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26

DATACENTER OUTLOOK GERMANY

2025

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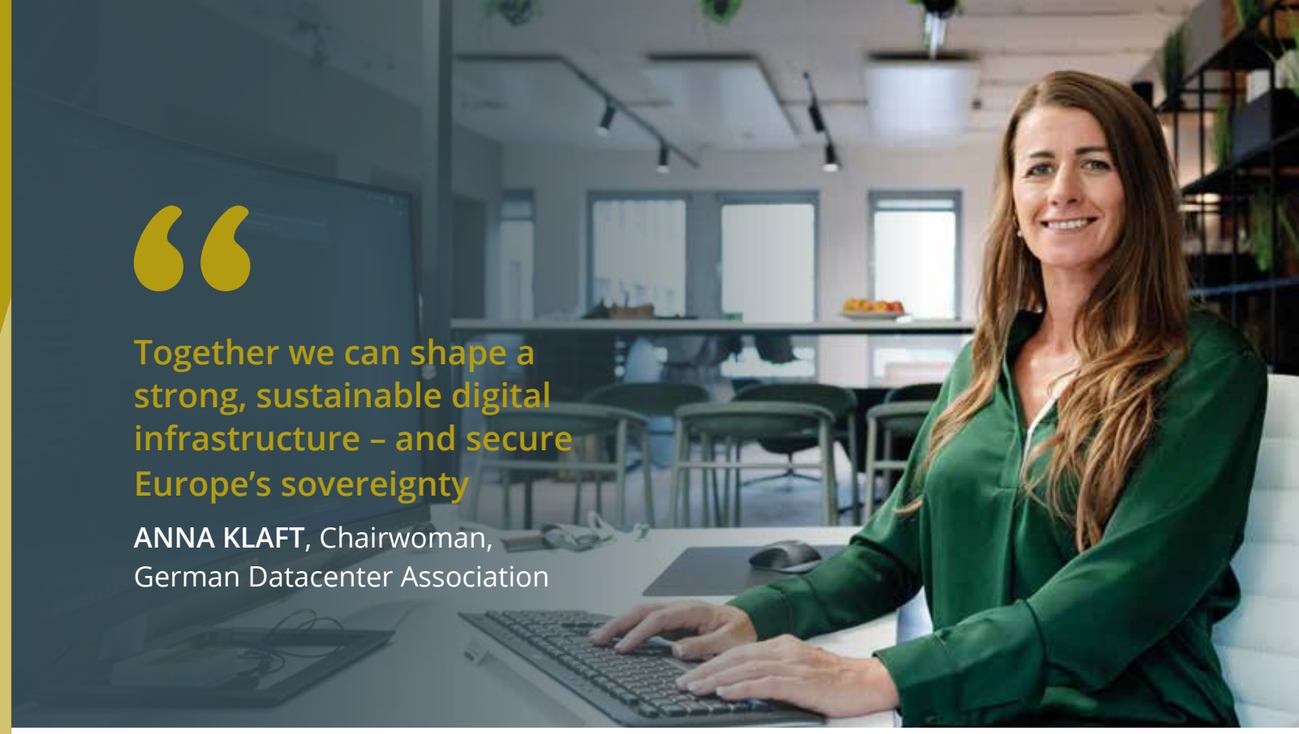

Together we can shape a strong, sustainable digital infrastructure – and secure Europe's sovereignty

ANNA KLAFT, Chairwoman,
German Datacenter Association

Germany and Europe are entering a new phase of digital transformation. Artificial intelligence, cloud services, and data-driven innovation are reshaping our economy, our society, and our daily lives. Yet all of this is only possible if data centers, as critical infrastructure, remain reliably available – secure, sustainable, and future-ready.

The Datacenter Outlook Germany 2025 / 26 both the opportunities ahead and the challenges we must confront: network expansion and energy supply have become decisive. Without reliable connections, growth and innovation will stall. At the same time, sustainability and efficiency must be firmly embedded as guiding principles in the architecture of our digital infrastructure. Only then can we meet the rising demands of AI and high-performance computing while honoring our responsibility to the climate and to society.

The German Datacenter Association sees itself as the voice of the industry. We pool the expertise of our members, engage in dialogue with policymakers and authorities at all levels, and with the German Datacenter Conference provide a platform that fosters knowledge-sharing, dialogue, and collaboration – and where this report is also presented. For us, political advocacy and social responsibility go hand in hand: data centers are more than technical facilities – they are drivers of digitalisation, enablers of innovation, and cornerstones of a sovereign Europe.

We also send a clear signal with the German Datacenter Talents & Impact Awards, which recognize young professionals, sustainable business practices, social responsibility, and innovative solutions. They highlight that the digital future is not shaped by technology alone, but by the people behind it.

Our task is to build bridges: between operators and energy providers, between municipalities and investors, between technology and sustainability. Only by working together across industries can we set the right course. What is needed is trust, openness, and the courage to see competition for resources not as a battle against one another, but as a shared effort for one another.

THE FUTURE IS IN OUR HANDS: data centers are the key to Europe's digital sovereignty. Let us ensure this infrastructure remains strong, sustainable, and future-ready.

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WE WOULD LIKE TO THANK ALL PARTNERS OF GDACON25!

The annual Networking & Strategy Conference of the German Datacenter Association offers companies the ideal platform to present themselves as an indispensable part of the datacenter ecosystem.

GERMAN DATA CENTER MARKET

Expanding the digital backbone of the European economy, leveraging synergy potential and providing digital infrastructure in an era of limited energy supply and ESG goals.

DR.-ING. DIRK TUREK is Associate Director of Research in the Data Centre Solutions division at CBRE. The research team provides market intelligence across EMEA, covering all relevant markets, from FLAPD to emerging tertiary markets. The team tracks key metrics such as supply, demand, pipeline, vacancy and pricing, providing unparalleled insights into the data center ecosystem.

CBRE

FACTS & FIGURES

FRANKFURT

IT-Load:	1,020 MW
Vacancy rate:	4.8 %
Projected CAGR (2026/2027):	18.6 %

BERLIN

IT-Load:	152 MW
Vacancy rate:	7.3 %
Projected CAGR (2026/2027):	25.5 %

- Demand for wholesale colocation and hyperscale build-to-suit are the core volume driver while retail colocation maintain a lucrative and healthy base demand
- Germany is the biggest data center market in Europe, over 1.3 GW of capacity are currently deployed
- Time-to-market is of the essence, grid capacity remains as the core bottleneck
- AI training demand in Germany remains shallow, but AI inference will turbocharge the market in the coming years

Despite continuous improvements in computational efficiency over the past fifty years, burgeoning demand for processing power has consistently outstripped these advancements. For more than a decade, engineers have achieved an annual reduction of 23% in the energy required per computation at the chip level. A 100-Watt chip from 2013, for example, would now require only 4.4 Watts to perform an equivalent workload. However, notwithstanding these year-on-year efficiency gains, the total data center capacity has grown annually, in Frankfurt by 20% year-on-year. This expansion, despite improvements in efficiency, is a trend observed across all European data center markets. The increasing demand for data center capacity is driven by the ongoing social and economic digitalisation, representing a fundamental shift towards a digital-first economy. In recent years this trend was additionally fuelled by innovations such as Large Language Models, AI-assistants, and generative AI.

Germany, strategically located at the heart of Europe and boasting excellent connectivity to the continent's economic and demographic centres, holds the position of the largest data center market in the region and is set to further grow, despite bottlenecks in grid capacity and a complex regulatory landscape.

EXPAND THE CORE, GROW THE EDGE

In Q2 2025, the FLAPD markets have reached a cumulative capacity of over 3,700 MW. London (1,134MW) and Frankfurt (1,020MW) are already above the 1GW mark, followed by Paris (616MW), Amsterdam (570MW) and Dublin (370MW). Demand for those core markets has continued to outpace new supply, resulting in a cumulative vacancy rate of 7.0% in Q2 of 2025. This is a significant drop compared to the cumulative vacancy of 20.6%

in 2019. Frankfurt remains the most sought-after market with a vacancy of 4.8% that is projected to reach a record low of 3.4% by the end of the year.

But the demand for data center capacity is no longer limited to core markets. Since 2022, other secondary markets have rapidly expanded alongside FLAPD. The ten biggest secondary markets in Europe are all the capital cities of their respective country, with Milan and Munich being the only exceptions to this rule. Those ten markets have grown from a cumulative capacity of 563MW by the start of 2022 to over 1GW as of Q2 2025, almost doubling their capacity.

Latency requirements, local demand and data sovereignty in combination with increasing lead times for new capacity in the core markets were the key drivers for the expansions in the secondary markets. As demand continues to rise, primary and secondary markets are set to continue growing simultaneously, with additional markets joining. Stock exchanges and banking hubs were for a long time the prime correlation attribute among data center hubs in Europe. This has expanded to encompass a correlation with a region's population density and GDP contribution as secondary markets have emerged. Now, additional regions in the Nordics and Southern Europe are appearing, showing little correlation to those factors, and being instead defined by low power prices and the widespread availability of power and land at scale.

Primarily seen as AI training clusters or hyperscale campuses, these regions are adding further supply to the market, which isn't directly competing with the established markets as it caters to a new set of requirements. From 2026 onwards, demand for data centers will therefore present itself in three categories:

1. **CONTINUED DEMAND IN FLAPD** with wholesale demand taking the lead, and operators developing facilities further afield to reduce power lead times.

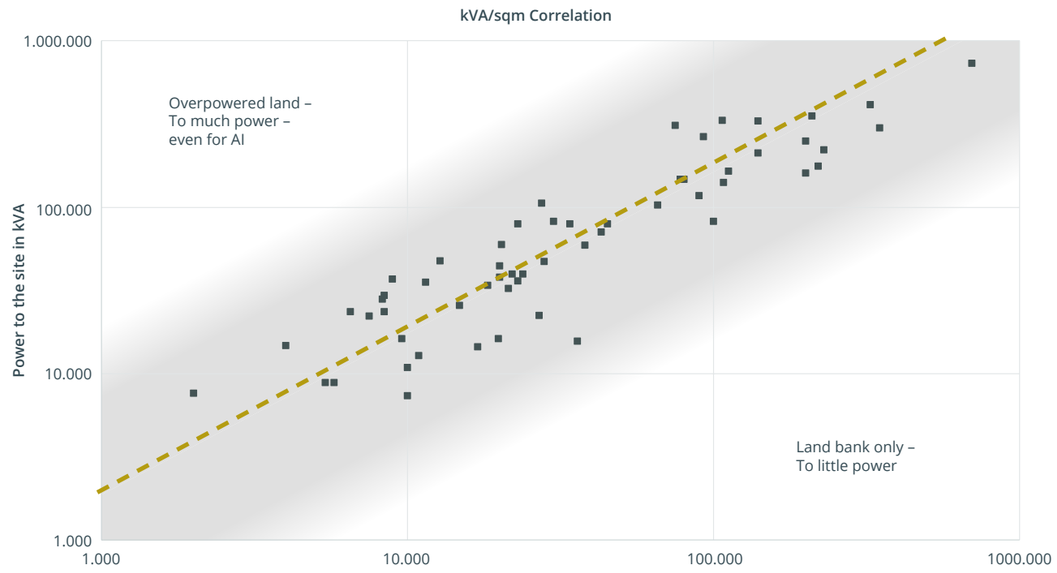
2. **DEMAND IN SECONDARY MARKETS,** increasingly wholesale-focused and clustered around existing hotspots.

3. **DEMAND IN MORE REMOTE REGIONS,** usually limited to a single customer but often in the triple-megawatt range.

Collectively, CBRE projects that the industry will see over 1GW of additional demand each year for the coming years, turbocharging Europe's digital economy.

BALANCING POWER AND LAND

Access to the electrical grid is the undisputed bottleneck for the growth ambitions of the data center industry. Constructing new substations, augmenting existing ones, and upgrading power transmission infrastructure are time-consuming processes, further exacerbated by supply chain and labour force bottlenecks that restrict grid operators' resources. Most applicants currently face lead times of at least 5 years, especially in core locations such as Frankfurt and Amsterdam. Furthermore, grid operators are inundated with preliminary requests for power as an increasing number of parties seek to capitalise on the data center value chain by offering powered land to operators. A significant portion of those requests are oversized in the sense that the power per square meter is above realistic values for data center development, even for AI developments. This not only hinders the efficient allocation of power but also creates "ghost capacity" that will either never be build or worst, never be used. To increase the grid allocation efficiency, CBRE has evaluated kVA/sqm data from existing and planned data centers and identified a universal and realistic power/plot allocation. Power applications should be around the 1.9 kVA/sqm mark. An allocation of less than 0.8 kVA/sqm can be considered under-powered, making it either a landbank option for future development or an incremental ramp up project. The upper limit is around the 3.8 kVA/sqm mark and also applies to AI development, especially for AI training campuses. Although AI clusters get more powerful, it is projected that training these models will require a similar power/plot allocation with only AI inference deployments pushing the boundaries. Power allocation exceeding this 3.8kVA/sqm limit will not significantly increase the land value and will most likely result in stranded power allocation. If Germany and Europe does not want to fall behind the international competition, efficiency in the whole value chain is currently the biggest leverage the industry can use, starting with power allocation.



Power and land correlation for data center developments. Dashed line represents a factor of 1.9 kVA/sqm. Dots represent selected data center projects. **SOURCE:** CBRE Research

LEVERAGING SYNERGY

Sometimes described as "glorified immersion heaters with redundant power supply", data centers undeniably consume vast amounts of electricity that for an outside observer only gets converted into heat. Putting aside for a moment the immense relevancy of this infrastructure to the growth and stability of our economy and society, this fundamental attribute of data centers can be leveraged and make them an integral part of a more sustainable energy system. Waste heat utilization and essential system services that stabilize the electrical grid are among the most prominent and also promising aspect of this synergy. Successful implementation, especially in the form of waste heat utilization, have been completed in recent year.

These implementations were characterized by highly motivated and connected individuals that endured complex regulatory hurdles and acted with multi-year foresight. The lessons learned from those projects can be used to truly leverage these potentials on a wider scale. By building and expanding district heating networks, connecting data center operators with district heating operators and planning authorities, and enabling data center operators to connect their facility in a cost-neutral and legally secure manner data centers can be further integrated into Europe's energy system.

