HELMUT KOHL
Management GmbH

Market, Infrastructure and Investment Study

Data Centers in Germany

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This study takes a hard look at Germany's data center market — how it's structured, where capital is flowing, what it costs to power, how regulators are intervening, and where it's headed. We focus on the three forces reshaping the industry today: AI workloads, hyperscaler buildouts, and the Energy Efficiency Act, with 3-, 5-, and 10-year forecasts. Sources include Bitkom/Borderstep 2025, the federal government's National Data Center Strategy of March 2026, BMWE/EnEfG materials, and analyses from leading research firms.

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1 Executive Summary

The German data center market reached a historic turning point in 2026. With more than 3,000 megawatts of installed IT connected load for the first time – an approximate nine percent increase compared to 2024 – Germany has further consolidated its position as Europe's leading data center location. Behind this growth lie around 2,000 data centers each with more than 100 kilowatts of connected load, of which roughly 100 large facilities exceed 5 megawatts. Frankfurt am Main remains by far the most important location and hosts more than a third of all German capacity by itself.

AI is what's pulling the market forward. HPC and AI workloads account for roughly 15% of Germany's total installed capacity today — about 450 MW out of 2,980 MW. Bitkom and Borderstep expect that share to hit 40% by 2030, which works out to roughly 2,000 MW of a projected 5,000 MW total. Power demand has tracked this growth: from 10.5 TWh in 2010 to 21.3 TWh in 2025, with dena projecting over 30 TWh by 2030 and around 80 TWh by 2045.

The hyperscalers — chiefly AWS, Microsoft, and Google — have lined up tens of billions of euros for the next few years. AWS is putting €8.8 billion into the Frankfurt region plus another €7.8 billion into its European Sovereign Cloud in Brandenburg. Microsoft is building €3.2 billion worth of facilities in the Rhineland mining region. Google has committed €5.5 billion for 2026–2029. All together, Bitkom estimates around €12 billion went into IT hardware in 2025, with another €3.5 billion into buildings and building services — an all time high.

Despite the momentum, Germany faces substantial challenges as a location. Power prices are among the highest of any major data center market. In individual cases permits can take up to seven years. And Tennet says there's hardly a free switchgear bay left for new connections to the 380 kV grid. The tighter rules in the Energy Efficiency Act (EnEfG), in effect since November 2023, were eased slightly in an early-2026 draft amendment — the PUE ceiling for new builds moved from 1.2 to 1.3 — but they still remain more demanding in comparison to the EU. And on the global stage, Germany remains a distant follower behind the United States.

On 18 March 2026, the federal cabinet adopted Germany's first National Data Center Strategy. The goal: to at least double overall capacity by 2030 and quadruple AI and HPC compute. The strategy sets out 28 concrete measures across three areas — energy and sustainability, sites and land, and technology and sovereignty. The federal infrastructure fund has earmarked €805 million as Germany's contribution to one of up to five European AI gigafactories, with site selection due in the summer of 2026.

This report maps the market, traces the dominant trends, names the obstacles, and lays out a detailed forecast. The throughline: how technology, regulation, the energy transition, and global competition are pulling against — and shaping — each other.

Key figures 2026 at a glance

Indicator	Status 2025	Forecast 2030
Number of data centers > 100 kW	approx. 2,000	approx. 2,300–2,500
Total IT connected load (MW)	**2,980**	**5,000–6,000[1]**
of which AI / HPC capacity (MW)	approx. 450	approx. 2,020
AI share of total capacity	15 %[2]	40 %
Energy consumption (TWh/year)	21.3	> 30
IT-hardware investment 2025 (€bn)	12.0	>18
Building / BMS investment 2025 (€bn)	3.5	>6
Derived ICT-hardware capital stock (€bn)	180[3]	>360[3]
Derived building / BMS capital stock (€bn)	45[3]	>90[3]
Share of renewable energy (electricity)	> 65 % (book-basis)	100 % (legal requirement)

Table 1: Key figures of the German data center market — current state and outlook. Source: Bitkom/Borderstep 2025; own calculations.1

[1] **Federal government conservative estimate.**

[2] **Percentages follow Bitkom/Borderstep; absolute MW values back-derived from total capacity.**

[3] **Our own rough estimate — not to be confused with annual CapEx. Assumes €0.015 billion in building/MEP per installed MW, with an ICT-to-building/MEP ratio of about 4:1.**

2 Introduction and Objectives

2.1 The role of data centers in the economy and society

Data centers are the physical backbone of the digital economy. Without the concentration of the server, storage and network capacity, modern applications such as cloud computing, streaming, e-commerce, autonomous driving, industrial automation and above all artificial intelligence would be unthinkable. While telecommunications networks form the data highways of the digital world, data centers are its junctions and production sites – Federal Minister for Digital Affairs Karsten Wildberger described them in April 2026 in front of the German Bundestag as the “new refineries” of an economy in which computing power has become a strategic raw material.

With advancing digitalization, and especially with the broad industrial use of artificial intelligence, the economic and political importance of data centers has changed markedly in recent years. They are no longer merely an infrastructure topic for the IT industry, but a first-order issue of location and sovereignty. Those who operate powerful in-house data centers retain control over the data processed in them, can develop and train AI models to their own standards, and are not dependent on foreign cloud providers that themselves are subject to the laws and possibly the political influence of their home countries.

The German economy benefits in several ways from the presence of strong data center locations. First, they form the basis for a competitive business location whose industry depends on data-intensive applications such as the Industrial Internet of Things, digital twins and predictive maintenance. Second, they themselves generate substantial value added through investments in construction, technical equipment and operations. AWS alone expects that its investments in Germany will generate €15.4 billion of additional GDP and support 15,200 jobs annually at local businesses. Third, they are a key lever for achieving climate targets, since efficient cloud- and AI-based applications in many sectors – transport, buildings, industrial manufacturing – enable CO_2 savings many times greater than their own energy consumption.

2.2 Objectives and research questions

This study sets out to give a comprehensive, data-driven view of where Germany's data center market stands in 2026 — and where it's headed. Six questions frame the work:

- How is the German data center market structured, which market segments and players dominate it, and how is capacity distributed geographically?
- What is Germany's position in international comparison, and what strengths and weaknesses characterize the location relative to the USA, China and competing European hubs?
- Which technological trends – particularly in high-performance cooling, power supply and AI accelerators – will shape the market in the years ahead?
- How do the regulatory framework conditions, in particular the Energy Efficiency Act and the National Data Center Strategy, affect investment and innovation dynamics?
- Which risks and challenges could jeopardize the forecast growth – from grid connection and skills shortages to public acceptance?
- What concrete recommendations can be derived for policymakers, businesses and public administration in order to secure Germany's competitiveness as a location over the next ten years?

2.3 Structure of the study

The study is organized in fourteen chapters. Chapter 3 sets out the methodology and sources. Chapter 4 lays out the headline numbers — count, capacity, revenue, growth. Chapters 5 through 7 cover where the data centers are, what's being invested, and what's being built. Chapters 8 through 10 dig into the cross-cutting issues: energy and sustainability, the regulatory framework, and AI. Chapters 11 and 12 turn to the challenges and to how Germany stacks up internationally. Chapters 13 through 15 close with the forecast, recommendations for action, and our conclusions.

3 Methodology and Data Basis

The data and analyses used in this study rest on a systematic evaluation of primary and secondary sources. The principal source for the quantitative market description is the annually updated Bitkom study “Data Centers in Germany”, prepared by the Borderstep Institute for Innovation and Sustainability. The underlying methodology combines a full survey of large data centers with a statistical extrapolation model for smaller facilities and with primary interviews of operators and industry experts.

Official sources include the National Data Center Strategy (adopted by the federal cabinet on 18 March 2026) and the April 2026 BMWE draft amendment to the Energy Efficiency Act. We also drew on dena data, German Datacenter Association (GDA) publications, and market analyses from Cushman & Wakefield, JLL, and CBRE. International benchmarks come from Synergy Research Group, the Uptime Institute, the IEA, and the relevant national industry associations.

Investment figures come straight from the operators' press releases — particularly AWS, Microsoft, and Google — together with investor decks and state economic development reports. For the regional breakdown, we cross-checked against Cloudscene, datacentermap.com, and the eco association's directory.

The forward-looking statements in this study are explicitly to be understood as forecasts or scenarios and are based on the growth drivers, investment announcements and policy settings currently visible. Structural breaks – for example a sudden slowdown in the AI boom, geopolitical upheaval or regulatory interventions – may cause developments to deviate from those described here. The quantitative forecasts are therefore generally expressed as corridors with a lower and an upper bound.

4 Market Overview: Data Centers in Germany 2026

4.1 Number, size and IT connected load

At the beginning of 2026 the German data center market is comprised of around 2,000 data centers each with an IT connected load of more than 100 kilowatts. In addition, there are about 50,000 smaller IT installations below this threshold which contribute little individually, but in aggregate represent a relevant load. Within the group of larger facilities, concentration is pronounced: around 100 large data centers each with more than 5 megawatts of connected load account for about half of the total installed load of 2,980 megawatts in 2025. In early 2026 the symbolically important 3,000-megawatt threshold has been crossed for the first time.

