheless, retrofit remains a compelling path forward, especially in the context of sustainability and resource efficiency. As AI and digital demand continue to rise, so too does the pressure to expand capacity quickly and responsibly. Constructing a new data center requires substantial material and land resources and often takes years of planning and permitting. Retrofitting, by contrast, offers the chance to reduce embodied CO₂, shorten deployment timelines, and reuse valuable infrastructure already connected to the grid. When well-executed, retrofits can improve a site's energy efficiency and environmental profile while extending its useful life.

Despite currently representing a relatively small share of the technical services, in some European countries, data center retrofitting is projected to outpace technical services for new-builds in CAGR over the next decade, across both sub-20 MW and >20 MW segments. This growth is fuelled by rising land and grid constraints, embodied carbon pressures, and the regulatory push for performance upgrades across existing infrastructure. In this context, few operators can handle retrofits end-to-end internally; instead, they rely on an ecosystem of technical services providers to de-risk delivery.

¹ This article focuses primarily on the **retrofitting of existing, purpose-built data centers**. While retrofitting other structures - such as warehouses - into data centers is also technically feasible and faces comparable constraints (e.g., space, cooling availability), it falls outside the scope of this analysis.

² Retrofit activity captured in this analysis is assumed to include a sustainability component. Even interventions primarily driven by AI deployment requirements, such as power density upgrades, do affect a facility's energy profile and key sustainability metrics. Purely AI-focused retrofits with no meaningful sustainability impact remain theoretically possible but are considered marginal at the aggregate market level.

Retrofitting can unlock meaningful sustainability gains and enhance data center performance

Retrofitting offers a combined sustainability and performance upside that new builds rarely match in practice. By upgrading existing infrastructure, operators can materially improve energy efficiency while directly lowering operating costs through reduced power losses, elimination of over-provisioned capacity, and lower maintenance intensity of legacy systems. At the same time, targeted upgrades to cooling, power distribution, and control systems enhance reliability, stabilize performance, and improve overall asset utilization, effectively extracting more usable capacity from the same footprint.

This dual impact is evidenced by real-world cases: in Germany, Vertiv's retrofit of a Contabo facility [reduced](#) PUE³ from ~2.0 to ~1.2 and cut total energy consumption by ~70%, translating into both emissions reduction and meaningful opex savings. Importantly, these gains were achieved without rebuilding the facility, avoiding the significant embodied carbon associated with new construction⁴. Given that a new data center [can generate](#) up to eight times more carbon emissions than upgrading an equivalent asset, retrofitting emerges not only as an efficiency lever but as a structurally lower-carbon pathway to capacity expansion.

Beyond carbon, retrofits yield benefits across the data center's entire **environmental footprint**. For example, cooling systems cuts both water use and refrigerant-related emissions, replacing outdated, high-GWP⁵ and water-intensive technologies. A retrofit allows operators to deploy greener alternatives – as Data4 did by replacing aging R134a refrigerant (GWP 1,430) with a next-generation coolant of GWP 6. In parallel, some next-generation designs are even beginning to demonstrate [zero-water cooling](#) for AI hardware.

Another overlooked advantage is **efficient land use**. Retrofits reuse existing sites, helping to avoid new land take, construction impacts, and long permitting delays. Older data centers often sit in strategic, grid-connected, user-proximate locations that are hard to secure today, allowing retrofits to unlock capacity far faster than building a new site. Industry analysis suggests that operators often [reserve far more grid power at legacy sites](#) than was initially used, meaning a retrofit can scale up IT load into pre-existing power headroom.

All these factors make retrofits attractive: they **improve operational efficiency, avoid “embodied” carbon emissions and related environmental impact**.

³ **PUE** (Power Usage Effectiveness) is a ratio that measures a data center's energy efficiency by comparing total facility energy use to the energy consumed by IT equipment only

⁴ **Embodied carbon** refers to the total greenhouse gas emissions generated throughout the lifecycle of construction materials (e.g. production and installation of high-density concrete)

⁵ **GWP** stands for Global Warming Potential; high-GWP refrigerants are mainly HFCs and other fluorinated gases whose warming effect is hundreds to thousands of times stronger than CO₂

However, retrofitting also faces structural, technical, and economic barriers that limit its feasibility in many cases

For all their promise, retrofits **are not a panacea**. Each project is highly site-specific, and success depends on recognizing the physical limitations of the existing facility. Floor slabs may not support the weight of today's dense racks, batteries, or liquid cooling systems, and raising a building's load-bearing capacity is rarely trivial. Traditional raised floors, once standard, now struggle under the weight of thousands of kilograms of GPU servers and cooling infrastructure, making them increasingly impractical for AI-centric data centers. Low ceiling heights can impede the installation of overhead busways or taller server cabinets. In many cases, even with investments in power and cooling, facilities might still only reach a maximum PUE of 1.4 due to these structural inefficiencies.

Moreover, the **complexity of retrofitting often exceeds that of new construction**. While a greenfield project allows engineers to optimize layout and systems from scratch, a retrofit must weave new solutions into an existing tapestry of old equipment. A retrofit is also challenging because work must be carefully phased within a 24/7 live environment, ensuring the data center stays fully operational throughout. Planning and execution require multidisciplinary coordination at a granular level. For example, detailed studies are needed to determine whether the existing power feed can be scaled up or if new transformers are required. Retrofitting is thus a bespoke, one-off endeavor each time – there is little opportunity for economies of scale or fast shortcuts because each site's conditions and history are different.

Cost is a critical factor in retrofit decision-making, and the comparison with new builds is not always straightforward. In some cases, retrofitting may prove more economical — particularly when a site already has spare power capacity, structural headroom, or existing connections that reduce permitting and infrastructure costs. But this is not a universal rule. Retrofitting an older facility often requires integrating advanced mechanical and electrical systems into an infrastructure never designed for them. If significant upgrades are needed, the unit cost of a retrofit can exceed that of a new build.

Conclusion

By extending the life of existing facilities, operators can meet rising capacity needs while avoiding the carbon and material footprint of new construction. Done well, retrofits can bring aging sites close to modern performance levels and support current workloads without rebuilding from scratch. At the same time, each case must be assessed objectively: some sites cannot cost-effectively meet new requirements. The priority is an unbiased evaluation of the building's structural and infrastructure limits, the achievable gains from retrofitting, and how these compare with a new-build alternative.

Looking ahead, we can expect retrofits to become an increasingly common part of the data center portfolio strategy. The challenges of securing new land and power in prime locations, combined with urgent climate objectives, make a strong case for squeezing more performance out of the assets we already have. Indeed, the industry has already seen a "[legacy revolution](#)" with operators refurbishing sites once thought obsolete and defying earlier predictions of short lifespans. For data center operators, mastering this art of retrofit will be essential to navigate

the next chapter of growth: one where success is measured not just in capacity delivered, but in capacity delivered sustainably.

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