POWERING THE FUTURE

Tackling the Energy Challenges in the Data Center Industry

CyrusOne FRA7 data center, the repurposed industrial building for BEOS's heat pump exchange, and E.ON's local power solution
SOURCE: CyrusOne

Data centers provide the digital infrastructure that underpins almost every aspect of our daily lives. They are the physical manifestation of our digital economy and quietly enable a vast range of economic, scientific and social activities from government services and medical research, to banking and weather forecasting. The criticality of the sector is evident and, as a result, our reliance on data centers will only increase, with growth projections reflecting this demand. While there are inevitable challenges to meeting such enormous demand, the issue of power constraints cannot be understated and solving for this will require a collective and concerted effort from the entire industry.

Power grids across Europe are in the midst of a lengthy and challenging transition period, which will ultimately impact the growth of the data center sector. Even before the emergence of AI, concerns were materializing that data center power demand was unlikely to be met by existing power grids in the short to medium term. This is because European grids need to be extensively upgraded to accommodate high-voltage loads required by modern data centers. This was supported in a recent report published by the International Energy Agency which found that grid constraints could delay about 20 percent of global data center capacity planned for construction by 2030.

The demand for connections to the grid for data centers comes at the same time as an enormous increase in demand for connections to the grid for solar farms, battery storage and wind farms. There simply isn't enough space in the existing substations to meet this demand.

In an effort to tackle this, and improve both generation and connection, CyrusOne and E.ON Energy Infrastructure Solutions (EIS) – one of Europe's largest energy companies and a leader in energy networks, energy infrastructure solutions and energy sales - have entered into a Preferred Partnership agreement to design and deliver local power generation solutions for data centers, offering near term capacity for customers in important availability zones in gateway markets with delayed access to grid capacity. As part of this, E.ON will design a local power generation system, to supply CyrusOne FRA7, supplementing the existing power supply to deliver an additional 61 megawatts of electrical output to the facility by 2029, enabling CyrusOne to extend total IT capacity to 126 MW for its customers.

In an industry first, the solution includes baseload cooling integration via absorption chillers designed to convert exhaust heat from the power generation process into cooling for the data center, increasing overall system efficiency, reducing overall power consumption and improving PUE. While natural gas will initially be used to fuel the plant, the system is built hydrogen-ready and capable of operating with up to 25% hydrogen blended into the fuel mix, with the option to transition to 100% hydrogen through upgrades where demand exists.

The local electricity grid in Frankfurt is almost at capacity, particularly for high-density zones where data centers require a lot of electricity, which further validates the timeliness, importance and necessity of the Partnership. This scalable platform has set new industry standards for the integration of advanced energy solutions, offering a replicable model for future data centers and setting the pace for European innovation in sustainable infrastructure.

It's clear that the industry more broadly recognizes the urgency around these generation issues, with markets across Europe exploring local power generation solutions ranging from tried-and-tested combustion of hydrocarbons to potential consideration of modularized nuclear technology. With this, no singular and definitive solution has yet been identified or agreed; a creative and innovative approach is necessary to enable the continued growth of our digital economy.

As we look ahead, it's evident that data centers will only become more central to the functioning of our modern societies, particularly as the demand for AI increases. Adequate computing capacity is a prerequisite to ensure digital access for all citizens and address the negative impacts of digital exclusion identified by the World Health Organization: poorer health, lower life expectancy and reduced financial mobility. It's essential that industry leaders continue to collaborate and challenge each other to create innovative solutions to address this issue and enable our sustainable digital future.

WE'RE PROUD OF OUR CONTRIBUTION SO FAR AND WILL CONTINUE TO EMBRACE THIS CHALLENGE HEAD ON OVER THE COMING YEARS.

CARSTEN SCHNEIDER currently serves as Vice President and Managing Director Germany, looking after one of the most important markets for CyrusOne's future growth in Europe. He is responsible for leading and overseeing the expansion and management of the organization in Germany.

EXPERT INSIGHTS

What current DEVELOPMENTS or framework conditions are slowing down market growth? What SOLUTIONS address these challenges?

The power shortage is now driving and blocking all data center developments. It is important to build partnerships and cooperate with power companies to successfully develop new projects in those circumstances.

CHRISTIAN KALLENBACH | Head of Sales & Marketing
GARBE Data Centers GmbH

Market growth is currently hindered by long lead times for transformers and the slow expansion of stable grids. Additionally, the lack of integration of storage solutions into the grid and the limited market for mobile generation solutions present challenges. To address these issues, we have developed innovative storage solutions and stabilizing equipment that can balance dynamic frequency and voltage fluctuations in or near data centers.

DR. THORSTEN KROL | Vertical Manager Grid Services and Infrastructure
Siemens Energy

Slow grid expansion, along with legal and local political demands beyond EU law, is deterring investment in Germany. Innovations at our FRA7 data center, including waste heat re-use and local power generation, actively address these challenges and showcase the industry's potential. To support and accelerate market growth in Germany, data centers must be recognised as paramount public interest.

CARSTEN SCHNEIDER | VP & Managing Director Germany
CyrusOne

Instead of overregulation, such as the EU AI Act, European champions and technological innovations must be promoted. We focus on expanding technological capabilities worldwide. For infrastructure, we develop energy-efficient cooling concepts with optimised heat recovery and are working on the computer architecture of tomorrow.

PROF. DR. NIKO MOHR | CEO
Rittal

Allocation and the application for said allocation is complex, time consuming and still an individual process for each DSO in Germany. Lacking a binding guideline means that this will only incrementally improve. Early partnership and transparent communication between data centers, developers, and DSOs can leads to faster project timelines.

DR. DIRK TUREK | Associate Director – Research Data Centre Solutions
CBRE

Power supply bottlenecks are slowing market growth in Central Europe, while regions like Scandinavia and Southern Europe are gaining ground thanks to faster grid connections. We address these hurdles with our own 110kV rated at 300 MWA in Digital Park Fechenheim. Competitive power prices and faster permitting processes are also needed.

VOLKER LUDWIG | SVP and Managing Director Digital Realty DACH
Digital Realty

Network operators are obliged to expand their networks in line with demand. Current network expansion planning is based on customer demand in 2022. This means that we will not be able to meet all network connection requests in the near future. Therefore, we need to continue expanding the networks to meet current demand. In addition, the grid connection procedure must be changed – for more grid-friendly prioritisation and more customer connection fields.

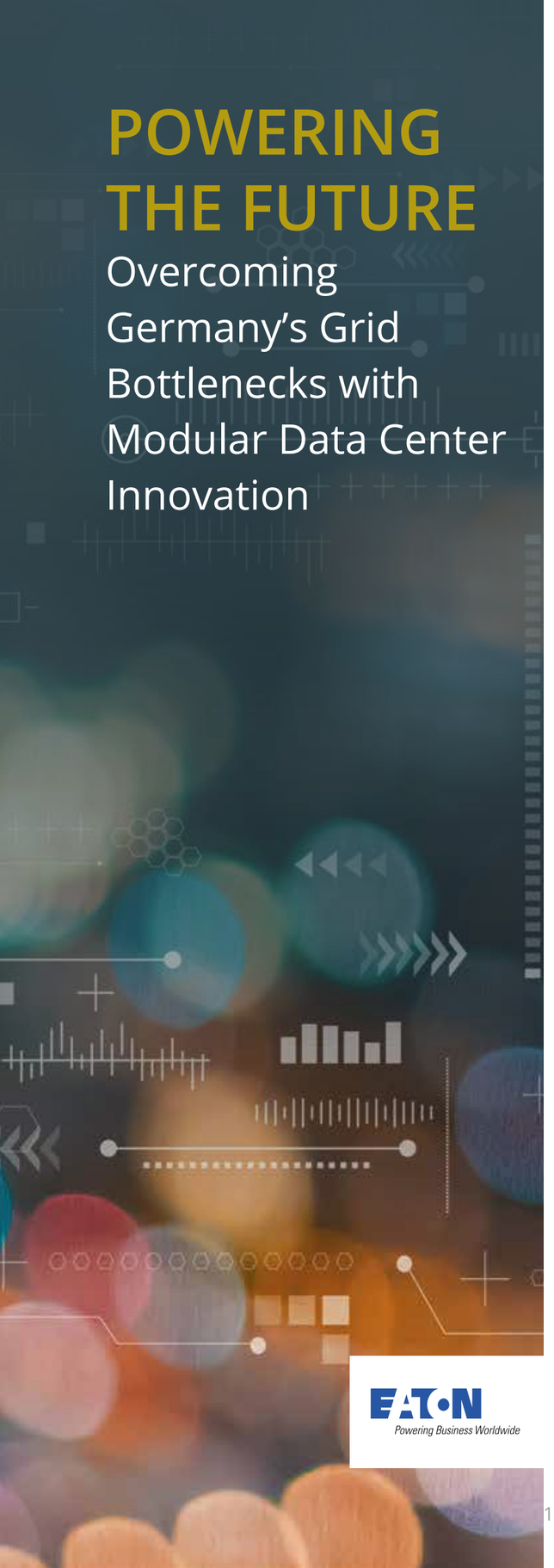
THORSTEN FRERK | Lead System & Markets
TenneT

Land shortages, limited power capacity, and slow permitting processes delay urgently needed infrastructure. We address these bottlenecks with early network planning, smart site selection, and strong partnerships with local authorities.

JEROME EVANS | Founder and CEO
firstcolo GmbH

POWERING THE FUTURE

Overcoming Germany's Grid Bottlenecks with Modular Data Center Innovation



Germany's digital economy is at a critical juncture. As demand for AI and cloud services skyrockets, our national grid infrastructure is being pushed to its limits. As a result, data centers are under increasing pressure to deliver capacity at speed, scale and efficiency, even as they face mounting obstacles to securing reliable grid connections.

In Berlin alone, pending data center grid requests now total 2.8 GW , more than the city's current available capacity - and Berlin is not alone. Across Germany, power bottlenecks are delaying new projects – with queues of up to seven years for capacity requests according to IEA's Energy and AI report - inflating costs and hindering the deployment of critical digital infrastructure. While regulatory reforms are in motion to better manage grid allocations, operators can't afford to wait. The demand is simply growing too fast.

AI IS REDEFINING CAPACITY NEEDS

The root cause of this pressure is clear: artificial intelligence. Whether it's training large language models or deploying inference at the edge, AI workloads are rewriting the rules of data center design. Industry projections suggest that data centers will consume nearly 9% of global electricity by 2030, with AI accounting for two-thirds of that load.

This shift isn't just about more power – it's about a fundamentally different operational model. AI workloads fluctuate rapidly; performance requirements are steep and there is little tolerance for downtime. Traditional data center construction and energy supply models are not fit for the new paradigm.

NO GRID? NO PROBLEM

The most pragmatic answer lies in decoupling data center growth from grid expansion timelines. This approach enables new capacity to be brought online independently of local grid upgrades, using on-site power generation combined with intelligent modular construction. Used either as a temporary or permanent solution, this radically accelerates deployment while reducing reliance on overburdened public infrastructure.

As such it becomes possible to deliver integrated, grid-independent solutions that combine pre-engineered data center modules with on-site power generation. The result is a one-stop solution – from power plant to plug – designed specifically for the speed, scale, and resilience modern data centers demand.

CAPACITY AT SPEED AND SCALE

Central to this vision are prefabricated, factory-tested modules that can be deployed and operational in weeks rather than months. Unlike traditional construction, which is limited by site dependencies, access to skilled labour and weather conditions, xModular systems are assembled under controlled conditions, commissioned (up to level 3), shipped to site and can be installed far more quickly. This modularity means operators can scale quickly in response to AI workload spikes or new customer demands without waiting on protracted build timelines.

By partnering with strategic allies within the industry, this model shaves up to two years off typical project schedules. That's a transformative advantage in today's market.

EFFICIENCY OPTIMIZED BY DESIGN

Of course, speed without sustainability is not a viable strategy. This is why solutions need to be built with efficiency at the core. From hydrogen-ready turbines and AI-enabled energy monitoring to pre-integrated cooling and distribution systems, this approach is designed to maximize performance and minimize environmental impact, by reducing (or even eliminating) the need for diesel engines on-site.

It's not just about doing more – it's about doing it better. By embedding intelligence and sustainability into the architecture itself, it becomes possible to help operators reduce both their carbon footprint and their operating costs. This is vital in a world where energy prices are volatile, and ESG requirements are becoming increasingly stringent.

[1]https://www.lexology.com/library/detail.aspx?g=85415276-22a8-479d-b5c8-908d3ca67b0c | [2]https://www.iea.org/reports/energy-and-ai | [3]https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/the-cost-of-compute-a-7-trillion-dollar-race-to-scale-data-centers

SUCCESS THROUGH PARTNERSHIP

At the heart of all this is collaboration. It requires a combination of deep expertise in modular data center infrastructure and leadership in on-site generation, to offer data center operators a cohesive, future-proof solution.

The result means you don't end up with a collection of off-the-shelf components, but rather a tightly integrated system, co-engineered for today's most demanding use cases.

Perhaps most importantly, it gives operators control. Control over location. Control over timelines. Control over energy sources and consumption. In a time of uncertainty, that kind of control is priceless.

POWER AVAILABILITY: UNLOCKED

The message is clear: power bottlenecks no longer need to dictate the pace of digital progress in Germany. With modular infrastructure and independent energy supply, data centers can be built and scaled where and when they're needed – not just where the grid allows.

This isn't a workaround. It's a new model which supports Germany's digital growth, aligns with its sustainability targets and provides the flexibility to adapt as AI, energy and compute technologies continue to evolve.

FUTURE-READY GERMANY

The path forward requires bold thinking and fast action. It requires commitment to enabling that future – not through incremental improvements, but through systemic innovation. For Germany's data center industry, the opportunity is clear: move faster, build smarter and power the future on your own terms.

ANDREAS ROCKENBAUCH has been working in the data center industry for almost 25 years. Now in his seventh year with Eaton, he is leading Eaton's Data Center Segment Germany since the beginning of 2025. Previous positions included positions at other well-known companies in the industry. He also holds an EMEA Key Account Manager position for three global colocation operators.

EXPERT INSIGHTS

What new DEVELOPMENTS or INITIATIVES are particularly relevant or promising for your organisation in 2026?