Compared with the previous year, installed load grew by around nine percent, or 250 megawatts, in 2025. Thus growth momentum from recent years continues unbroken even in the current phase of tighter regulatory requirements and rising energy costs. The composition of the growth drivers has shifted, however: while during the 2010s classical cloud computing dominated the build-out, since 2023/2024 a growing share has come from the AI segment, which now accounts for around 15 percent of installed load.

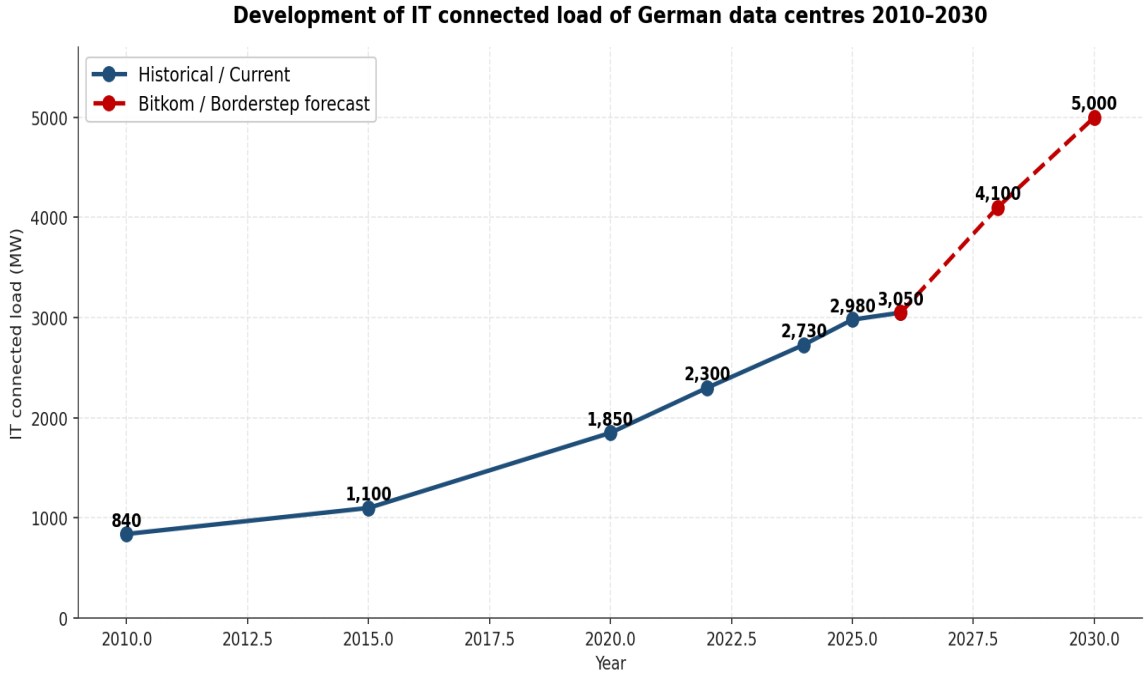


Figure 1: Development of IT connected load of German data centers 2010–2030 (in MW). Source: Bitkom study "Data Centers in Germany 2025" (Borderstep Institute), own representation1

4.1.1 Classification and market segments

The market can be segmented in several dimensions. By deployment model, a distinction is made between enterprise or on-premises data centers (operated in-house by companies for their own applications), colocation data centers (renting rack space, power and cooling to multiple customers) and cloud data centers (providing scalable IT resources). Added to those are AI data centers, which depending on the business model may be organized as specialized cloud, colocation or in-house facilities, as well as edge data centers, typically with less than 5 MW of capacity and in close proximity to the end user.

Cloud and hyperscale sites now dominate the mix. Their capacity grew by around 150% between 2016 and 2021, while classical enterprise data centers remained largely stagnant. Cloud installations account for roughly 49% of German capacity in 2025, and Bitkom/Borderstep puts colocation above 50% — the two overlap, since hyperscalers in Germany tend to lease colocation space rather than build their own shells.

Market structure by analytical categories (partly overlapping)

Market segment	Share of capacity (MW, 2025)	Growth p.a. 2022–2025	Example providers
Cloud installations	approx. 49 % (1,450 MW)	approx. 16.5 %	AWS, Microsoft, Google, Oracle, IBM
Colocation data centers (incl. cloud usage)	> 50 % of capacity (overlapping with cloud)	approx. 14 %	Equinix, Digital Realty/Interxion, NTT, Cloud HQ
On-premises / Enterprise + traditional	declining share; together with edge > 1/3	approx. 1 %	DAX / MDAX corporations, banks, insurers
HPC / AI workloads	approx. 15 % of total capacity	approx. 30 %	FZ Jülich (JUPITER), HLRS Stuttgart, LRZ Garching
Edge & smaller installations	approx. 8 % edge; smaller IT installations in addition	approx. 18 %	Telecommunications providers, industry, mobile networks

Table 2: Market structure of the German data center market by provider category (estimate). Source: Own calculation based on Bitkom/Borderstep, Synergy Research, Cushman & Wakefield2

4.2 Growth drivers

In 2026 also, market growth is being driven by a bundle of mutually reinforcing factors. The dominant driver is now artificial intelligence, whose training and inference models require substantial – and exponentially growing over the past three years – amounts of specialized computing power. Added to this is the ongoing migration to the cloud, fueled by the consolidation of decentralized IT landscapes, the modernization of legacy systems and the increasing spread of software-as-a-service models.

On the demand side, further structural factors contribute to growth. The increasing digitalization of public administration under the so-called Deutschland-Stack, the demand for digital sovereignty and the related repatriation of sensitive workloads from non-European clouds, regulatory requirements such as DORA for the financial sector, and the digital transformation of industrial value chains form a robust foundation for market momentum. The spread of streaming services, gaming and especially generative AI applications for end consumers likewise generates a continuous increase in load.

Demand is refelected most starkly in the vacancy rates. Bitkom/Borderstep, citing CBRE 2025, puts Frankfurt/Rhine-Main at just 3% vacancy — the lowest of any leading European location. The result is as expected: rising prices, waiting lists, and the Frankfurt cluster spilling outward into Rhine-Main, Rhine-Neckar, and southern Hesse.

4.3 Revenue, value added and employment

The numbers underscore the sector's economic significance. Bitkom estimates IT hardware investment hit roughly €12 billion in 2025, with another €3.5 billion going into buildings and MEP — a record and exceeding the prior-year value by roughly 18% . The broader German cloud market accounts for around €20 billion in 2026, a growth of 17% compared to 2025.

Direct employment in German data centers is estimated at around 130,000 full-time equivalents. Including upstream and downstream sectors – construction firms, equipment manufacturers, electricity utilities, IT services, consulting and maintenance companies – the employment effect rises to an order of magnitude of 250,000 to 300,000 people. Direct and indirect gross value added of the sector is estimated at €30 to 35 billion per year.

5 Geographic distribution and regional clusters

5.1 Federal states compared

The distribution of data center capacity above 40 MW is heavily concentrated geographically. Hesse — anchored by Frankfurt/Rhine-Main metropolitan region — accounts for more than a third of all installed capacity, with a clear lead over Bavaria, North Rhine-Westphalia, and Baden-Württemberg. On a per-capita basis, Hesse runs roughly five times denser than the other large area states, and about three times denser than Hamburg and Berlin.