We are investing in Europe‘s digital sovereignty. By the end of 2025, our customers will have access to the AWS European Sovereign Cloud (ESC)—a new, fully independent cloud for Europe that will help companies in highly regulated industries and the public sector to meet the most stringent sovereignty requirements.

JONATHAN WEISS | Managing Director Amazon Development Center Germany GmbH
AWS

We are currently planning and constructing numerous new data centers, including one of the largest data center sites in Europe. Advancing these construction projects is a top priority for us. It is positive that Europe is becoming more aware that digitalization requires data centers, and that funding opportunities are being created as a result.

KONSTANTIN HARTMANN | Managing Director EMEA
NTT

In 2026, HARTING will focus on high-performance infrastructure components for data centers in order to meet the higher energy requirements driven by AI. Modular, space-saving power supply and cabling solutions that enable „More Power to the Rack“ and rapid scaling will be particularly relevant.

DANNY HÖRIG | Industry Segment Manager EMEA – Datacenter
HARTING Deutschland GmbH & Co.KG

Data center developments are uniquely positioned to support the regeneration of economically underutilised areas. Prioritising brownfield sites not only protects greenbelt land but also injects new economic life into neglected urban zones. With the right planning frameworks and infrastructure support, these projects can deliver long-term community benefit, through job creation, improved local services, and sustainable development aligned with regional levelling-up agendas. Incentivise brownfield redevelopment for critical infrastructure projects!

CHRIS COWARD | Director of Project Management
BCS Consultancy

The focus is on integrating intelligent energy management systems to increase sustainability and efficiency. Retrofitting existing data centers to comply with the EnEfG and higher AI performance requirements is becoming increasingly important. On the other hand, we are seeing an increase in migrations from old to new data centers during ongoing operations.

MATHIAS FRANKE | Manager
Drees & Sommer

We are currently experiencing a sharp increase in grid connection requests, including those from data centers. While only five customer projects were submitted to TenneT in 2021/22, 488 requests with a total capacity of over 156 GW have been submitted since 2023. The number of data center requests has risen sharply in a very short period of time (currently 7 GW).

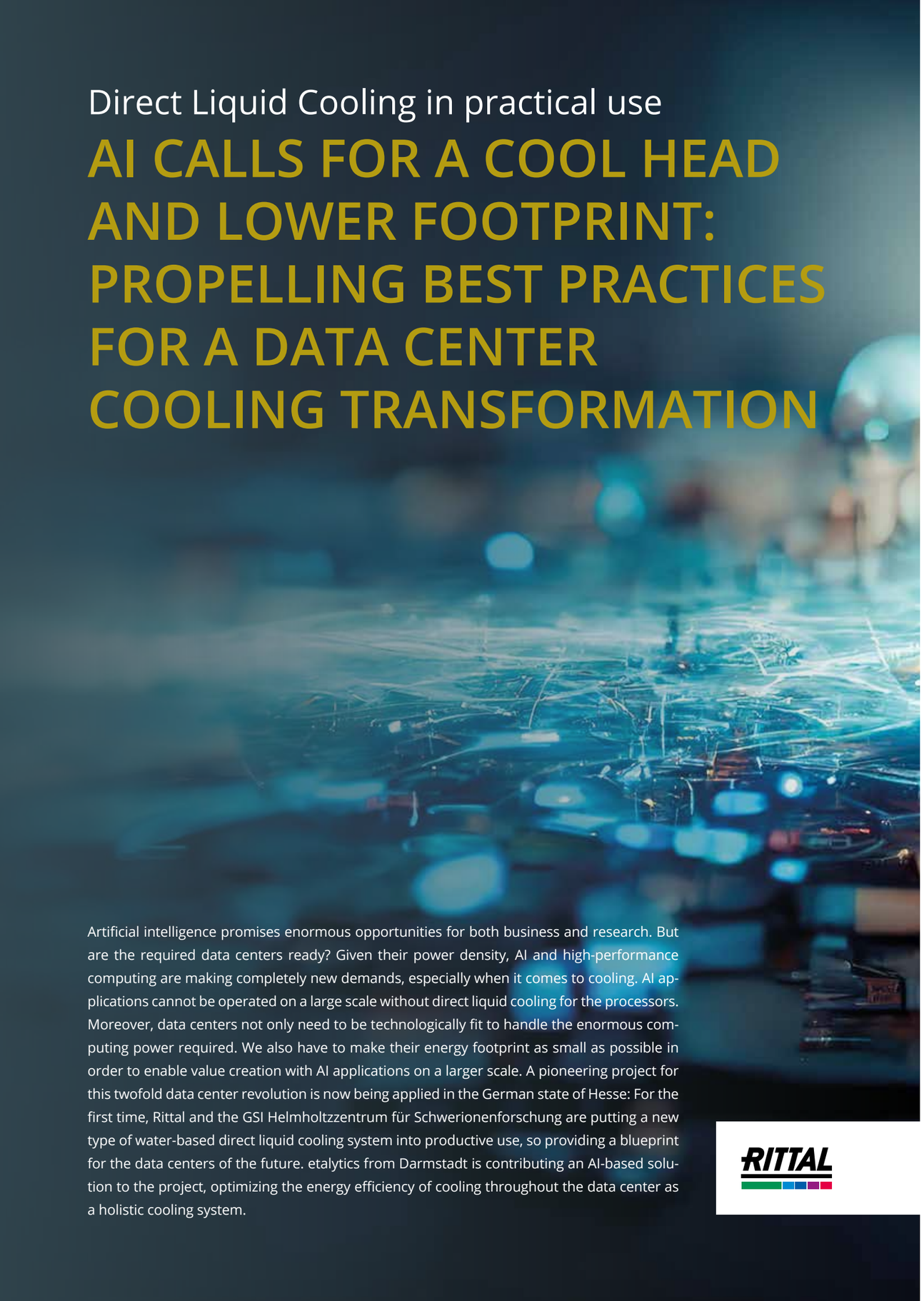
THORSTEN FRERK | Lead System & Markets
TenneT

For Willers, like for many of our consulting engineers peers, the DC industry remains vibrant with growth, innovation, and attractive career paths across the board. It cannot be overstated that the opportunities for disruptive design and energy efficiency create an inspiring ecosystem attracting young talent.

MAGNUS WILLERS | CEO
J. Willers Engineering AG

Arcadis is committed to driving innovation in the German and EU data center sector by focusing on decarbonization through energy-efficient designs and the integration of renewable energy solutions. Refurbishing existing data centers to reduce embodied carbon while enhancing operational efficiency is also a priority. Additionally, deploying Battery Energy Storage Systems (BESS) to stabilize grids, increase resilience, and store renewable energy is a promising avenue. These initiatives align with the EU’s climate goals and support the transition to sustainable digital infrastructure, ensuring that data centers contribute to a greener economy without compromising performance.

CHRISTIAN GOLDSMITH | Senior Programme Director Data Centre Sector
Arcadis



Direct Liquid Cooling in practical use

AI CALLS FOR A COOL HEAD AND LOWER FOOTPRINT: PROPELLING BEST PRACTICES FOR A DATA CENTER COOLING TRANSFORMATION

Artificial intelligence promises enormous opportunities for both business and research. But are the required data centers ready? Given their power density, AI and high-performance computing are making completely new demands, especially when it comes to cooling. AI applications cannot be operated on a large scale without direct liquid cooling for the processors. Moreover, data centers not only need to be technologically fit to handle the enormous computing power required. We also have to make their energy footprint as small as possible in order to enable value creation with AI applications on a larger scale. A pioneering project for this twofold data center revolution is now being applied in the German state of Hesse: For the first time, Rittal and the GSI Helmholtzzentrum für Schwerionenforschung are putting a new type of water-based direct liquid cooling system into productive use, so providing a blueprint for the data centers of the future. etalytics from Darmstadt is contributing an AI-based solution to the project, optimizing the energy efficiency of cooling throughout the data center as a holistic cooling system.

Data centers and, consequently, economic growth through AI in Germany could run into a heat trap. Modern applications, such as AI and high-performance computing, demand maximum performance: over 150 kilowatts of power per rack will soon become the standard. This also means something else: a massive amount of heat. Liquid cooling, rather than the air still commonly used today, must be supplied directly to the new AI chips. This is because the physical limit of air cooling has easily been exceeded.

Rittal has now developed a novel cooling solution to fill this gap: a cooling distribution unit with a cooling output of over one megawatt in compact rack format, which, through its modular construction, can be integrated more easily with data centers in practical operations. The technology has been developed in cooperation with US hyperscalers and server OEMs, who Rittal supplies worldwide. It is now being used and optimised under real high-load conditions during a collaboration with the GSI in Darmstadt.

THE “UNIVERSE IN THE LABORATORY” IN DARMSTADT – HIGH COMPUTING POWER FOR RESEARCH

The GSI Helmholtzzentrum für Schwerionenforschung is bringing the universe to its laboratory in Darmstadt in Germany. A new international accelerator center, named FAIR, is currently being built here, one of the world’s largest research projects. At FAIR, matter that usually only exists in the depth of space will be produced in a lab for research. Scientists from around the world expect new insights into the structure of matter and the evolution of the universe, from the Big Bang to the present.

GREEN IT CUBE: MAXIMUM PERFORMANCE IN COMPUTING POWER AND ENERGY EFFICIENCY

The upcoming experiments at the FAIR accelerator facility will generate unprecedented amounts of data that will need to be processed in real time. To meet these requirements in a sustainable way, GSI/FAIR has developed an innovative and energy-efficient data center - the Green IT Cube - specifically designed for the extreme data throughput of next-generation physics research.

The „Green IT Cube“ on the GSI/FAIR campus is an exemplary model for sustainable high-performance computing. Its design combines high computational power with energy efficiency. The data center‘s advanced cooling system, which uses water cooling at the rear of the server racks, minimizes energy consumption. Notably, the energy required for cooling is less than seven percent of the total electrical power used for computing, achieving a Power Usage Effectiveness (PUE) of less than 1.07. This approach makes the Green IT Cube a leader in environmentally friendly data centers.

With Rittal, GSI is now closing the last air-cooled gap and taking the water right up to the processors. This also creates the optimal conditions for highly efficient heat recovery, resulting in an even smaller carbon footprint.

The waste heat is already warming an office and canteen building on the campus. With the new type of direct chip cooling, GSI and Rittal are breaking new technical ground together, and at the same time performing pioneering work into how such systems can be used on a larger scale in data centers. Thus, the collaboration extends beyond on-site deployment to setting an example for the data center world.

REDUCING THE ENERGY DEMAND OF AI WITH AI

One of the biggest challenges in the widespread use of AI applications is managing their energy consumption. Part of the collaboration between Rittal and GSI therefore involves optimizing the energy efficiency of cooling in practical operation – not just at the unit level, but throughout the data center as a holistic cooling system. etalytics from Darmstadt is contributing an AI-based solution to the project. etalytics emerged as a spin-off from the renowned research group „ETA | Energy Technologies and Applications in Production“ at TU Darmstadt and brings groundbreaking technologies from the fields of Data Analytics, AI, and Energy Science from research to practice. Utilizing data- and model-based methods, digital twins are computed to continuously monitor system behavior and predictively optimize it, considering various influencing factors. In effect, AI from Hesse is ensuring better energy efficiency in the use of AI.

Cooling output of over 1 MW for direct chip cooling with water on a small footprint. **SOURCE:** Rittal GmbH & Co. KG

How does the cooling solution get into the data center? And how is it integrated into the service? These practical issues are highly relevant for use on a large scale. **SOURCE:** Rittal GmbH & Co. KG

TECHNOLOGY MULTIPLIERS FROM HESSE

The digital economy can add value for industry and advance research through AI and high-performance computing. With this objective, we also quickly have to create the necessary conditions in data centers. Showing how this can be done in practice is a relevant objective of the application in Darmstadt. The better the answers for practical questions of installation, operation and maintenance of such cooling solutions are tested and proven, the more likely it is that operators of large data centers will use them. Such infrastructure must be established quickly on a bigger scale so that AI can drive growth for industry, research and the digital business. The members and partners of GDA can be the driving force.

Rittal and GSI sign a cooperation agreement for AI-capable IT cooling (from left to right): Uwe Scharf, Managing Director Rittal Sales Germany, Dr. Katharina Stummeyer, Administrative Managing Director of GSI and FAIR, and Professor Thomas Nilsson, Scientific Managing Director of GSI and FAIR. **SOURCE:** K. Göbel, GSI

MICHAEL NICOLAI is Head of Rittal IT Sales in Germany. His team provides customers with holistic advice on IT infrastructure using platform modules for rack, cooling, power, monitoring and security levels. A physicist by training, he has been involved in IT cooling for two decades and was a driving force behind the development of water cooling for IT.

EXPERT INSIGHTS

Which TRENDS do you think will be particularly important in 2026?

The year 2026 will be a decisive one in terms of how much companies outside of service providers invest in AI, and how much of this investment is directed towards their own or on-premises data centers. This is the next step in AI development and will have far-reaching consequences for many enterprise data centers.

HEIKO EBERMANN | Global Offering Manager Liquid Cooling
Vertiv

In 2026, the focus will be on further accelerating the expansion of AI structures for co-location, hyperscale and enterprise applications. Condition monitoring and the coordinated management of energy, cooling and computing power are becoming increasingly important. Quantum computing and hybrid architectures are the trends of the day after tomorrow.

PROF. DR. NIKO MOHR | CEO
Rittal

Geopolitical initiatives on data sovereignty and accelerating AI growth will shape 2026, driving demand for secure, scalable digital infrastructure and reinforcing Europe's need to strengthen its position as a hub for AI and cloud services.

EMMA FRYER | Director Public Policy Europe
CyrusOne

Balancing the near to the customer and availability of infrastructure is the key to success in the rapid implementation of data center projects.

DR. MARKUS DOLL | Head of Network Assets and Operations
Bundesnetzagentur

In 2026, AI will become crucial for data center operations: from autonomous anomaly detection and planning of maintenance or retrofit measures to optimal system control – AI will support operations teams and elevate efficiency and resilience to a new level.

DR. THOMAS WEBER | Co-Founder & CSO
etalytics GmbH

Redesign of DC infrastructure to support the rise of AI and machine learning, requiring advanced liquid cooling systems and greater power availability, sustainability and CO2 reduction in accordance with EnEfG and Climate Neutrality Pact, as well as on-site energy generation and storage (PV, green gas, battery) to reduce dependence on the grid.

KATRIN FUHRMANN | Board Member
ENGIE Deutschland AG

Next year will also be dominated by liquid cooling. Although Europe may still be cautious in this regard, I am convinced that 2026 will mark a trend revolution toward liquid cooling. Existing data processing guidelines will also make data centers necessary for AI workloads in Europe.

JÖRG DESLER | Global Director Technology
STULZ GmbH

AI-driven infrastructure growth, energy constraints, and power grid tensions, along with mandatory sustainability reporting and real emissions reduction, highlight the need for modular, scalable, and edge-centric architectures. This is why we focus on developing more efficient solutions and strengthening our structure to support clients in reporting.

ROBERTO MULTINEDDU | DAE SpA Vizepräsident EMEA – DAPG GmbH Geschäftsführer
Daikin Applied Europe SpA / Daikin Applied Germany GmbH

Interview

EVERY KILOWATT HOUR COUNTS

SOURCE: NTT Global Data Centers

The Rhine-Main region around Frankfurt already has one of the highest concentrations of data centers in Europe. Its proximity to the German internet hub DE-CIX, coupled with the city's status as a major financial center in Europe, makes this location particularly attractive.

In the coming years, one of Europe's largest data center locations will also be built here. Over the next few years, Global Data Centers, a division of NTT DATA plans to build a campus in the Rhein-Selz-Park, a former military site in Nierstein, which will have an IT capacity of 482MW in the final expansion stage.

We talk to Günter Eggers, Director Public at NTT Global Data Centers EMEA, about the challenges involved in planning such a project and how electricity requirements and waste heat will be covered.

GÜNTER EGGERS

The debate about the power requirements of data centers is in full swing. Meanwhile, NTT has announced a new megaproject in the metropolitan area.

How do these two things fit together?

The conversation around data center power usage is both critical and timely. As digitalization and AI adoption accelerate across Germany and all of Europe, the demand for scalable, high-performance infrastructure is growing rapidly. Our new data center project is a direct response to that need. However, we are committed to building energy-efficient, future-ready data centers that not only support this growing demand but are also aligned with our sustainability goals.

Do you already have concrete plans in place to guarantee the power supply?

Securing a reliable power supply is the first step in any data center development. For our new site, we are working closely with Westnetz GmbH to ensure timely grid integration, including the construction of a dedicated transformer station at Rhein-Selz-Park. The site will be connected to the existing high-voltage network, with grid expansion measures managed by the operator under regulatory oversight. As a critical infrastructure provider, we are implementing a fully redundant power architecture to ensure resilience. All planning activities are progressing on schedule.

From 2027 onwards, German data centers will be legally required to source their electricity from renewable energy.

What is your experience of these requirements so far?

The requirements are strict, and implementation is not always straightforward. We are dependent on what is available on the market. For instance, the electricity supplied via the high-voltage grid at the Rhein-Selz-Park site is similar to the standard mix of electricity in the German grid. We are currently examining the extent to which we can include electricity directly from wind farms or PV systems. In any case, we will, of course, comply with the legal requirements.

We also plan to install photovoltaic elements on the façades of the planned data center buildings where it is technically possible and economically viable, to enable us to generate our own electricity. The detailed planning will be finalized in the coming months. One thing is certain: every kilowatt hour of self-generated electricity counts. We will utilize all possibilities.

What role do environmental protection and nature conservation play in your overall approach to data center projects?

At Global Data Centers, environmental protection and nature conservation are fundamental to our approach. Our mission at NTT DATA is to use technology to help build a sustainable future. And that commitment is reflected in every data center project we undertake.

We recognize the importance of preserving natural habitats and understand the public's concern for environmental stewardship. As data centers are essential infrastructure, it's our responsibility to ensure they are developed and operated as sustainably as possible.

In our new construction projects, we prioritize minimizing landscape disruption. Green spaces, trees, and park-like environments are thoughtfully integrated into our site designs. Additionally, we focus on maximizing energy efficiency, including the reuse of waste heat generated by IT systems: an important step toward reducing our environmental footprint.

Waste heat utilization is a good keyword. How would you assess the potential of this technology?

Waste heat utilization offers enormous potential, both in new builds and existing data centers. At Global Data Centers, we are committed to creating the technical infrastructure necessary to transfer waste heat efficiently. However, realizing its full potential requires strong collaboration with energy providers who can help bring this resource to broader use.

We've long used waste heat internally, for example, to heat our offices and preheat emergency power systems. But interest in broader applications has grown considerably. Today, waste heat is increasingly being considered for heating residential neighborhoods or supporting agricultural operations.

A great example is our Frankfurt 4 site in Hattersheim, where waste heat will soon supply a local heating network. Our partner, Mainova, will use this energy to provide heating for over 500 households. Even more impactful is at our Berlin 1 campus, where waste heat will help supply heat to more than 10,000 residents. This project was developed in partnership with Quartierswerk Gartenfeld GmbH, a joint venture between ENGIE Deutschland and GASAG Solution Plus.

What are the biggest challenges in data center projects, in your experience?

One of the biggest challenges in data center projects is site selection. Each site must meet a complex set of criteria, particularly with regard to power supply and sustainability. At Global Data Centers, our extensive experience in delivering large-scale construction projects helps us navigate these challenges effectively. However, every project is unique and presents its own set of requirements.

Staying at the forefront of technological innovation is essential. We continuously evaluate and implement advanced solutions tailored to local conditions. These include HVO100 as a sustainable alternative to diesel fuel for emergency generators in Vienna, groundwater cooling systems in Munich, reverse osmosis filtration in London, and immersion cooling technologies in Mumbai.

Many thanks for the interview!

From Brussels to the Town Hall

HOW GDA IS PUTTING DIGITAL INFRASTRUCTURE ON THE AGENDA

MARTIN KOHOUTEK | General Secretary GDA

MATTHIAS PLÖTZKE | Head of Public Affairs GDA

All position papers at a glance: use the QR codes on pages 40/41

This year, the German Datacenter Association (GDA) has significantly stepped up and expanded its activities and commitment to political advocacy. Alongside its robust event and networking programme, the association is striving to establish itself as a more engaged dialogue partner for political decision-makers at the EU, federal, and state levels.

Why now? GDA General Secretary Martin Kohoutek and Head of Public Affairs Matthias Plötzke discuss this.

“ONLY WHEN OUR MEMBERS SHARE THEIR EXPERIENCES AND CONCERNS CAN WE, AS AN ASSOCIATION, BE EFFECTIVE. JOIN US – YOUR VOICE COUNTS.”

MARTIN KOHOUTEK, GENERAL SECRETARY

MARTIN KOHOUTEK (MK): Since its foundation in 2018, the GDA has quickly become a key point of contact for the data center industry in Germany. And its growth has gained tremendous momentum since then. Never before have data centers been so much in the spotlight of the business community and the public as they are today. At the same time, political debates on energy efficiency, digitalisation and sustainable infrastructure have become much more intense. This is precisely where we want to further strengthen the association.

MATTHIAS PLÖTZKE (MP): We see this in politics too. Market dynamics are now directly reflected in political awareness – especially when it comes to topics such as AI and digitalisation. And that’s a good thing! After all, a powerful digital infrastructure is just as important as roads and railways. The fact that data centers are mentioned so prominently in the coalition agreement is therefore an important and welcome signal. Now it’s all about implementation. → For the GDA, this means being a credible and competent partner in the political dialogue with concrete proposals for action. The association’s work ensures that the industry’s interests and concerns are incorporated into legislative processes in a timely manner.

MK: Absolutely. The coalition agreement is the basis – but we want to play an active role in its implementation. To achieve this, we have set ourselves ambitious goals, such as targeted lobbying at state, federal and EU level for clear and sustainable framework conditions. Take energy policy, for example: legislative competence lies in Brussels. This is why we are intensifying our dialogue with the European Commission and Parliament. At the same time, environmental and climate targets, as well as planning and approval processes at federal and state level, play a major role. This is where we contribute our expertise – right down to discussions at local level, often directly with the local mayor.

MP: In terms of organisation, we are taking a step-by-step approach: in Brussels, for example, we are becoming more involved with the European Data Centre Association (EUDCA). In the medium term, we will also hold direct talks with Parliament and the Commission. Decisions made in Brussels end up as regulations on our members’ desks three to four years later. This is why it is important to establish our presence there at an early stage.

MK: At the national level, strong connections to federal ministries are crucial – GDA is already well positioned in this regard, and we are expanding on this. At the state and local levels, we will increase our presence with local events, such as municipal dialogues. We see a lot of potential here for good ideas, suggestions and better processes. Ultimately, this is exactly what defines an association: pooling the skills, experience and ideas of our members – and representing their concerns, worries and requests for change to politicians with a strong voice.

“POLITICS NEEDS CLEAR MESSAGES. EVERYONE IN THE GDA CAN CONTRIBUTE TO THIS, SO LET‘S WORK TOGETHER TO MAKE OUR VOICE EVEN STRONGER.”

MATTHIAS PLÖTZKE, HEAD OF PUBLIC AFFAIRS

RESILIENT THROUGH TECHNOLOGY: HOW COMPANIES ARE SECURING THEIR ENERGY FUTURE

Secure power supply in uncertain times

UPS, BATTERY STORAGE AND EMERGENCY POWER SYSTEMS AS THE FOUNDATION OF BUSINESS RESILIENCE

In an increasingly unstable energy environment, the issue of supply security is becoming a key strategic issue for companies. Whether it is protection against grid fluctuations, geopolitically distributed risks or compliance with operational or legal safety standards, dependence on the public power grid has become a potential weak point in many areas. The key lies in a smart form of independence – the interaction of UPS, emergency power systems and battery storage creates a resilient overall system. This is best achieved with an experienced system integrator at your side who not only understands emergency power, but lives it – like NTC.

SOURCE: Notstromtechnik-Clasen GmbH

IMMEDIATE PROTECTION IN THE EVENT OF A POWER FAILURE: THE ROLE OF UPS

Uninterruptible power supply (UPS) immediately takes over the supply of sensitive consumers in the event of a power failure or voltage fluctuations – without any time delay. In data centers in particular, even a brief power drop can cause considerable damage or data loss. A UPS compensates for such disruptions and bridges the gap until an emergency power supply system takes over power generation. The UPS also protects against voltage peaks and frequency deviations, which are increasingly common in unstable networks.

In addition, UPS systems can also be used specifically for peak shaving. In combination with intelligent control technology, they relieve the load on the grid during peak periods, thereby reducing grid fees – an economic benefit that is becoming increasingly important.

LONG-TERM SECURITY WITH EMERGENCY POWER SYSTEMS (EPS)

However, a UPS alone is not sufficient in the event of prolonged power failures. This is where emergency power systems (EPS) come into play. These are usually diesel or gas-powered generators that can cover a company's energy requirements independently for several hours or even days. Emergency power systems are available in various designs – from manually operated units to automatic systems with island operation capability. The latter detect power failures independently and start up within a few seconds to quickly take over the power supply. Particularly powerful EPS even enable a company to operate completely independently of the public grid.

Emergency power systems can also contribute to peak load shaving: targeted use during peak times can smooth out load peaks and reduce the load on the grid. Such strategies not only improve economic efficiency, but also the grid compatibility of the energy supply.

UPS AND NEA IN PERFECT HARMONY

The combination of UPS and NEA is an extremely reliable power supply solution. While the UPS bridges the first few minutes of the outage, the NEA takes over the power supply immediately afterwards. As soon as the public grid is stable again, the switchback is automatic and controlled. This coordinated interaction prevents interruptions in operation, minimises production downtime and increases the safety of critical systems. In addition, modern control technology intelligently regulates load distribution and switching, depending on the consumption profile and prioritisation of individual consumers.

This system is increasingly being supplemented by battery storage systems, which act both as additional buffers and as active energy managers. They not only take over the short-term supply, but also enable economical temporary storage and release of electricity – for example, by participating in electricity trading or for optimising self-consumption.

ISLAND OPERATION AS A STRATEGIC DECISION

More and more companies are going one step further and consciously opting for so-called island operation. This involves completely decoupling the power supply from the public grid. Reasons for this include unreliable grid quality in certain regions, planned production peaks, the targeted reduction of grid load costs or the integration of renewable energy sources such as photovoltaics. In island mode, the emergency power system takes over the power supply together with buffer storage, UPS and, if necessary, a PV system. Thanks to intelligent control, the energy supply can be independently guaranteed for several days – a crucial feature in crisis situations or during large-scale grid failures.

Battery storage systems play a key role here: they increase grid stability in island mode, buffer fluctuations in renewable power generation and optimise self-consumption.

ENERGY SELF-SUFFICIENCY CREATES SECURITY AND EFFICIENCY

The advantages of such controlled independence are obvious: companies are protected against unpredictable grid disruptions, minimise the risk of costly downtime and meet the highest requirements for security of supply. In addition, economic advantages can be achieved, for example through peak load optimisation, participation in energy markets with battery storage systems or by avoiding production downtimes. Increasing regulatory pressure – for example, through requirements for emergency power supply in critical infrastructures – is also making investments in proprietary power supply systems increasingly attractive.

TAKE CONTROL – GAIN RESILIENCE

The close integration of UPS, NEA, battery storage and control technology creates systems that not only react to external circumstances, but actively anticipate them. Those who opt for an in-house power supply today gain not only security, but also control, flexibility and competitiveness. With an experienced partner like NTC at your side, this future is already becoming a reality – technically convincing, economically viable and strategically intelligent.

JÖRG BÖHME has been CEO of Notstromtechnik-Clasen GmbH, a system integrator for manufacturer-independent, high-availability emergency power systems, since 2019. „We equip companies with reliable emergency power so that they can operate independently and without worry," is the guiding principle of the company, which since 1996 has been designing, planning, installing and maintaining the best possible, needs-based energy supply in emergencies, particularly for customers in critical infrastructure.

TdoRZ
TAG DER OFFENEN RECHENZENTREN

Where does the internet actually live?!