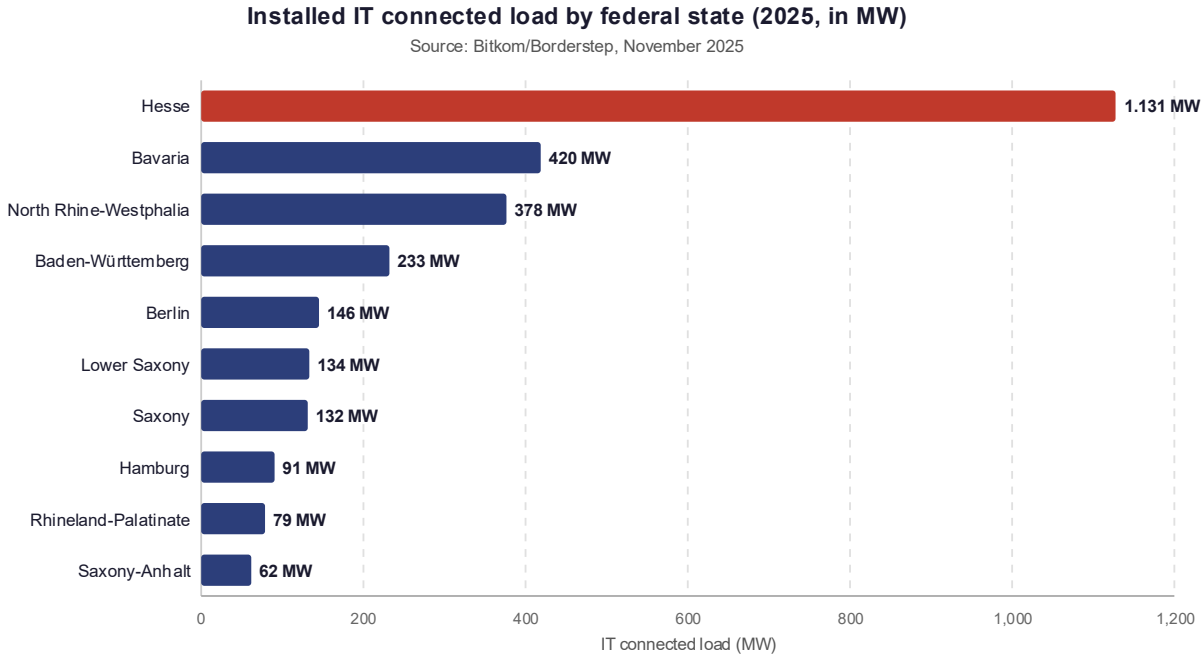


Figure 2: Installed IT connected load by federal state 2025 (in MW). Source: Bitkom study "Data Centers in Germany 2025" (Borderstep), own representation2

Detailed data on the top 10 federal states

Federal state	MW (2025)	Share DE	Growth p.a.	Location characteristics
Hesse	**1,131**	**38 %**	**approx. 14 %**	DE-CIX, financial center, DC cluster
Bavaria	420	14 %	approx. 10 %	Industry, Munich, LRZ Garching
North Rhine-Westphalia	378	13 %	approx. 12 %	Rhenish mining district, FZ Jülich
Baden-Württemberg	233	8 %	approx. 8 %	Stuttgart HLRS, industry, research
Berlin	146	5 %	approx. 18 %	Start-up scene, public administration, gateway to the East
Lower Saxony	134	5 %	approx. 12 %	Wind power, large land area
Saxony	132	4 %	approx. 10 %	Silicon Saxony, TSMC semiconductor cluster
Hamburg	91	3 %	approx. 9 %	Subsea cable landing, logistics, media
Rhineland-Palatinate	79	3 %	approx. 22 %	480 MW project Nierstein, Mainz
Saxony-Anhalt	62	2 %	approx. 22 %	T-Systems Twin-Core, cloud / high-security DC ecosystem

Table 3: Top-10 federal states by installed IT connected load 2025. Source: Bitkom/Borderstep, own calculations.3

5.2 Frankfurt: Europe's leading location

The Frankfurt/Rhine-Main metropolitan region forms by far the most important data center cluster in Germany and is at the same time the largest location in all of Europe. More than 100 commercial data centers are operated here by international providers such as NTT, Equinix, Digital Realty (Interxion), Telehouse, Global Switch, Cloud HQ and numerous specialized operators. Installed capacity exceeds 1,131 megawatts – more than a third of all German data center capacity is thus concentrated within a radius of around 50 kilometers of Frankfurt Airport.

Frankfurt's pull rests on a dense web of locational advantages. At its core sits DE-CIX — one of the largest internet exchanges in the world, with a record 18.73 Tbps of peak traffic in 2025 — which makes the city Europe's central data hub. Add the proximity to one of Europe's biggest financial centers (with all its latency-sensitive workloads), a mature ecosystem of utilities, specialized contractors, and service partners, historically strong grid supply (now reaching its limits for large new projects), and a central European location.

Frankfurt is growing at roughly 14% a year — faster than any other major European hub — while running at just 3% vacancy. This high utilisation produces a squeeze-out effect: new large projects increasingly relocate into the Rhine-Main metropolitan area (NTT Nierstein with 480 MW planned, STACKIT Infrastructure in Liederbach with 80 MW), to Bavaria (hyperscale projects in greater Munich) or to southern Hesse. Inside Frankfurt itself, the city has used a data center concept to steer new facilities to industrial sites such as Höchst or Fechenheim, in order to minimise conflict with residential areas.

Frankfurt's data center ecosystem is closely tied to the so-called FLAP-D region — an acronym for Frankfurt, London, Amsterdam, Paris and Dublin, the five most significant European data center locations. Within this group, Frankfurt is the fastest-growing market, narrowly followed by London. The combined capacity of the FLAP-D markets stands at around 4.7 gigawatts. While London grapples with tightened permitting, Amsterdam imposed a temporary moratorium on new data centers in 2019 whose effects continue to be felt, and Dublin faces multi-year waiting times due to grid bottlenecks, Frankfurt currently benefits from comparatively stable framework conditions.

5.3 Emerging locations

Beyond the traditional clusters, growth is shifting visibly into the "second tier." The Rhineland mining region — with Microsoft and QTS moving in — is emerging as a serious new hub. Berlin is on the rise too, driven by Vantage Data Centers' buildout.

In Brandenburg, sizeable new projects are in the pipeline — led by AWS's €7.8 billion European Sovereign Cloud build. Rhineland-Palatinate is getting a 480 MW data center in Nierstein, and a modern 80 MW site is rising in Mainz on the Ingelheimer Aue, on the former KMW AG grounds, due for completion in 2026.

This shift to Tier-2 regions follows a Europe-wide pattern that industry representatives describe as a possible beginning of the “end of the FLAP acronym”: in place of a few dominant hubs, an increasingly evenly distributed network of data center locations interconnected by high-capacity fiber links is emerging. For Germany this opens up growth opportunities in structurally weaker regions, whose regional-policy significance is considerable.

6 Investments and Investment Environment

6.1 Total investment and investment dynamics

Investment in the German data center market has reached a new all-time high in 2025. According to Bitkom calculations, €12 billion flowed into IT hardware (servers, storage, networking) and another €3.5 billion into buildings and building services (power, cooling, security, UPS) in 2025. Total investment thus reached around €15.5 billion — growth of about 18 percent compared to 2024.

Alongside the general cloud expansion, the main driver of this investment momentum is AI infrastructure. Specialized GPU servers, whose unit cost is many times that of conventional server hardware, account for a rapidly growing share of IT hardware investment. With the replacement of the NVIDIA H100/H200 generation by the Blackwell family (B100, B200, GB300) and the planned transition to the next-generation Vera Rubin in 2027, investment cycles will shorten further.

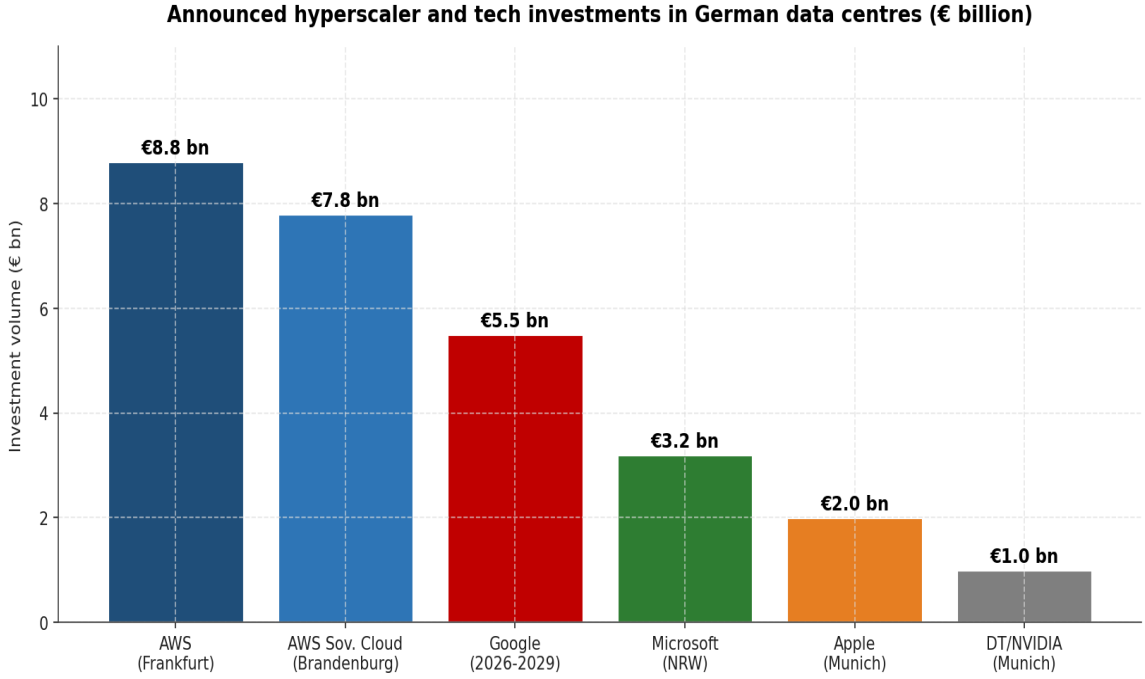


Figure 3: Announced hyperscaler and tech investments in German data center, cloud and adjacent tech infrastructure (€bn). Source: Press releases of the respective companies, as of March 20263

6.2 Hyperscaler investments in detail

The investment amounts of international tech companies in the German data center market have reached new dimensions over the past eighteen months. The most important projects at a glance:

Amazon Web Services (AWS)

AWS has committed €8.8 billion to its AWS Europe (Frankfurt) Region through 2026. The region currently spans three Availability Zones in greater Frankfurt and is AWS's most important EU region after Ireland. On top of that, AWS is building a standalone European Sovereign Cloud in Brandenburg, run end-to-end in Europe by European staff for customers with hard data sovereignty requirements — €7.8 billion through 2040, with the service expected to go live in 2026. That brings AWS's total German commitment to €16.6 billion — the largest single-company foreign direct investment in Germany of the past decade.