OPEN DATA CENTER DAY

The "Open Data Center Day" reveals what usually remains hidden: the places where our digital life actually resides. Across Germany, operators – both members of the German Datacenter Association and companies outside the GDA – open their doors and provide insights into a world normally reserved for experts. The response confirms its relevance: in 2024, 26 data centers in 16 cities took part. More than 1,000 visitors seized the opportunity to experience server rooms, cooling systems, and emergency power infrastructure up close. 93% of all tours were fully booked – a strong signal of society's interest in an infrastructure that is indispensable in everyday life but often invisible.

This outward openness creates proximity: citizens discover how data centers secure jobs, drive sustainability, and form the backbone of innovation from cloud services to AI. For policymakers and municipalities, it becomes tangible how closely location attractiveness and digitalisation are intertwined. The dialogue on energy, efficiency, and responsibility is thus raised to a new, concrete level.

Supported by the Federal Ministry of Digital Affairs, "Open Data Center Day" represents an industry that does not hide but takes responsibility. In 2025, 20 sites in Germany are already participating – and for the first time, the Austrian and Italian Datacenter Associations are joining in. Thus, the GDA's format is evolving into a European movement: data centers are not "black boxes" – they are engines of our digital society and partners for a sustainable future.

Interview

MODULAR DATA CENTERS IN THE ERA OF AI AND EDGE COMPUTING

PETER WÄSCH

The German data center market is currently experiencing solid growth: According to the „Data Center Impact Report“ published by the German Datacenter Association (GDA), installed IT capacity in the important colocation sector will grow to around 3.3 GW by the end of 2029, more than doubling in size. Peter Wäsch, Head of Modular Datacenter Germany at STULZ, explains why modular solutions are particularly benefiting from this boom and which approaches to AI and edge computing could define the market in the future.

The GDA forecasts growth of around 150 percent for the colocation sector by 2029. What opportunities does this create for modular infrastructures?

The overall strong market growth in the data center environment is also increasing the demand for modular data center solutions. Today, companies need to compensate for IT capacity constraints quickly and efficiently without having to accept long construction times and construction risks. Prefabricated solutions are usually ready for use within a few weeks, while conventional construction projects take several months or even years. Standardized solutions also ensure excellent predictability of investment costs and minimize construction and operational risks. By using modular systems, operators can start with a solid foundation and scale it as needed at any time without having to extensively redesign their existing IT infrastructure. This keeps IT flexible and allows it to quickly adapt to trends such as on-premise cloud and edge implementations. In the fast-growing colocation segment in particular, modular solutions also offer the flexibility needed to respond quickly to customer requirements.

What important developments shaped the modular sector over the past five years?

Modern modular systems are characterized above all by significantly higher power densities and lower unit costs. The power provided per rack has gradually increased from around 5 kW to over 20 kW in recent years. This means that there are no longer any reasons to avoid integrating high-density installations, even in compact outdoor enclosures. At the same time, economies of scale in series production have reduced the unit costs of prefabricated solutions. In general, standardized basic designs have reduced investment risks, even though the sector continues to thrive on strong customer focus and a high level of customization expertise. There is also a clear trend in cooling technologies: the use of Liquid Cooling in modular systems is steadily increasing and will certainly have a noticeable impact on future demand, for example in AI integration.

Where will the development of modular systems lead in the coming years?

Above all, I expect to see greater integration of AI-supported monitoring and control systems for predicting potential malfunctions and optimizing maintenance intervals. Circular-Economy approaches are also gaining importance in modular construction. The aim is to ensure that certain module components can be returned to the material flow at the end of their life cycle and recycled accordingly. Furthermore, modular data centers can be increasingly integrated with 5G and edge infrastructures to enable low latency and decentralized AI applications.

SOURCE: STULZ

The current KRITIS legislation is increasing the requirements for security and local data processing. What role do modular data centers play in this context?

It is becoming increasingly important, especially for operators of critical infrastructure, to process sensitive data and systems locally and in accordance with the highest security standards. The KRITIS regulations restrict the use of cloud services, meaning that certain IT resources must be operated on-site. Modular data centers offer a decisive advantage here: They enable local computing power to be set up flexible, fast, and in a cost-efficient manner—tailored precisely to the respective regulatory requirements. This allows companies to expand their infrastructure as needed while reliably complying with legal requirements. Especially in combination with edge and AI applications, which require low latency and high data sovereignty, modular solutions are the ideal answer for a KRITIS-compliant infrastructure.

What role does sustainability play in prefabricated solutions?

Modular data centers offer several key advantages in terms of sustainability: They reduce material and waste compared to traditional building solutions and enable significantly higher energy efficiency thanks to optimized designs. Our CyberRow series, for example, can be combined with indirect Free Cooling to reduce energy consumption. For even higher power densities, advanced Liquid Cooling methods can reduce greenhouse gas emissions by up to 20 percent while being more water-efficient than traditional evaporative cooling systems.

SOURCE: STULZ

AI workloads are driving power densities up massively. How is STULZ preparing for the increasing demands and growing popularity of Liquid Cooling?

Current developments confirm our strategy of focusing on Liquid Cooling at an early stage. Air Cooling reaches its limits at around 50 kW per rack, whereas Liquid Cooling can easily meet the power requirements of current AI systems, which are around 130 kW and well above that. Our direct-to-chip solutions can already cool 75 percent of the IT load, while the remaining 25 percent is cooled by our Air-Cooling solutions. In general, the integration of Liquid Cooling means that where five containers or outdoor enclosures may have been required in the past, one or two units with Liquid Cooling are now sufficient. The high level of compactness is a decisive factor here, as AI applications, for example, will increasingly be moved to the edge in the future.

Many thanks for the interview!

PETER WÄSCH, a graduate electrical engineer, is Head of Modular Datacenter & MDC Germany and has been with the company since 2023. His many years of international experience in management positions within the data center industry and his expertise in the field of modular data centers make him a key figure in this segment. According to Peter Wäsch, STULZ is excellently positioned as a global specialist for data center climate control in the dynamic market for modular data centers. Wäsch emphasizes that STULZ is ideally equipped to master the challenges of the future. For classic standard applications with moderate heat loads, the company uses proven side coolers that can also be combined with indirect free cooling. Special liquid cooling solutions have been developed for high-performance computing and AI applications. The modular solutions with integrated CyberCool CMU/CDU can currently extract heat loads of around 1650 kW per unit, making them ideal for high-performance AI systems.

PUBLIC AFFAIRS

The voice of the GDA: impetus for politics and industry

Over the past year, the German Datacenter Association has further expanded its role as the central voice of the data center industry. Through statements, consultation contributions and position papers, the GDA brings its members' concerns into the political process – from energy efficiency and grid fees to issues of security of supply. The aim is to create reliable framework conditions for sustainable growth and to highlight the importance of data centers for digitalisation, the economy and society. Below is an overview of the GDA's most important statements and position papers from the past year.

THE GDA'S RECOMMENDATIONS FOR THE NEW LEGISLATIVE TERM

Sustaining Germany's position as a leading industrial nation requires decisive policy action. The new federal government should drive digital transformation through clear strategic objectives and predictable regulatory frameworks, remove barriers to innovation, and lay the foundations for a high-performance, resilient, and sovereign digital infrastructure. To this end, the German Datacenter Association (GDA) presented concrete proposals and recommendations for the forthcoming legislative term.

GDA POSITION ON BNETZA'S DISCUSSION PAPER FOR THE FRAMEWORK DETERMINATION ON THE GENERAL ELECTRICITY NETWORK TARIFF METHODOLOGY (AGNES)

Responding to BNetzA's AgNeS discussion paper, the German Datacenter Association (GDA) calls for a transparent, cost-reflective and practicable tariff framework that provides planning certainty and reflects data centers' 24/7 load profile. The GDA cautions against dynamic and capacity-based components that overburden low-flex consumers and supports nationwide distribution-level tariffs only if phased in with clear efficiency incentives.

GDA SUBMISSION TO THE FEDERAL NETWORK AGENCY'S CONSULTATION ON THE ALLOCATION OF OFFTAKE CAPACITY AT VOLTAGE LEVELS ABOVE LOW VOLTAGE (AZ. BK6-24-245)

As part of the Federal Network Agency's (BNetzA) consultation on the allocation of offtake capacity at voltage levels above low voltage, the German Datacenter Association (GDA) has submitted a position paper. The GDA underscores the critical importance of a reliable, predictable and cost-efficient power supply for data centers. As key enablers of digitalisation and economic growth, data centers must be appropriately considered in the design of future grid charges and regulatory requirements. The GDA also calls for a policy framework that actively supports investment in sustainable and energy-efficient solutions.

GDA POSITION PAPER ON THE ENERGY EFFICIENCY ACT (ENEFG)

The German Datacenter Association (GDA) welcomes the German Federal Government's efforts to increase energy efficiency and reduce energy waste through the Energy Efficiency Act (EnEfG). In its current form, however, the GDA sees significant challenges that could adversely affect Germany as a data center location and, in turn, the competitiveness of the economy, the provision of essential digital services, and public life.

The GDA therefore advocates targeted adjustments to the Energy Efficiency Act that enable practical implementation and pave the way for sustainable, future-oriented solutions.

PHASING OUT INDIVIDUAL GRID TARIFFS FOR DATA CENTERS WOULD BE THE WRONG DECISION AT THE WRONG TIME

The German Datacenter Association (GDA) has submitted a formal response to the Federal Network Agency (BNetzA) regarding its announcement to abolish privileged individual grid tariffs for large consumers with constant electricity demand after 2026. In its submission, the GDA voices serious concerns about the proposal.

The association advocates maintaining individual grid tariffs at least through the end of the decade to avoid unnecessary additional costs and to prevent adverse effects on Germany's digital transformation and overall economy.

SHAPING DIGITALISATION

High-quality architecture is a catalyst for the expansion of digital infrastructure

ARCHITECTURE IS MORE THAN JUST A “MEANS TO AN END”

Good architecture – a familiar term that, on closer inspection, goes beyond the pure design of buildings. It creates places, shapes identities and influences our social interaction. Amidst the conflicting demands of ecological responsibility, technical complexity, legal requirements and social forces, expectations are rising – and with them the demands placed on the planning and design of buildings.

This is particularly noticeable in types of buildings – like data centers – that are resilient and highly technical. Here, it is not only a matter of assuring operational reliability and energy efficiency, but also of considering sustainability, urban integration and design. In this way architecture is becoming an integral part of responsible infrastructure development.

FUNCTIONALITY AS A STARTING POINT

As part of critical infrastructure, data centers are required to operate reliably, efficiently and permanently around the clock, whilst observing maximum security. However, in addition to the resilient computer areas, offices, technical management and logistics areas are also subject to strict user-driven functional requirements.

Solving these construction challenges does not arise by chance – it is the result of careful planning that strikes a balance between all the requirements of the stakeholders involved. Good architecture begins here, with a deep understanding of our customers‘ processes and business models, and a sober assessment of planning constraints and available resources. The complete and equal consideration of the requirements of all parties involved forms the basis for the subsequent design of data centers.

DESIGN AS A QUALITY FEATURE

Form follows function: design means making conscious decisions about the structure and layout of a building, the materials to be used, air and light management, and how sustainability is to be presented to the outside world. This always takes into account the identified interactions and trade-offs between technical requirements, economic constraints and the appearance of the building. Architecture that convinces is comprehensible, pleasing, proportionate and carefully executed. These elements influence not only the appearance, but also the quality and usability of a building throughout its entire life cycle.

Visible design quality creates acceptance – among customers, local authorities and the public. A well-thought-out design is increasingly seen as a contribution to the common good. Good design thus becomes socially demanded. The expected quality of the architecture is often a decisive factor in convincing decision-makers when it comes to the question of locating new data centers.

CONTEXT SENSITIVITY AS A PLANNING REQUIREMENT

The design of a building should not be viewed in isolation, but always as it stands in relation to its surroundings – be it urban, design or social. Cities and municipalities, neighbourhoods and approval authorities today increasingly value the integration of new buildings into the existing environment. Data centers are often very large, are subject to significant technical requirements, and are here for the long run. This makes it all the more important to find an architectural solution that responds to its surroundings and respects their scale; one that creates clear, logical and environmentally-compatible structures. Engaging with the location thus becomes a design principle – and a prerequisite for public acceptance. A harmonious overall appearance strengthens the economic and political support for a project.

SUSTAINABILITY AS A BENCHMARK

Sustainability is no longer a 'nice to have', but has become an integral part of legal requirements and public expectations. Legislators, local authorities and clients demand proof of ecological, economic and social responsibility. Sustainability affects the entire life cycle of a building – from the choice of materials and type of construction to the energy efficiency of its operation and flexibility to adapt in the future.

Data centers are also energy centres: apart from optimising their resource consumption they should contribute to the decarbonisation of cities and municipalities. It is therefore important to consider how waste heat might be used, thereby replacing the consumption of fossil fuels, reducing CO_2 emissions, being powered by renewable energy, and designed to be climate-friendly and recyclable. Sustainable architecture means creating buildings that are economically viable for decades.

TECHNOLOGY AS AN INTEGRAL PART OF BUILDING DESIGN

Even though the building technology required for the electrification and cooling of computer equipment is crucially important and shapes the design from the inside out, the building shell has also to be considered. High quality design seeks to integrate technical elements for lighting and air exchange, PV elements for power generation, and vertical greening for dust binding, all of which bear witness to the needs of sustainability.

In addition to integrating technology into buildings, consideration of energy resources in the local context is also playing an increasingly decisive role in design. Data centers consume a lot of energy, and this becomes particularly noticeable at a time when growth of the grid is stagnating. Supplying energy from natural or non-fossil sources, optimising and offsetting consumption through selfgenerated electricity or storage of locally generated electricity, and utilising waste heat, are the overarching means of achieving the municipal heating plans and CO_2 reduction targets of cities and municipalities.

Only holistically designed architecture can achieve these goals.

SOURCE: TTSP HWP

OUR SELF-IMAGE AS GENERALISTS

The demands placed on architecture today are high and diverse – and rightly so. Functionality, design, sustainability, contextual relevance and user orientation are integral components of responsible planning.

As planners and consultants, we take this task seriously and fulfil it with passion. We develop buildings that go beyond what is technically necessary. We design places with identity, structure and attitude; buildings that enable processes, serve people and respect the environment.

This is how we succeed in making every project – from the initial idea to implementation – an individual contribution to a responsible digital future.

ALEXANDER HAUSER The CEO, heads up the TTSP HWP group whose companies provide expertise to the data center market. The group's companies provide general planning, project management, building & energy engineering, DC consulting, and a real estate broking services.

GERMAN DATACENTER TALENTS & IMPACT AWARDS

Winners 2025

COMMUNITY ENGAGEMENT AND SOCIAL IMPACT

CyrusOne | „LISTENING TO COMMUNITIES“

The project demonstrates the importance of community engagement in data center operations. CyrusOne launched the “Listening to Communities” initiative to improve public understanding of data centers, their functions, and their societal benefits. In collaboration with the independent research firm Censuswide, over 13,000 people across seven European markets were surveyed, including 2,020 respondents in Germany. The study examined public awareness of data centers, the factors influencing their acceptance, and the perceived benefits or concerns from a community perspective. The results revealed significant knowledge gaps, but also a more positive baseline attitude than expected. At the same time, the research highlighted that understanding the needs of host communities is crucial for building trust, fostering acceptance, and ensuring long-term success. Based on these insights, CyrusOne developed a multilingual, market-specific information campaign featuring localized reports, targeted media outreach, and digital content to inform policymakers, stakeholders, and the public, while initiating concrete actions to support community engagement. The initiative provides practical guidance for operators on building trust, creating local value, and driving sustainable growth, demonstrating that communities are key partners for the long-term success of data centers.

INNOVATION & FUTURE TECHNOLOGIES

ANYOPS | „FIBERBOT – ENABLING ROBOTIC AUTOMATION IN DATA CENTER OPERATIONS“

ANYOPS‘ innovative project demonstrates how robotics can sustainably transform the operation of data centers and POPs. FiberBot is a modular robotic system specifically designed to automate passive infrastructure maintenance. Unlike existing solutions, which operate manually or only partially remotely, FiberBot acts as a “digital technician,” performing tasks such as fiber inspection, cleaning, connector testing, as well as light and power measurements—directly at optical interfaces, around the clock, during live operation, and without on-site presence. A key advantage lies in linking the physical and logical infrastructure layers: integration with Logical Infrastructure Management (LIM) systems enables autonomous workflows. At the same time, connection to orchestration software allows both remote interaction and full automation. This minimizes human intervention while significantly increasing resilience. FiberBot is already deployed in four POPs in Italy, in close collaboration with leading operator Fastweb. The results are measurable: approximately 120 kg less CO_2 per operation, over 70% shorter repair times, and fewer outages due to clean connectors. With four granted patents and a roadmap toward full autonomy, the project highlights how robotics and network technology converge to set new standards in efficiency and operational reliability.

SUSTAINABILITY & GREEN DATA CENTER

FIRSTCOLO | “FRA7 – BLUEPRINT FOR SUSTAINABLE AND COMPETITIVE DATA CENTERS“

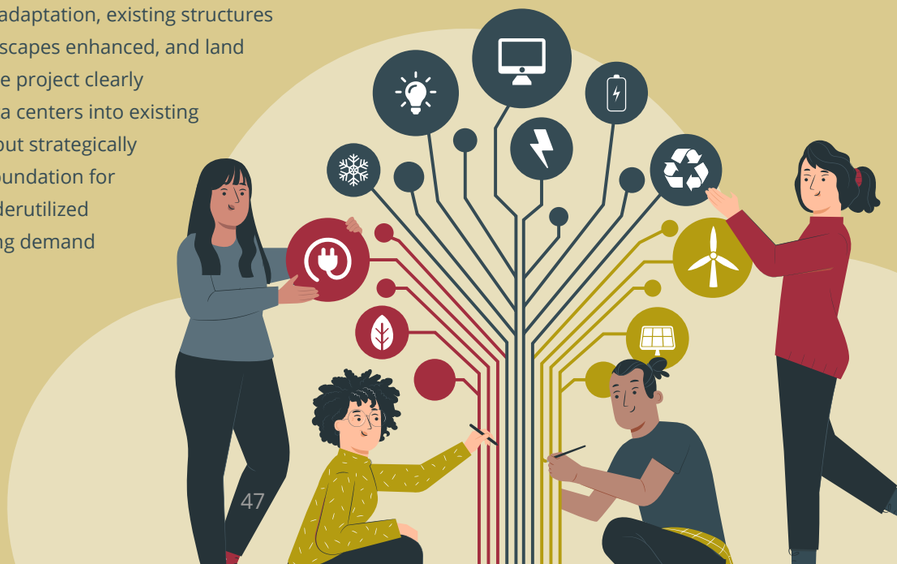
With the construction of FRA7 in Frankfurt, a data center is being created that serves as a blueprint for the next generation of sustainable, high-performance, and competitive infrastructures. FRA7 features 100% high-density racks with liquid cooling, each capable of up to 200 kW, making it the first large-scale data center in Germany to offer fully high-density infrastructure and optimal readiness for artificial intelligence, machine learning, and high-performance computing. Sustainability is consistently implemented: FRA7 operates exclusively on green electricity, achieves a low Power Usage Effectiveness (PUE), and feeds waste heat directly into the city’s district heating network. Resource-efficient construction and innovative water management reduce CO_2 emissions and increase the city’s overall energy efficiency.

FRA7 strengthens the competitiveness of Frankfurt as a digital hub: energy-intensive applications run efficiently and securely, while data sovereignty “Made in Germany” is preserved. AI-driven operational optimization, modular scalability, and seamless integration into urban infrastructure make FRA7 a model project. As a blueprint, the insights gained can be transferred to other locations. FRA7 unites ecological responsibility, technological excellence, and economic viability, setting new standards for the entire industry.

YOUNG TALENTS

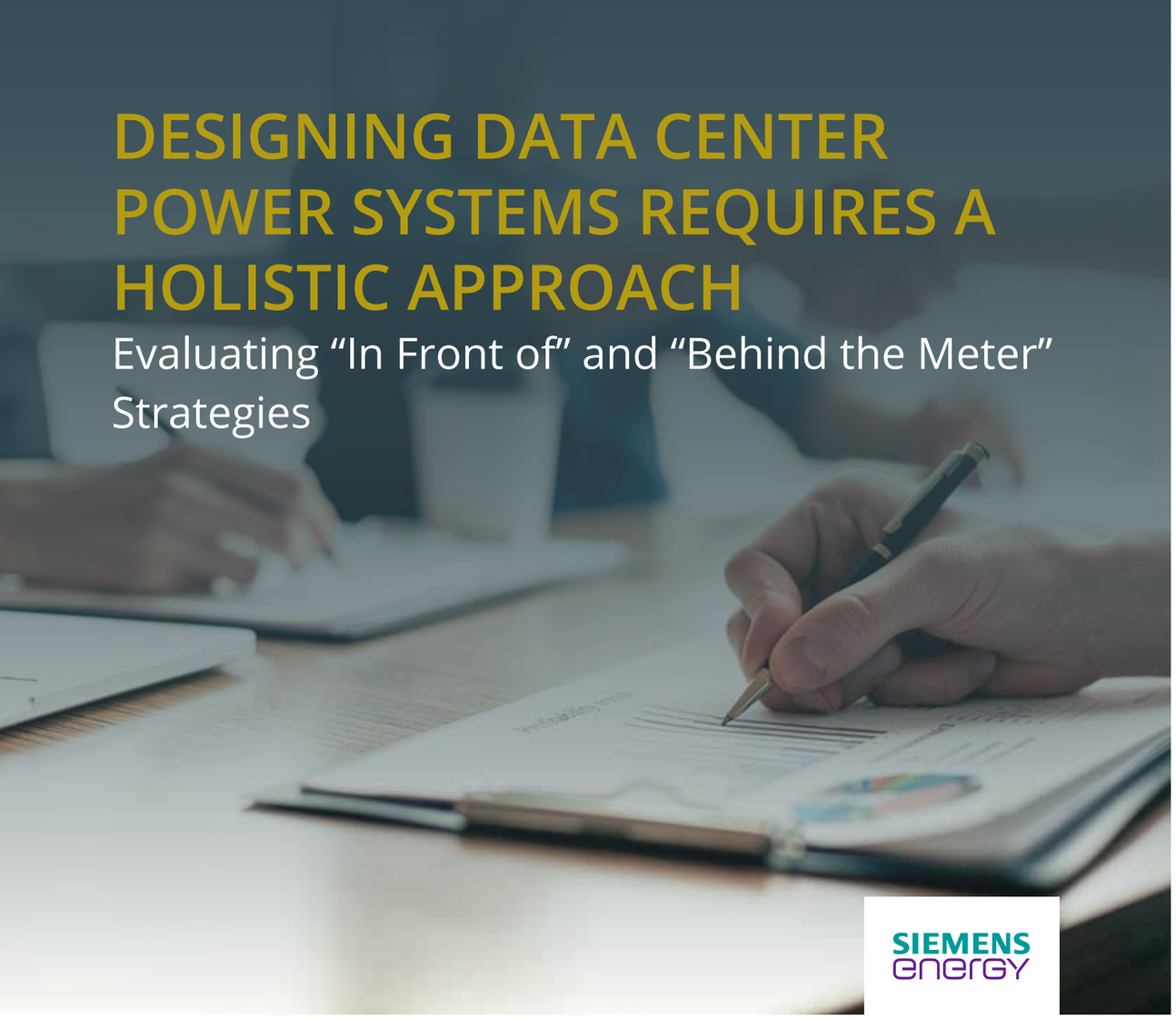
RAPHAEL KESSENER, BERGISCHE UNIVERSITÄT WUPPERTAL | INTEGRATING DATA CENTERS INTO EXISTING BUILDINGS – A CRITERIA CATALOG FOR ASSESSMENT

The increasing demand for data centers is creating a growing land scarcity, particularly in metropolitan areas such as Frankfurt am Main. Traditionally, data centers are developed on “greenfield” sites, while existing buildings are rarely repurposed. In his master’s thesis, Raphael Kessener explores how old warehouses or factories can be adapted as data center shells. The aim is to demonstrate the advantages of reusing existing buildings—cost efficiency, shorter construction times, and sustainability through the preservation of building structures. To achieve this, expert interviews with operators and planners were conducted, and the findings were incorporated into a criteria catalog for assessing potential sites. In addition to regulatory, structural, and safety considerations, location and infrastructural requirements are also evaluated. The results show that existing properties can provide a realistic and efficient alternative to new construction, especially where free land is limited.
With careful assessment and adaptation, existing structures can be revitalized, urban landscapes enhanced, and land use optimized sustainably. The project clearly illustrates that integrating data centers into existing buildings is not only feasible but strategically beneficial, providing a solid foundation for unlocking the potential of underutilized properties to meet the growing demand for data center capacity.



DESIGNING DATA CENTER POWER SYSTEMS REQUIRES A HOLISTIC APPROACH

Evaluating “In Front of” and “Behind the Meter” Strategies



Power availability has become the central challenge for data center developers across the globe. Per the International Energy Agency (IEA), data centers consumed over 400 terawatt-hours (TWh) of electricity in 2024 (around 1.5% of all electricity usage worldwide). Projections are for that figure to more than double by the end of the decade, reaching 945 TWh or more than the entire electricity consumption of Japan.

While the amount of power needed to meet AI data center demand in the coming years is staggering, it is not simply a matter of bringing more generating capacity online. The carbon footprint, cost, and timeline to receive that power, as well as resulting impact on the external grid are critical factors that must also be considered when evaluating options.

Balancing these trade-offs is a complex undertaking that requires a strategic approach and long-term thinking. Designing power systems that are optimized for site-specific conditions, while still allowing for optionality to integrate new technologies and/or energy sources in the future is crucial to ensuring compliance, avoiding obsolescence, and achieving a low total cost of ownership (TCO).

LOOKING “BEHIND THE METER”

Many of today’s large data center projects are targeting ~24 months from conception to operation. However, in certain areas where there is already a high concentration of data centers, fully subscribed transmission lines, long equipment lead times (i.e., for transformers), and a lack of generating capacity are making this timeline infeasible.

With time to power now a priority given rapidly accelerating cloud and AI workloads, an increasing number of developers are considering bringing power generation onsite (i.e., “behind the meter”).

Gas turbines are the logical choice given their high power density, reliability, and emissions profile compared to traditional gas or diesel engines. The availability and price of natural gas is also attractive purely from a cost standpoint.

Additionally, modern gas turbines are designed to handle low- or zero-carbon fuels, like hydrogen and HVO (Hydrotreated Vegetable Oil), which provide a pathway for operators to move towards 100% decarbonized operations in the future.

At Siemens Energy, we are seeing essentially four main use cases for gas turbines in data centers:

1. BASELOAD GENERATION USING SIMPLE OR COMBINED CYCLE POWER.
The carbon intensity of combined cycle plants is often lower than that of many of today’s utilities.

2. PEAK SHAVING SOLUTIONS USING INDUSTRIAL OR AERODERIVATIVE GAS TURBINES.
These are mainly applicable on sites where grid power is insufficient to meet the data center’s demands at all times.

3. ONSITE BACK-UP SYSTEMS TO ENSURE CONTRACTUAL UPTIME OBLIGATIONS ARE MET VIA FAST STARTING AERODERIVATIVE GAS TURBINES.
Some developers are considering using gas turbines as the main source of power until a grid connection is available, after which they can be transitioned to the main back-up source. PEM fuel cells that can operate with hydrogen or methanol are also being explored as a back-up option.

4. ON GRID ADDITIONS IN PARTNERSHIP WITH UTILITIES OR IPPS, which involves the installation of industrial or large-scale gas turbines to increase the capacity of existing power plants.

ENSURING GRID STABILITY

The highly variable power demands associated with AI workloads poses a significant risk to grid stability and data center uptime if not properly addressed¬, regardless of whether electricity is generated onsite or at the utility,

Especially for large grid-connected data centers, utilities require compliance with interconnection standards to prevent frequency and voltage disturbances that can impact other consumers. This often necessitates the use of equipment, such as batteries or static synchronous compensators (STATCOMs or E-STATCOMs), which can provide near instantaneous reactive power support and “ride-through” capabilities, allowing a data center to stay online during short-term faults or frequency dips caused by sudden load changes.

These devices are also relevant for facilities that are connected (or plan to connect) to a dedicated renewable source in the future, such as a solar or wind farm.