Microsoft

Microsoft is building new data centers in Bedburg, in the Rhineland mining region, as part of a €3.2 billion plan to double its German AI and cloud capacity. The new sites will sit alongside the existing Microsoft Frankfurt region. The Bedburg choice is partly political: the region is losing its coal industry, and the buildout is meant to bring high-quality jobs in to replace those losses.

Google / Alphabet

In November 2025 Google announced a total of €5.5 billion of investment in cloud and AI infrastructure and offices in Germany over the period 2026 to 2029. Planned facilities include cloud and AI data centers in Dietzenbach and Hanau in the greater Frankfurt area, significantly extending the Google Cloud Region Frankfurt. With this, Google is responding to growing European demand for AI services and positioning itself against the established hyperscalers AWS and Microsoft Azure.

Deutsche Telekom & NVIDIA

In autumn 2025 Deutsche Telekom and NVIDIA announced the construction of a joint AI data center in Munich with an investment volume of around one billion euros. The project, branded as the “Industrial AI Cloud”, is marketed as the first of its kind worldwide – with the claim of being tailored specifically to the needs of European industry for developing and operating industrial AI applications. SAP is the first major customer. The project underscores the strategic importance of local AI infrastructure for German industry and creates an alternative to dependence on US hyperscalers.

Apple and other players

Apple has put roughly €2 billion into its European Silicon Design Center in Munich, where 2,000+ engineers work on its own chip architectures — though strictly speaking this is chip R&D, not data center infrastructure. Other international operators are also active: Equinix is spending over US$730 million through 2027 to expand its Frankfurt xScale and retail footprint (including FR10x.1 at 14 MW); Digital Realty is developing Digital Park Fechenheim into a campus of up to 200 MW (around €1 billion in total); Vantage Data Centers has two more Frankfurt-area mega-projects, Bad Vilbel (160 MW) and Groß-Gerau (€2.5 billion total); and Oracle has committed US$2 billion over five years to its Cloud Region Frankfurt.

Alongside the classical hyperscalers, a new provider category has emerged into prominence since 2024: so-called neocloud providers. These infrastructure operators specialized in GPU-as-a-service build — including CoreWeave (USA), Nebius (Netherlands) and Nscale (UK), purpose-built AI data centers and rent GPU compute to hyperscalers and AI developers. According to Synergy Research Group, the segment generated more than US$25 billion in global revenue in 2025 — a tripling compared to the year prior.

Notable from a German perspective: none of the leading neocloud providers has yet announced a concrete infrastructure project in Germany. CoreWeave is investing US$2.2 billion in data centers in Norway, Sweden and Spain; Nebius operates its European lead site in Finland; Nscale focuses on Norway, the United Kingdom and Portugal. More than half of all European neocloud capacity deals in 2025 went to the Nordic countries — regions with cheap hydropower and low land prices. Germany's structurally higher energy costs and complex permitting are thus proving a competitive disadvantage not only against classical hyperscalers but also against this fast-growing new provider category.

Table 4 provides an overview of the largest announced individual projects.

Overview of the largest announced individual projects

Project / location	Investor	Capacity (MW)	Volume	Timeline
Brandenburg (Sov. Cloud)	AWS	**n.d. (not publicly disclosed)**	€7.8 bn	by 2040
Nierstein, Rhineland-Palatinate	NTT	**480**	approx. €4 bn	from 2027
Frankfurt-Höchst (FRA03)	Cloud HQ	**approx. 276**	> €2 bn	from 2026
Frankfurt region (total)	AWS	**n.d. (not publicly disclosed)**	€8.8 bn	by 2026
Rhineland mining region / Bedburg	Microsoft	**n.d. (not publicly disclosed)**	€3.2 bn	Groundbreaking 12.03.2026
Dietzenbach/Hanau	Google	**n.d. (not publicly disclosed)**	€5.5 bn	2026–2029
Munich (Industrial AI)	DT/NVIDIA	**n.d. (AI cluster; ~10,000 NVIDIA GPUs announced)**	€1.0 bn	from 2026

Table 4: Largest announced individual data center projects in Germany. Source: Corporate press releases, city authorities, trade press (as of March 2026); MW figures, where not officially published, should be treated as indicative assumptions.4

Supplementary analysis of capacity planning (MW):

Since leading hyperscalers (notably AWS, Google and Microsoft) do not as a rule officially disclose the exact IT connected load of their sites — for competitive reasons and to protect business-critical infrastructure — Table 4 uses "n.d." (not disclosed) for these projects.

Customary market analyses and publicly available permitting procedures (including grid-connection requests and zoning plans) nonetheless allow capacity to be narrowed down. Based on current industry data, the following indicative reference values apply to the project developments:

- Brandenburg region (AWS): the long-term target capacity at full build-out (forecast horizon 2040) is estimated at around 700 MW.
- Frankfurt-Höchst (CloudHQ / FRA03): planning documents indicate a total capacity of up to 350 MW.
- Rhineland mining region / Bedburg (Microsoft): an initial build-out of the Cloud Region West is calculated at around 180 MW.
- Rhine-Main / Dietzenbach & Hanau (Google): the combined capacity of the new sites is estimated at around 200 MW.

These values are estimates and can vary by modular build-out stage and actual server density (in particular for AI-specific workloads).

6.3 Investment environment and value-added effects

The economic effects of these investments are considerable. AWS alone estimates that its planned investments will generate €15.4 billion of additional gross domestic product and support 15,200 jobs annually at local companies. In total, the large projects listed in the table above could trigger direct and indirect gross value added of €80 to 100 billion over the next ten years – a substantial contribution to the modernization and diversification of the German economy.

Despite these high absolute investment volumes, significant locational disadvantages emerge in international comparison. While Germany, according to the latest EY Attractiveness Survey 2025, recorded the largest decline (–17 percent) in foreign direct investment of any major European country, US and Chinese investment is increasingly flowing to Tier-1 markets with lower electricity prices, shorter permitting times and more available land. With the special infrastructure fund and the National Data Center Strategy, the federal government has sought to counter this trend, but competition for hyperscale investments remains intense.

7 Infrastructure and Technology

7.1 Server hardware and power density

For about three years now, technological development in the data center has been driven by two mutually reinforcing trends: the rapid rise in power density per rack and the growing specialization of hardware for AI workloads. While a typical enterprise rack in 2020 drew 10 to 15 kilowatts, current AI clusters reach 80 to 150 kilowatts per rack. For 2026 experts expect rack densities of 240 kilowatts, in 2028 of one megawatt, and research is already exploring the feasibility of 1.5 megawatts per rack.

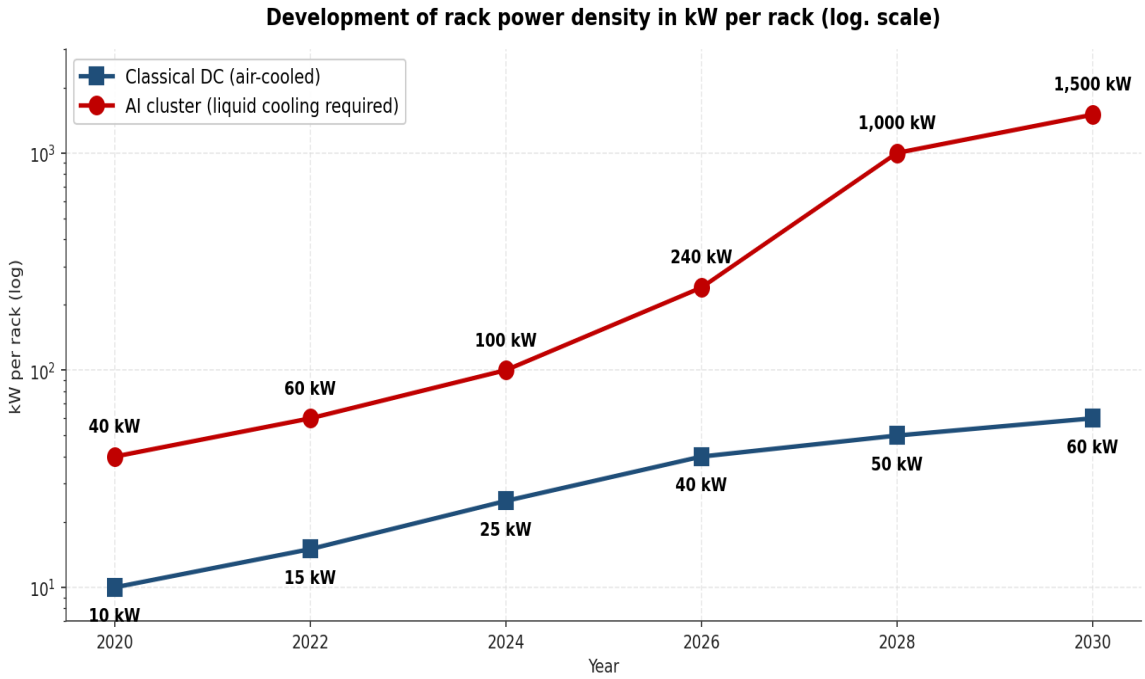


Figure 4: Development of rack power density for classical and AI workloads (kW per rack). Source: Schneider Electric, Vertiv, Rittal, own analysis4