Batteries, for example, can smooth out fluctuations in solar output, store excess generation, and enable time-shifting of energy use, whereas STATCOMs help manage voltage instability that can arise from variable generation, especially in islanded or microgrid configurations.

UTILIZING WASTE HEAT

Waste heat utilization is another important focus area that goes hand in hand with designing power systems.

Energy OEMs possess extensive experience in waste heat integration, having implemented these systems for decades in industrial settings and process plants. Data centers can benefit from this expertise by engaging early in the design phase to ensure that equipment is tightly integrated so that the potential for process disruptions and unplanned downtime is minimized.

One potential use case for data centers is combined heat and power (CHP or cogeneration plants), where waste heat from power generation is used to cool water via absorption chillers. In certain locations, it may also be possible to export thermal energy to a local municipality for district heating purposes or to a nearby industrial site, opening the door to an additional revenue stream.

WHY EARLY ENGAGEMENT IS IMPORTANT

While minimizing the time to receive electricity is the top priority for data center projects today, decisions regarding power must be made through the lens that considers emissions, cost, reliability, operational flexibility, etc. In many cases, these requirements are in tension, which means that temporary trade-offs are required.

Ultimately, by embracing a holistic development approach project stakeholders can arrive at a highly flexible and optimized power plant and electrical system that can meet uptime and emissions requirements today and into the future.

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WHY NORTHERN GERMANY'S COASTAL CITIES ARE EMERGING AS PRIME HUBS FOR SMART, SUSTAINABLE DATA CENTERS

Digitalization continues to accelerate across all industries, and with it, the global demand for robust, secure, and environmentally responsible data center infrastructure. While major metropolitan areas such as Frankfurt and Berlin have traditionally dominated the landscape, a new wave of opportunity is rising in northern Germany's coastal cities. Medium-sized towns along the North Sea coast are increasingly being recognized as strategically smart, cost-effective, and sustainable alternatives for future data center investments.

In a market projected to surpass $1 trillion by 2030, this emerging focus on coastal regions is both commercially and strategically advantageous. The rise of AI, cloud computing, and edge technologies is driving unprecedented demand, and secondary cities with strong infra-

Prototype design by Arcadis for one of the world's most sustainable data centers, for Terra Ventures in San Jose, California **SOURCE:** Arcadis

structure and renewable energy access are fast becoming high-value locations.

Here's why these coastal locations should be on every data center operator's radar:

NATURAL COOLING FROM COASTAL CLIMATES

One of the most significant operating costs for data centers is the energy required to cool servers. Northern Germany's coastal region benefits from a temperate, maritime climate, with consistently lower average temperatures and strong, cooling sea breezes. These climatic conditions support energy-efficient cooling solutions such as "free cooling," which uses outside air to regulate server temperatures.

As rack densities rise and cooling becomes more challenging globally, these natural advantages reduce the need for advanced mechanical or liquid cooling. This helps to lower capital expenditure while supporting sustainability goals. The result is lower energy consumption, reduced carbon emissions, and significantly decreased operating costs.

POWERED BY RENEWABLE ENERGY: WIND AND WATER

The North Sea coast is a national leader in renewable energy, particularly wind power. A dense network of onshore and offshore farms provides abundant green electricity, which is an essential asset for data center operators targeting carbon neutrality. Existing infrastructure in the region is already aligned with clean energy sources, enabling faster and easier grid integration for new facilities.

Coastal sites also benefit from access to seawater for innovative cooling. Closed-loop systems and hear exchange technologies can draw cold water from the North Sea or Baltic Sea to support efficient thermal management without relying on energy-intensive chillers. Proven in Nordic regions, these technologies could be similarly effective in northern Germany, particularly where environmental regulations and intake/discharge conditions are carefully managed.

Looking ahead, emerging technologies such as Small Modular Reactors (SMRs) may also offer a complementary route to low-carbon energy security. As energy demands rise and grid resilience becomes critical, interest in SMRs is accelerating, highlighting their potential role in Europe's long-term energy mix.

With Net Zero commitments now central to investor and client decisions, locations with direct access to renewable energy and alternative cooling solutions are increasingly prioritized. Combined with advances in energy-efficient technologies such as modular reactor systems, coastal sites offer a future-proof approach to sustainable data center growth.

UNLOCKING ADDITIONAL VALUE: HEAT RECOVERY AND LOCAL INTEGRATION

As Germany places growing regulatory emphasis on the reuse of waste heat, heat network integration is becoming a critical factor in data center permitting decisions. Fortunately, many northern coastal towns have the infrastructure - or potential - to develop or expand district heating systems that could harness excess thermal energy from data centers.

Waste heat from servers can be captured and redistributed to nearby residential, industrial, or mixed-use developments, delivering real social and environmental value. With many coastal cities pursuing decarbonization at the local level, data centers could play a pivotal role in supporting municipal Net Zero targets. This not only strengthens the case for planning approval but also enhances community engagement, futureproofs development, and improves the return on environmental investment.

In addition, northern German regions offer the possibility of feeding the available waste heat into local greenhouses due to the potential availability of land, as these can reduce the low temperature levels all year round.

COST-EFFECTIVE LAND AND OPERATING CONDITIONS

The race for power, land, and flexibility is reshaping data center footprints. Compared to crowded urban centers, coastal towns in northern Germany offer more affordable real estate, lower utility costs, and fewer logistical constraints. These locations often feature spacious industrial zones with strong transport links and pre-existing infrastructure, making ideal conditions for new construction or phased expansion. Additionally, lower wage levels and the cost of living in these regions can reduce operational expenditures. All of this makes a compelling business case for data center development at scale.

STRATEGIC CONNECTIVITY TO GLOBAL DIGITAL NETWORKS

Despite their relatively remote setting, many coastal cities are well integrated into Germany's national fiber optic backbone and benefit from proximity to landing stations for international submarine cables. This gives operators high-speed, low-latency access to global digital traffic routes, which are essential for applications like cloud services, AI workloads, and edge computing. Network reliability and scalability are supported by ongoing public and private investment in digital infrastructure.

Europe's largest sustainable data center, SINES DC in Portugal, runs on renewables and uses seawater cooling.
SOURCE: Arcadis

POLITICAL SUPPORT AND FUNDING PROGRAMS

Regional and municipal governments in northern Germany are increasingly proactive in supporting digital infrastructure projects. Attractive investment incentives, streamlined permitting processes, and pro-business policies are part of the broader effort to stimulate economic development and digital innovation in less densely populated areas. For data center developers, this means faster time-to-market and lower administrative overheads.

In a sector where speed-to-market is critical, delivering with agility by mobilizing global expertise and local teams can be essential when it comes to meeting tight schedules and evolving regulatory demands.

LOW EXPOSURE TO NATURAL DISASTER RISKS

When it comes to resilience and uptime, physical safety is paramount. Northern Germany's coastal regions are not prone to earthquakes or other major natural disasters, and decades of experience with flood protection and coastal defenses make the risk of storm-related disruption exceptionally low. For mission-critical infrastructure that demands high availability, this adds an additional layer of long-term operational reliability and security.

COASTAL NORTHERN GERMANY: THE SMART CHOICE FOR THE DIGITAL AGE

The North Sea coastal region of northern Germany offers an exceptionally balanced combination of climate, sustainability, affordability, and infrastructure readiness. These underappreciated locations present a compelling alternative to the overcrowded and increasingly expensive metropolitan hubs.

With the European data center construction market expected to grow at over 13% CAGR, and Germany forecast to double its market size by 2029, these regions are poised to play a significant role in Europe's digital infrastructure evolution.

For companies looking to future-proof their digital operations, the message is clear. The North Sea coast offers more than just a viable alternative location; it could signal a strategic advantage. As demand for sustainable and scalable data centers grows, these coastal cities offer a compelling solution: cooler, greener, and built for the digital future.

CHRISTIAN GOLDSMITH is Arcadis' Global Data Center Solutions Lead, bringing over 20 years of leadership experience in data center consultancy and major infrastructure projects. He has delivered complex, high-value programs across Europe, focusing on sustainable and innovative solutions. Christian is dedicated to shaping the future of data center infrastructure, with an emphasis on ESG principles and design innovation.

ENHANCING DATA CENTER EFFICIENCY

Improving Power Usage Effectiveness (PUE) with trigeneration in 24/7 operation

JENBACHER | INNIO

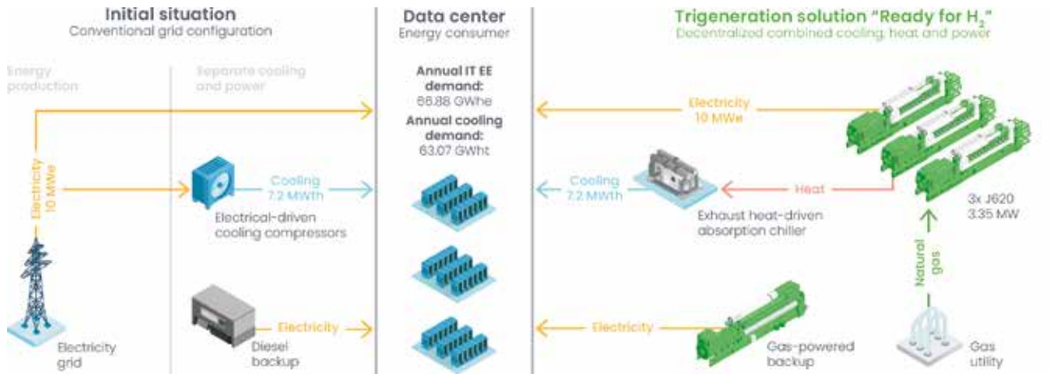
INDUSTRY NEEDS

Data centers have unique energy demands, particularly in terms of cooling, which constitutes a significant portion of their overall energy consumption. Implementing a highly reliable trigeneration solution can optimize this energy use by simultaneously producing cooling, heating, and power (CCHP).

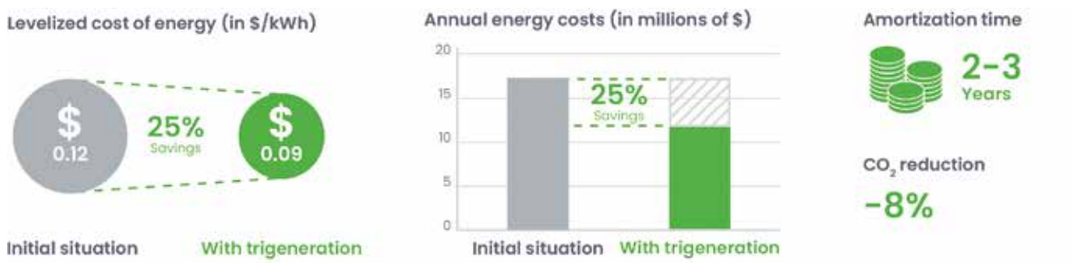
This integrated approach not only enhances energy efficiency but also contributes to a lower Power Usage Effectiveness (PUE), a critical metric for evaluating data center efficiency. PUE is calculated as the ratio of the total energy used by the data center to the energy consumed by its Information Technology (IT) equipment. The following use case provides insights into the technical, financial, and environmental benefits of adopting a trigeneration system for a 10 MW data center.

BUSINESS CASE SIMULATION[1]

The exemplary business case presented is a simulation performed using dedicated data center simulation software. This business case is illustrative only, and projects need to be evaluated on a case-by-case basis.



BUSINESS CASE SIMULATION AT A GLANCE



ASSUMPTIONS: Electrical Energy (EE) grid price: 0.183 USD/kWh. Natural gas price: 0.065 USD/kWh. Backup system not included. European EE grid average CO2 emission.

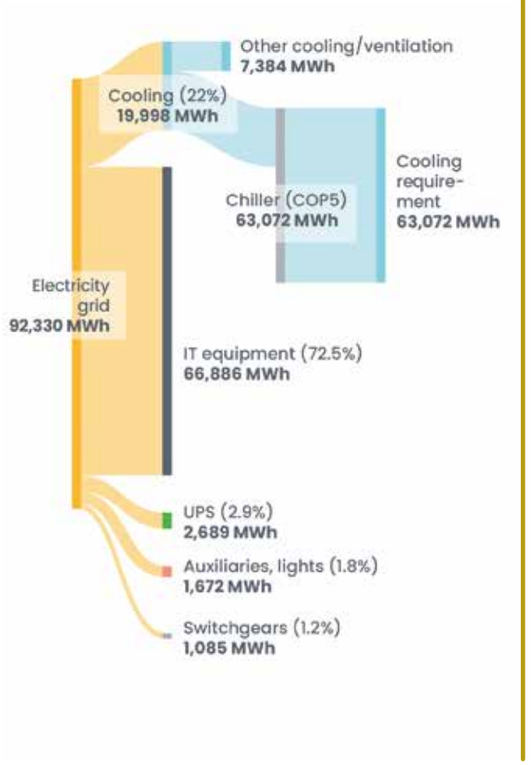
[1]Legal disclaimer: The information provided herein is based on assumptions and may vary on individual circumstances. It is intended for illustrative purposes only and shall not constitute legal or tax advice. No part of this information shall be construed or interpreted as a representation or warranty by INNIO. INNIO expressly excludes any liability arising from the use or interpretation of the information provided.

ENHANCING DATA CENTER EFFICIENCY WITH A 24/7 TRIGENERATION SOLUTIONS TO ACHIEVE IMPROVED POWER USAGE EFFECTIVENESS (PUE)

CONVENTIONAL GRID CONFIGURATION

10 MW grid capacity data center with PUE = 1.38, based on energy consumption. Full year energy consumption, with electricity purchase from the grid (energy in MWh).