The drivers of this trend are the latest GPU generations. An NVIDIA H100 draws around 700 watts, a B200 already 1,000 watts, and a fully equipped NVIDIA GB200 NVL72 rack with 72 accelerators consumes around 120 kilowatts. The planned GB300 and Vera Rubin generations will push these figures still higher. New requirements result across the entire infrastructure: power distribution, cooling, fire protection, floor load-bearing capacity and not least the building physics.

According to Schneider Electric, the market will split into three clearly delineated segments by 2030: around 25 percent of new builds will be facilities designed for less than 40 kilowatts per rack for the productive operation of classical workloads. Around 50 percent will be hybrid data centers in the 40 to 80 kW per rack range, handling both production and training workloads. The remaining 25 percent will be high-performance training clusters with more than 100 kW per rack used exclusively for large-scale AI model training.

7.2 Cooling: from airflow to liquid cooling

Classical air cooling via raised floors and hot/cold-aisle layouts reaches its physical limits at around 50 to 60 kilowatts per rack. Since AI clusters already substantially exceed this density today, liquid cooling has evolved from a niche application to the de-facto standard for AI and HPC workloads within a few years. Market researchers expect the global liquid-cooling market to grow rapidly, with double-digit annual growth rates over the upcoming years

Three liquid-cooling architectures have essentially established themselves. In direct-to-chip cooling, a cold plate through which liquid flows is mounted directly onto the main heat sources such as CPU and GPU; heat is removed efficiently via closed cooling loops and so-called Coolant Distribution Units (CDUs). Single-phase or two-phase immersion cooling submerges entire servers in an electrically non-conductive dielectric liquid and uses either pure heat conduction or a phase change for heat removal. Liquid-to-air hybrid solutions combine both worlds and enable the gradual conversion of existing, primarily air-cooled data centers into AI-capable facilities.

The advantages of liquid cooling over air cooling are considerable. Water has substantially better heat-transfer properties than air. This allows higher supply temperatures (typically 40 to 52 °C), which both improves cooling efficiency and creates the conditions for effective waste-heat utilization. Noise emissions drop sharply, as fewer and smaller fans are needed.

On the supplier side, alongside the established specialists Vertiv, Rittal and Stulz, international players such as Schneider Electric (through the acquisition of Motivair), Eaton, ZutaCore and CoolIT have positioned themselves. Rittal, for example, offers CDUs with 500 to over 1,000 kilowatts of cooling capacity, while Schneider/Motivair offers an MCDU-70 with 2.5 megawatts of centralized control and seamless scalability beyond 10 megawatts.

7.3 Power supply and resilience

The power supply is the dominant variable in the planning, construction and operation of modern data centers. It covers external connection to the transmission and distribution grid, uninterruptible power supply (UPS) systems to bridge short voltage dips, emergency power from diesel generators for longer outages, and increasingly also local generation and storage concepts.

Hyperscale data centers usually need a direct connection to the 110 kV high-voltage grid today; large facilities with more than 100 MW of IT connected load require a connection to the 380 kV extra-high-voltage grid. Serious bottlenecks have emerged here: according to Tennet TSO GmbH, there is currently not a single free switching bay anywhere across the entire transmission network, so for every new large connection the switching stations must first be extended. Waiting times of four to seven years for a high-capacity connection are no longer the exception.

In response to these bottlenecks, local power-generation concepts are gaining importance. Rooftop and ground-mounted photovoltaic systems, gas turbines with CO_2 capture, combined heat-and-power plants, fuel cells and HVO-powered emergency generators are increasingly being used to bridge connection delays and stabilize supply. International front-runners such as Microsoft are even relying on small modular reactors (SMRs) as a long-term power source for their data centers – a concept currently not feasible in Germany due to the nuclear phase-out.

For uninterruptible power supply, battery-based UPS systems continue to dominate, increasingly benefiting from lithium-ion batteries with higher energy density and longer life than the lead-acid batteries previously used. Emergency power is almost universally provided by diesel generators, whose fuel reserves guarantee several days of autonomous operation. A growing number of new data centers are switching to the bio-based diesel substitute HVO (hydrotreated vegetable oil), which enables CO_2 savings of up to 90 percent compared with conventional diesel.

7.4 Connectivity and network infrastructure

The performance of a data center location depends critically on its connection to the global fiber network and to the central internet exchanges. In Europe, DE-CIX in Frankfurt, at a record peak of 18.73 terabits per second in 2025, is by far the largest internet exchange. It serves as the central hub for European data traffic and is one of the principal reasons for Frankfurt's dominant position in the European data center market. Other significant internet exchanges in Germany include BCIX in Berlin, Ecix in Munich and KleyReX in Frankfurt.

At the supra-regional level, connectivity is supplemented by a dense network of dedicated dark fiber links, cloud on-ramps to the major hyperscalers and private interconnection services. According to the Global Interconnection Index, Frankfurt is the fastest-growing location for private interconnection in Europe among the FLAP markets, with an average annual growth rate of around 50 percent.

Inside the data centers themselves, network architecture has changed fundamentally in recent years. Classical three-tier topologies have been replaced by flatter, highly meshed spine-leaf architectures optimized for the east-west traffic patterns of modern AI and big-data workloads. At the physical layer, 400-gigabit and increasingly 800-gigabit Ethernet and Infiniband solutions with up to 800 Gbps for AI clusters have become established. The next step – 1.6 terabit-per-second Ethernet – is approaching market readiness in 2026/2027.

8 Energy demand and sustainability

8.1 Energy consumption of German data centers

The energy consumption of German data centers has risen continuously over the past one and a half decades. The sector used 10.5 TWh in 2010, 16 TWh by 2020, around 20 TWh in 2024, and roughly 21.3 TWh in 2025 — about 4% of total German electricity demand. That's more than every German hydropower plant combined, and roughly twice the electricity demand of the federal capital Berlin.

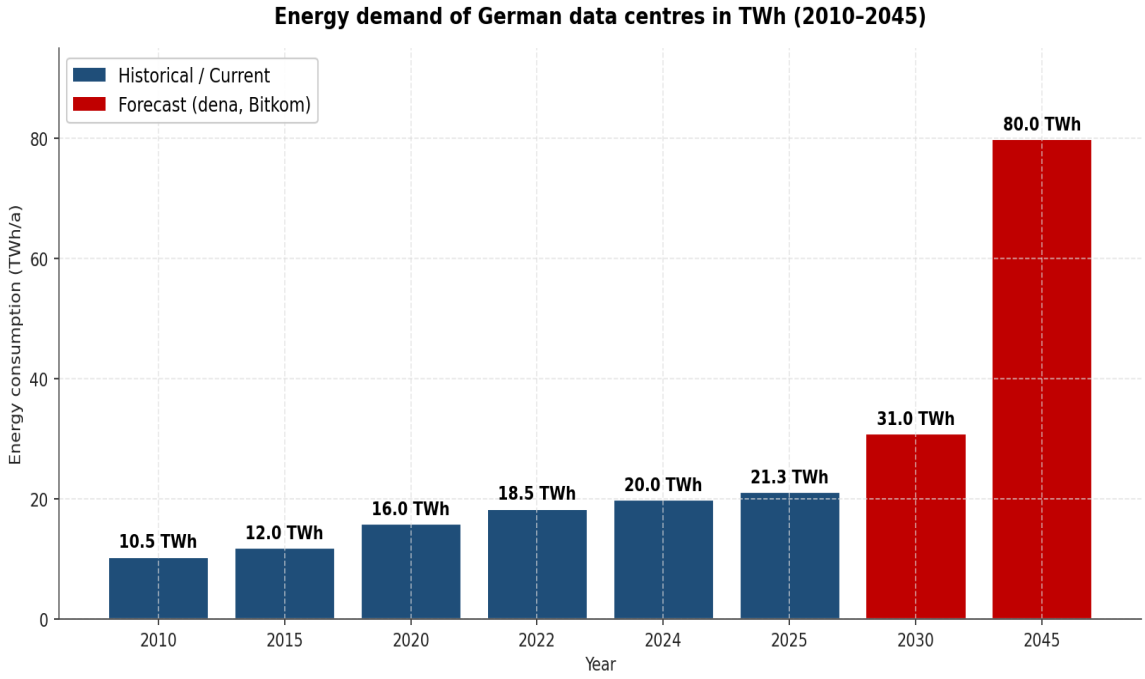


Figure 5: Energy demand of German data centers in TWh (2010–2045). Source: Bitkom/Borderstep, dena, own representation5

Roughly two-thirds of this consumption is attributable directly to the IT infrastructure — servers, storage and network equipment. The remaining one-third is distributed across the building infrastructure, above all air-conditioning and cooling as well as the uninterruptible power supply. This split is shifting gradually in favor of the IT share as liquid cooling and better-designed thermal management systems become more widespread.

Absolute consumption and per-unit efficiency have moved in opposite directions — but not symmetrically. Total electricity use has doubled since 2010, while compute capacity per kWh has grown by close to 5x over the same period. Standard server efficiency improved by roughly 26% a year between 2017 and 2022, according to Bitkom. None of that has been enough: demand for compute has outrun the efficiency gains. A classic Jevons effect.

Looking ahead, the German Energy Agency (dena) expects consumption to rise to more than 30 TWh by 2030 and — assuming unchanged growth dynamics — to nearly 80 TWh by 2045. This forecast implies that data centers will, in the medium term, become one of Germany's largest industrial electricity consumers, on a par with the aluminium or steel industry. The political debate already warns of a multifold increase in data center electricity demand by 2045.

8.2 Power Usage Effectiveness (PUE) and efficiency

The central metric for assessing the energy efficiency of data centers is Power Usage Effectiveness (PUE), defined as the ratio of total power consumption to the power consumption of the IT infrastructure. A PUE of 1.0 would mean that no energy at all is required for cooling, UPS or other infrastructure — a theoretical ideal. The average PUE of German data centers has improved considerably over the past 15 years: from around 2.0 in 2010 to 1.43 in 2025.

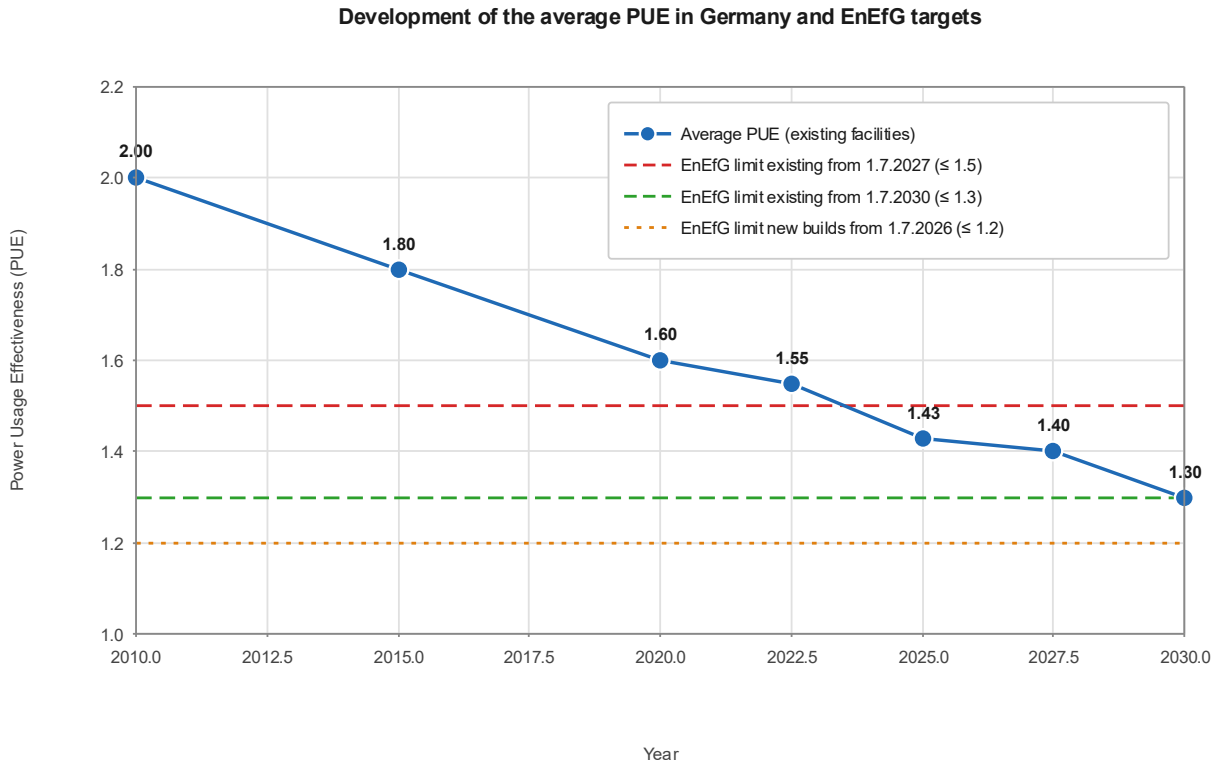


Figure 6: Development of the average PUE in Germany and statutory targets under the Energy Efficiency Act (EnEfG). Source: Borderstep, EnEfG, own representation6

This improvement has been achieved through a wide range of technical measures: rigorous separation of cold and hot aisles, raising of permissible server inlet temperatures, the use of indirect free cooling, optimization of UPS topologies and, not in the least, the economies of scale of large hyperscale facilities that typically reach PUE values of 1.1 to 1.2. The Energy Efficiency Act (EnEfG), in effect since November 2023, has further accelerated this development with binding PUE requirements: new facilities entering service after 1 July 2026 must achieve a PUE of 1.2 or better; existing facilities must reach 1.5 by July 2027 and 1.3 by July 2030.

The referent's draft amendment of the EnEfG, submitted by the Federal Ministry for Economic Affairs and Energy (BMWE) in April 2026, provides for a moderate relaxation of these limits: for new facilities, the permissible PUE rises from 1.2 to 1.3; for existing facilities, from 1.5 to 1.6 by 2027 and from 1.3 to 1.4 by 2030. Supporters argue that the original values were not consistently feasible technically or economically, especially for AI data centers, whose specific load profiles complicate full optimization. Critics — including the German Industry Energy Efficiency Initiative (DENEFF) — see the relaxation as a breach of the EU Energy Efficiency Directive and a step back in meeting climate targets.

8.3 Renewable energy and electricity origin

The EnEfG requires data centers to cover their electricity consumption from renewable sources on a balance-sheet basis: 50 percent from 2024 and 100 percent from 2027. This requirement is largely uncontested among the hyperscalers: AWS, Microsoft, Google and Meta have publicly committed to 100 percent renewable electricity supply for years and have concluded substantial power purchase agreements (PPAs) with German and European wind and solar operators.

Balance-sheet supply of renewable electricity should not, however, be confused with physical supply. Since wind and solar fluctuate with the weather, data centers in reality draw the public-grid electricity mix at any given moment. Only through the acquisition of guarantees of origin or through synchronized PPAs is the balance-sheet renewable share brought to 100 percent. True 24/7 matching of consumption and renewable generation — Google's so-called 24/7 Carbon-Free Energy concept — is currently neither technically nor economically feasible on scale.

According to International Energy Agency data, roughly 27 percent of the electricity consumed by data centers globally currently comes physically from renewables, mostly from wind, solar and hydropower. Total renewable electricity generation is projected to grow by 22 percent annually through 2030 and to cover almost half of the projected increase in data center electricity demand. For the remaining gap, gas with carbon capture, fuel cells and — internationally — nuclear power (in particular small modular reactors) are under discussion as bridging options.

8.4 Waste-heat utilization

A central lever for the sustainability of data centers is the utilization of the heat they generate. Servers release practically all the electrical energy they consume as heat — a potential that has so far been wasted into the atmosphere in most cases. The EnEfG has, with binding quotas, created the first framework: new data centers entering service from July 1st, 2026 must use, or hand over to economically viable use, at least 10 percent of their waste heat. For facilities entering service from July 2027 this quota rises to 15 percent, and from July 2028 to 20 percent.

Technical implementation typically takes the form of feeding the heated cooling liquid into local or regional district-heating networks, of supplying neighboring buildings directly (office complexes, residential buildings, greenhouses, fish farms), or — for low-temperature heat — via heat pumps that raise the temperature level to the 65 to 80 °C required for heating purposes. The growing adoption of liquid cooling, which enables supply temperatures of 50 to 52 °C, makes waste-heat utilization substantially more economical than at air-cooled facilities, whose waste heat is typically only 25 to 35 °C.