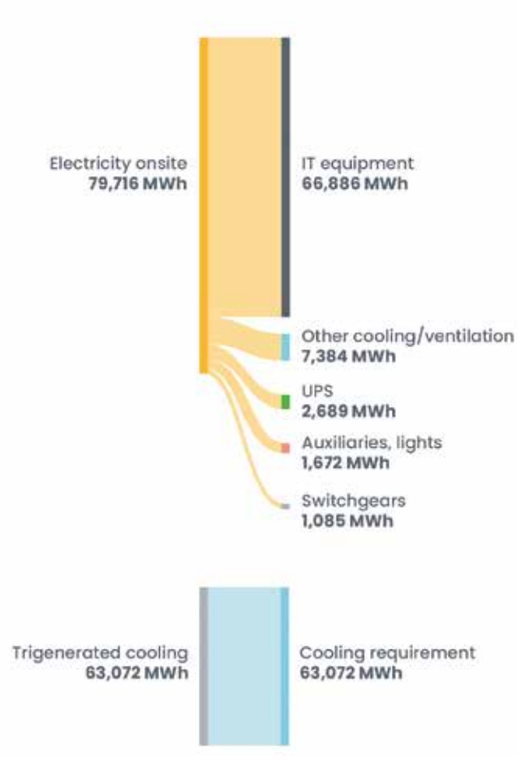
10 MW

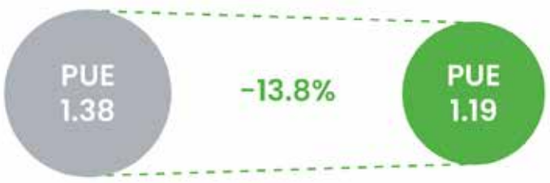


TRIGENERATION CONFIGURATION

Same data center with PUE = 1.19, based on energy consumption. No grid integration, with trigeneration from three Jenbacher J620 engines. Full year energy consumption (energy in MWh).

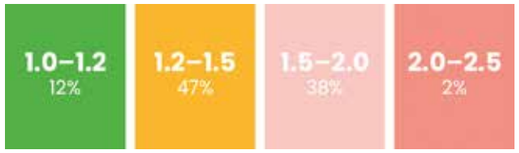
3 X J620, 10 MW

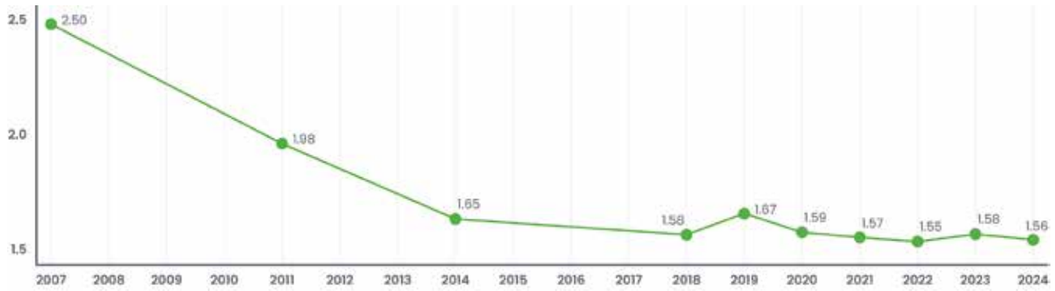




POWER USAGE EFFECTIVENESS (PUE)

The PUE measures the energy efficiency of a data center. The ideal PUE is 1.0, indicating perfect efficiency. The industry average PUE has remained around 1.58 since 2020, although an increase in innovative IT and facility designs has helped reduce average PUE over time.





SOURCE: Uptime Institute Global Data Center Survey 2024

BENEFITS OF JENBACHER TRIGENERATION SOLUTIONS FOR THE DATA CENTER INDUSTRY

COOLING EFFICIENCY

Cooling typically accounts for 20–40% of power usage in data centers, making it a critical area for efficiency improvements with trigeneration systems, which usually combine a gas engine with heat recovery and an absorption chiller for cooling.

ENERGY COST SAVINGS

Trigeneration helps reduce energy consumption by effectively managing heat dissipation. Jenbacher simulation showed nearly 25% annual energy cost savings with trigeneration compared with the conventional grid configuration.

EMISSION REDUCTIONS

Our simulation shows 8% CO_2 reduction when a trigeneration system is installed compared with just using grid electricity.

"READY FOR H_2"

Jenbacher power solutions can accept an increasing blend of renewable fuels such as hydrogen, ammonia, or biogas, with the aim of eventually running on 100% renewable fuel as supply chains develop. Jenbacher "Ready for H_2" and H_2-Engines offer a strategic advantage, aligning with the growing trend of sustainable data center operations.

TRIGENERATION POLICY SUPPORT

EUROPEAN UNION

Article 12 of the Energy Efficiency Directive (EED) requires data center operators to monitor and report on their energy performance.

Under delegated regulation (EU) 2024/1364, adopted in March 2024, data center operators are obligated to report key performance indicators (KPIs) to the European database on a yearly basis. These include energy consumption, power utilization, temperature set points, waste heat utilization, water usage, and use of renewable energy.

European Code of Conduct for Data Centers (EU DC CoC), launched in 2008, is a voluntary initiative set to encourage and guide data center operators and owners in cost- effective reductions in energy consumption.

GERMANY

Energy Efficiency Act mandates waste heat recovery in data centers and has set a target of 10% heat reuse in data center operations by 2026 and 20% by 2028.

INNIO Group offers a variety of Jenbacher solutions based on individual data center needs. Depending on the data center's operating system, the appropriate configuration is selected—from continuous to hybrid to backup power solutions.

DR. UWE BRAUN is Business Development Manager for INNIO Group's Jenbacher technology. Since 2019, he has focused on delivering resilient on-site power generation for data centers' prime, backup, and peaking needs.

Furthermore, he is responsible for the sales of large CHP (combined heat and power) projects with typically 50 MW for public utilities and industries.

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RITTAL

Rittal is a leading global systems supplier for hardware, software and automation. Rittal solutions for industrial, IT, energy, power and cooling applications are used in over 90% of global industries. The group of companies is a pioneer of AI-driven industrial automation, driving AI in industrial software and enabling capable IT-infrastructure. Founded in 1961, Rittal is the largest company in the family-run Friedhelm Loh Group. The group operates worldwide, with 13 production sites and 95 international subsidiaries. It has 12,600 employees and posted revenues of 3.1 billion euros in fiscal 2024.

WWW.RITTAL.COM

TTSP HWP

TTSP HWP plans integrated data centers for international customers, advises on their design, and oversees their implementation. The Frankfurt-based consulting firm has been involved in over 40 data center projects across Germany and has provided general planning services to DCs with a total IT capacity of over 2 GW. TTSP HWP advises most of the global players in the data center sector on their planned locations. Its services range from initial site assessment and investor consulting to planning, permitting, tendering, construction supervision, and handover of the operational facilities.

WWW.TTSP-HWP.DE

CBRE

As the world's largest data center real estate practice, CBRE Data Center Solutions provides the strategies, insights and end-to end services needed to optimize data center solutions from inception through disposition. With an unparalleled understanding of the market, CBRE leverages its extensive global footprint and deep industry expertise to deliver tailored solutions that meet the unique needs of clients across the globe. The Data Centre Solutions team has covered the market for over 25 years, amassing unparalleled expertise in this distinctive asset class.

WWW.CBRE.COM

EATON
Powering Business Worldwide

Eaton is an intelligent power management company dedicated to improving the quality of life and protecting the environment for people everywhere. The company is guided by its commitment to do business right, to operate sustainably and to help customers manage power – today and well into the future. By capitalising on the global growth trends of electrification and digitalisation, the company is accelerating the planet's transition to renewable energy, helping to solve the world's most urgent power management challenges. Eaton reported revenues of $24.9 billion in 2024 and serves customers in more than 140 countries.

WWW.EATON.COM

NTC
NOTSTROM
TECHNIK CLASEN

Notstromtechnik-Clasen GmbH (NTC) has been a leading system integrator in the field of emergency power design and installation for almost 30 years. As a manufacturer-independent company, we specialise in integrating tailor-made emergency power solutions into existing infrastructures and implementing complete supply systems according to individual customer requirements and legal and infrastructural specifications. Our many years of experience range from early server room installations in the late 1990s to state-of-the-art data centers of all sizes – including projects with a capacity of up to 300 MW. A key factor in our success is the manufacturer-independent consulting, planning, implementation and support we provide for our customers' power supply solutions. NTC develops tailor-made concepts that are precisely tailored to the technical, economic and operational requirements of our customers – regardless of whether existing systems are being expanded or new systems are being built from scratch.

WWW.NTC-GMBH.COM

Global Data Centers, a division of NTT Ltd., operates a global platform spanning more than 20 countries and regions, including North America, Europe, Africa, India and APAC. In the EMEA region, NTT currently operates 18 data centers with 160,000 m² of mission-critical data center space and a further 100,000 m² under development. Nine of these data centers are located in Germany. As a neutral operator, NTT provides access to many cloud providers, internet exchanges and telecommunications network providers, including its own IPv6-compliant, global Tier 1 IP network.

SERVICES.GLOBAL.NTT

The Hamburg-based company STULZ is one of the world's leading suppliers of air conditioning technology. For over 40 years, the company has been developing air-conditioning technology at the highest level: whether data center, industrial application or communication technology, the company offers tailor-made cooling solutions with highest precision and energy efficiency worldwide and from one single source. STULZ products also make a significant contribution to efficient and environmentally friendly data center operation: the company is one of the leading manufacturers of particularly energy-saving cooling and air conditioning technologies.

WWW.STULZ.COM

Arcadis is a leading global partner, delivering transformative projects with businesses, cities, and industries. With 36,000 people in 30+ countries, we bring together the best minds to deliver intelligent solutions across environment, energy, water, buildings, transport and infrastructure.

We provide design, engineering, and consultancy services for data center providers, financial institutions, and asset owners, including hyperscale, co-location, and investor clients. We support every stage of a project, from advisory and site selection to planning, permitting, construction, and operations – helping clients reduce risk and ensure long-term performance.

WWW.ARCADIS.COM

CyrusOne is a leading global data center owner, developer and operator, delivering sophisticated digital infrastructure solutions worldwide. Headquartered in Dallas, Texas, the company operates over 55 data centers across the United States, Europe, and Japan. Specializing in comprehensive solutions for hyperscale and enterprise companies, CyrusOne enables customers to align with their unique business and sustainability goals, catering to the complex needs of AI-driven applications and services workloads. CyrusOne's data centers offer unparalleled flexibility, enabling customers to modernize, simplify, and rapidly respond to changing demands. CyrusOne delivers tailored build-to-suit, colocation, and interconnection solutions that meet the evolving digital needs of its customers. For more information, please visit cyrusone.com.

WWW.CYRUSONE.COM

INNIO Group is a leading energy solution and service provider that empowers industries and communities to make sustainable energy work today. With its Jenbacher and Waukesha product brands and its AI-powered myplant digital platform, INNIO Group offers innovative solutions for the power generation and compression segments that help industries and communities generate and manage energy sustainably. With its flexible, scalable, and resilient energy solutions and services, INNIO Group enables its customers to manage the energy transition along the energy value chain. INNIO Group is headquartered in Jenbach (Austria), with other primary operations in Waukesha (Wisconsin, U.S.) and Welland (Ontario, Canada).

WWW.INNIO.COM

Siemens Energy is one of the world's leading energy technology companies.

The company works with its customers and partners on energy systems for the future, thus supporting the transition to a more sustainable world. With its portfolio of products, solutions and services, Siemens Energy covers almost the entire energy value chain – from power generation and transmission to storage. The portfolio includes conventional and renewable energy technology, such as gas and steam turbines, heat pumps, hybrid power plants operated with hydrogen, and power generators and transformers. Its wind power subsidiary Siemens Gamesa Renewable Energy (SGRE) makes Siemens Energy a global market leader for renewable energies. An estimated one-sixth of the electricity generated worldwide is based on technologies from Siemens Energy. Siemens Energy employs around 96,000 people worldwide in more than 90 countries and generated revenue of €31 billion in fiscal year 2023.

WWW.SIEMENS-ENERGY.COM

ABOUT GDA

GERMAN DATACENTER CONFERENCE (GDACon)

The German Datacenter Conference (GDACon) is the annual networking and strategy conference of the German Datacenter Association.

Since its first edition in 2022, GDACon has been setting trends for digital infrastructure in Germany with high-calibre expert presentations and interdisciplinary panel discussions. In addition, the conference offers all players in the data center ecosystem a platform to network and exchange ideas with renowned experts and new faces in the German and European market.

GERMAN DATACENTER ASSOCIATION

The German Datacenter Association (GDA) unites all players in Germany's digital infrastructure value chain. GDA's more than 250 members include companies from across the data center ecosystem, including the majority of operators and owners of data centers of all sizes. This network of expert companies promotes synergies across traditional industry boundaries.

Founded in Frankfurt am Main in 2018, the GDA offers data center operators in Germany a platform to jointly promote the growth of the industry.

The association's goal is to sustainably improve the framework conditions for the operation of data centers in Germany, strengthen the industry's public image and increase the attractiveness of German locations for investors.

INTERESTED IN BECOMING A MEMBER OF GDA OR PARTNER OF THE GERMAN DATACENTER CONFERENCE 2026? CONTACT US VIA OFFICE@GERMANDATACENTERS.COM

ANNA KLAFT
Chairwoman
klaft@germandatacenters.com

MARTIN KOHOUTEK
General Secretary
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GERMAN DATACENTER ASSOCIATION

EVENTS IN 2025

OCTOBER
22.10.2025 **GDA NET[T]WORK LUNCH @ RITTAL** | Frankfurt

NOVEMBER
07.11.2025 **OPEN DATA CENTER DAY (TAG DER OFFENEN RECHENZENTREN – TDORZ)** | Nationwide
19.11.2025 **GDA INNOVATION DAY @ SOCOMEC** | Benfeld

EVENTS IN 2026

JANUARY
27.01.2026 **POLITICAL NEW YEAR'S RECEPTION** | Berlin

FEBRUARY
03.-04.02.2026 **KICKSTART EUROPE** | Amsterdam

MARCH
04.-05.03.2026 **TECHSHOW** | Data Centre World London
25.-26.03.2026 **GDA GOES FIBERDAYS** | Frankfurt
25.-26.03.2026 **DATACLOUD ESG & ENERGY** | Brussels

MAY
06.-07.05.2026 **GDA GOES TECHSHOW** | Data Centre World Frankfurt

JUNE
02.-04.06.2026 **DATACLOUD GLOBAL** | Cannes
30.06.-01.07.2026 **GITEX EUROPE** | Berlin

SEPTEMBER
GERMAN DATACENTER CONFERENCE

NOVEMBER
OPEN DATA CENTER DAY (TAG DER OFFENEN RECHENZENTREN – TDORZ) | Nationwide

GERMAN
DATACENTER
CONFERENCE

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