Practical implementation faces considerable hurdles. Most data centers are not located close to district-heating networks, and building a connection line over several kilometers is rarely economical without public funding. Added to this are the seasonal fluctuation in heat demand (which is minimal in summer) and divergent technical standards. The EnEfG amendment therefore provides for an exemption from the waste-heat obligation where no technically and economically reasonable connection is available within five kilometers.

Lighthouse projects nonetheless show what is technically possible. The Frankfurt Cloud HQ project at the Höchst industrial park leverages synergies with the 120 production and combustion plants operated on the site. The planned hyperscale data center in Frankfurt (Oder) will contribute a subsidy of 15 million euros toward connection to the municipal district-heating network. In Stockholm, Helsinki and Copenhagen, models have been established for years in which data centers make a substantial contribution to city-center district heating — examples Germany should follow.

8.5 Water consumption and WUE

An increasingly prominent sustainability topic is the water consumption of data centers. While air-cooled facilities use practically no water, evaporative cooling towers require considerable quantities of fresh water. Water Usage Effectiveness (WUE) — the ratio of water consumption to IT energy in liters per kilowatt-hour — typically lies between 0.5 and 2.0 l/kWh at large hyperscale facilities. In water-scarce regions — Spain, Italy, parts of France — this consumption is increasingly the subject of public criticism.

In Germany, water supply is less critical in most regions, but operators here are increasingly turning to water-saving concepts, too. The federal government has identified water-efficient cooling systems as a central sustainability lever in the National Data Center Strategy. Adiabatic cooling systems with markedly reduced water use, closed cooling loops and the use of treated grey water or rainwater are becoming standard. The data center being built on the Ingelheimer Aue in Mainz is intended to become one of the most reliable and environmentally friendly in Europe under Level-3 standards.

9 Regulatory framework: EnEfG and the National Data Center Strategy

9.1 Energy Efficiency Act (EnEfG)

The Energy Efficiency Act, in short EnEfG, has been in effect since 18 November 2023 and is the central federal law for raising energy efficiency in Germany. It transposes the EU Energy Efficiency Directive (EED) into national law and contains specific requirements for data centers in section 4. These requirements apply in principle to all data centers with a non-redundant nominal electrical connected load of 300 kilowatts and above; stricter obligations apply from 1 megawatt.

The EnEfG's central requirements for data centers can be grouped into five categories:

- Power Usage Effectiveness (PUE): binding limits depending on the date of commissioning, graduated between existing and new facilities.
- Energy Reuse Factor (ERF): mandatory waste-heat utilization, with staged minimum shares of 10 to 20 percent for new facilities.
- Balance-sheet electricity supply from renewables: 50 percent from 2024, 100 percent from 2027.
- Energy or environmental management system to ISO 50001 or EMAS, certification obligation from 1 January 2026.
- Reporting obligation: annual submission of data on energy consumption, PUE, cooling systems and waste-heat utilization to the energy efficiency register at BAFA / BfEE.

PUE limits and waste-heat quotas in detail

Commissioning	PUE target (original)	PUE target (amendment)	Waste-heat quota (ERF)
Existing before 1.7.2026	≤ 1.5 from 1.7.2027	≤ 1.6 from 1.7.2027	Cost-benefit analysis
Existing before 1.7.2026	≤ 1.3 from 1.7.2030	≤ 1.4 from 1.7.2030	Cost-benefit analysis
New facilities from 1.7.2026	**≤ 1.2**	**≤ 1.3**	min. 10 %
New facilities from 1.7.2027	**≤ 1.2**	**≤ 1.3**	min. 15 %
New facilities from 1.7.2028	**≤ 1.2**	**≤ 1.3**	min. 20 %

Table 5: PUE and waste-heat quota requirements under the EnEfG (status before and after the planned amendment of April 2026). Source: § 11 EnEfG, BMWE referent's draft of 9 April 20265

9.1.1 The amendment to the EnEfG

On 9 April 2026 the Federal Ministry for Economic Affairs and Energy published a referent's draft to amend the EnEfG. The objective is to respond to the significantly increased importance of energy-intensive infrastructure and to reduce the high implementation burden on companies. The draft essentially provides for the following changes: a 0.1 increase in PUE limits across all commissioning categories; a relaxation of the waste-heat obligation via a new exemption where no connection is available within five kilometers; a switch of the waste-heat avoidance obligation to a cost-benefit analysis at the planning or substantial-modernization stage; and an increase in the thresholds for mandatory energy management systems from 7.5 GWh to 23.6 GWh of final energy consumption per year.

The industry has largely welcomed the planned changes, as they substantially reduce implementation effort. The original limits are particularly difficult to meet for AI data centers with their specific load profiles. Criticism comes from environmental associations and DENEFF, which see a breach of EU requirements. Adoption of the amendment is expected only in the third or fourth quarter of 2026, so the original limits will continue to apply to new facilities entering service before that point.

9.2 National Data Center Strategy 2026

The Federal Cabinet adopted the first National Data Center Strategy on 18 March 2026. It builds on a participation process launched by the Federal Ministry for Digital Affairs and State Modernization (BMDS) in August 2025 and combines existing initiatives with concrete new measures. The strategy was first debated in the Bundestag on April 16th, 2026, and referred to the Committee for Digital Affairs and State Modernization.

The strategy aims to at least double data center capacity in Germany by 2030 and to at least quadruple compute capacity for high-performance computing and artificial intelligence. It comprises 28 measures across three central fields of action:

- Energy and sustainability: support for sustainable data centers using renewable electricity, energy-efficient solutions and water-saving cooling. Creation of reliable and affordable electricity supply.
- Location and land: acceleration of planning and approval procedures, designation of priority sites, adaptation of grid-connection procedures and introduction of reservation mechanisms for grid-connection capacity.
- Technology and sovereignty: build-out of high-performance AI compute capacity, support for the location of at least one European AI gigafactory in Germany, strengthening of HPC and research networks, and the establishment of a sovereign cloud platform for government AI as part of the Deutschland-Stack initiative.

9.2.1 Grid package and grid-connection procedures

Closely intertwined with the data center strategy is the grid package, published as a working draft in March 2026 and proposing various amendments to the Energy Industry Act (EnWG). Central elements are: the possibility of prioritizing and reserving grid-connection capacity by transmission system operators (§ 17b draft EnWG), the digital identification of available capacity in the distribution grid (§ 17c draft EnWG) and a uniform reservation mechanism for grid-connection capacity (§ 17f draft EnWG).

Despite these measures, industry experts see one key structural problem as inadequately addressed: at the transmission-grid level, according to Tennet TSO GmbH, the primary shortage is not of grid-connection capacity but of connection points — specifically of free switching bays in existing substations. Building new switching stations or extending existing ones requires multi-year approval and construction processes.

9.3 EU rules and international framework

Beyond national law, various EU rules shape the framework for German data centers. The EU Energy Efficiency Directive (EED) underpins the EnEfG. The EU Taxonomy defines criteria for sustainable investment that increasingly affect the financing costs of data center projects. The EU Digital Operational Resilience Act (DORA) requires financial institutions to ensure the resilience of their IT infrastructure. The General Data Protection Regulation (GDPR) remains the gold standard for handling personal data.

With the EU AI Act adopted in 2024, specific requirements for AI systems also come into effect that have indirect implications for the data center landscape. The classification of certain AI models as "General Purpose AI with Systemic Risk" entails additional transparency, audit and risk-management obligations whose operational implementation typically takes place inside the data center.

A central new EU-level initiative is the InvestAI facility, with a volume of 20 billion euros, for the establishment of up to five European AI gigafactories. These will be tendered under the EuroHPC Joint Undertaking and are scheduled to enter service from 2028. Germany has earmarked 805 million euros in its special-purpose fund as a financing contribution to an AI gigafactory in Germany. The location decision is expected in the summer of 2026.

10 Artificial intelligence as a growth driver

10.1 AI data centers in Germany

Looking ahead, the German Energy Agency (dena) expects consumption to rise to more than 30 TWh by 2030 and — assuming unchanged growth dynamics — to nearly 80 TWh by 2045. This forecast implies that data centers will, in the medium term, become one of Germany's largest industrial electricity consumers, on a par with the aluminium or steel industry. The political debate already warns of a multifold increase in data center electricity demand by 2045.

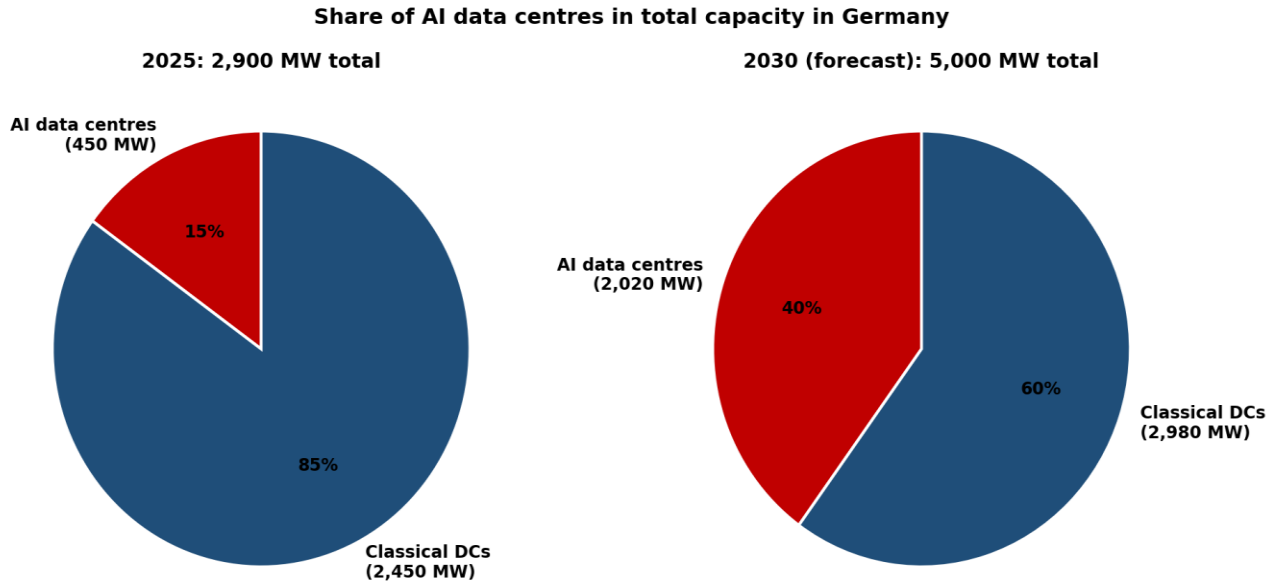


Figure 7: Share of HPC / AI capacity in total capacity in Germany — 2025 vs. 2030 forecast. Source: Bitkom study 2025, own representation7

AI data centers differ in several respects from classical cloud data centers. On the hardware side, specialized GPU accelerators dominate — currently above all the NVIDIA family H100, H200, B100, B200 and GB200 — alongside increasingly strong competitor products from AMD (Instinct MI300, MI325), Intel (Gaudi 3, Gaudi 4) and customer-specific ASICs (Google TPU, Amazon Trainium/Inferentia). These accelerators exhibit extremely high power density and require correspondingly powerful cooling, power and network infrastructure.

AI workloads typically split into two main categories: training (the one-off or periodically repeated learning of a model from large data sets) and inference (the ongoing application of the trained model to new inputs). While training is extremely compute- and energy-intensive and takes place in large, dedicated clusters, inference can be carried out in a distributed fashion, including in smaller data centers or at the edge. With the introduction of the next generation of large language models, which will have ten to a hundred times more parameters than today's leading models, training requirements will explode further.

10.2 EuroHPC AI Factories and gigafactories

With the EuroHPC Joint Undertaking, the European Union has created a central platform for the support of high-performance and AI compute capacity. Complementing the existing supercomputer infrastructure, so-called AI Factories have been under construction since 2024 — AI-optimized high-performance data centers that, together with data, advisory and training offerings, are intended to give European start-ups, SMEs and researchers access to state-of-the-art AI infrastructure.

Seven initial AI Factories were selected in December 2024 — including a German site with the "Jupiter AI Factory" at Forschungszentrum Jülich. JUPITER is Europe's first exascale-class supercomputer, equipped with more than 24,000 NVIDIA GH200 Superchips. In March 2025 six further AI Factories followed in Austria, Bulgaria, France, Poland, Slovenia and a second German site: "Hammer HAI", coordinated by the High-Performance Computing Center Stuttgart. In October 2025 six more AI Factories in the Czech Republic, Lithuania, the Netherlands, Romania, Spain and Poland, plus 13 so-called AI Factory Antennas in further member and associated states, were announced.

The next stage of European AI infrastructure build-out is formed by the AI Gigafactories. These will be equipped with three to four times as many accelerators as the current AI Factories — the European Commission cites around 100,000 specialized AI processors per gigafactory — and are explicitly geared toward the development of the next generation state-of-the-art AI models. Investment costs per gigafactory are estimated at four to five billion euros, of which the EU funds up to 35 percent via the InvestAI facility. The official bidding process starts in Q1 2026, and the selection of up to five sites is scheduled for summer 2026.

By the end of the expression-of-interest phase in June 2025, 76 bids had been submitted from 16 EU member states for 60 different locations. Germany is represented by several consortia involving, among others, Deutsche Telekom, the Schwarz Group (Schwarz Digits) and Ionos. The coalition agreement of the 21st legislative term stipulates that Germany should host at least one of the planned AI centers. The federal government has earmarked 805 million euros in its special-purpose fund as a German financing contribution. Construction of the first AI Gigafactories is expected no earlier than 2028.

10.3 Sovereignty and Industrial-AI initiatives

Alongside the EU-driven build-out of AI gigafactories, several initiatives for industrial and sovereign AI infrastructure have been established in Germany. The most prominent example is the "Industrial AI Cloud" in Munich, announced in autumn 2025 between Deutsche Telekom and NVIDIA: with investment of around one billion euros and an independent operating company staffed by European personnel, it is designed specifically for the needs of European industry. SAP is its first major customer.

Schwarz Digits, the IT arm of the Schwarz Group (Lidl, Kaufland), has positioned itself as a European cloud provider with Schwarz Cloud and operates its own AI data centers with German data residency. Ionos, Germany's largest web-hosting provider, has built a competitive alternative to the US hyperscalers with the "Ionos Cloud", which increasingly also serves AI workloads. The German start-up Aleph Alpha from Heidelberg is developing a competitive European alternative to OpenAI and Anthropic with its "Pharia" language model, trained on domestic infrastructure.

On the research side, Forschungszentrum Jülich, through the JUPITER AI Factory, coordinates Germany's contributions to European AI infrastructure. Partners include the AI Center at RWTH Aachen, the Fraunhofer Institutes for Applied Information Technology and for Intelligent Analysis and Information Systems, and the Hessian Center for Artificial Intelligence. The High-Performance Computing Center Stuttgart coordinates another German EuroHPC site with "Hammer HAI".

11 Challenges and risks

11.1 Electricity prices and energy costs

By far the largest structural challenge for Germany as a location is its internationally exceptionally high electricity prices. Industrial electricity prices above 15 cents per kilowatt-hour are two to three times higher than at competing locations such as the United States (5–8 ct/kWh), Scandinavia (4–7 ct/kWh) or certain regions of France (nuclear offerings below 6 ct/kWh). Because energy costs account for around 50 percent of a data center's operating expenses according to the German Datacenter Association (GDA), this locational disadvantage feeds directly through to competitiveness.

A central industry demand is therefore the inclusion of data centers in relief measures for energy-intensive industries, such as electricity-price compensation or the planned industrial electricity price. To date, data centers — unlike classical industry — are not recognized as a manufacturing activity and are excluded from many relief schemes. A legal opinion commissioned by Bitkom concludes that European state-aid frameworks would in principle permit the inclusion of data centers as digital infrastructure.

11.2 Grid connection and procedures

The availability of grid connections is emerging as the second central bottleneck. In particular at the transmission grid — mandatory for hyperscale facilities with more than 100 MW connected load — Tennet TSO GmbH reports that hardly any free switching bays remain. The waiting time for a new 380 kV connection can run up to four to seven years — a horizon prohibitively long for many investment decisions.

The federal government addresses this challenge with the grid package presented in March 2026 and the reservation mechanism anchored in the data center strategy. Industry experts criticize, however, that these measures do not solve the actual problem — the lack of physical switching-bay infrastructure. Acceleration of approval procedures for switching stations and transformer stations would be needed, as would financial support for the transmission system operators in expanding hub locations.

11.3 Permitting and bureaucracy

Alongside grid connections, lengthy approval procedures slow the expansion of data center capacity. Urban land-use planning, immission control, fire protection and water-law permits take 18 to 36 months in many federal states and can take significantly more time in individual cases. Added to this are procedures under the Federal Immission Control Act (BImSchG) for the approval of emergency generators and cooling towers, which can take a further 12 to 18 months depending on the type of equipment and location.

The National Data Center Strategy provides for a series of acceleration measures in the "Location and land" field of action: designation of priority sites by the federal states, standardization of approval procedures, digitalization of application submission and bundled administrative responsibilities. Concrete implementation falls to the federal states and municipalities, so the effectiveness of these measures will only be observable in the upcoming years.

11.4 Skills shortage

The skills shortage is a cross-industry challenge that hits data centers particularly hard. Operating modern data centers requires a broad palette of specialized qualifications: electrical engineers for power supply, building-services engineers for HVAC, network specialists, security experts, liquid-cooling specialists, cloud architects and AI-infrastructure engineers. In Europe, data centers employ around 600,000 full-time equivalents; an increase of 14 percent was expected by 2025, with growth likely to overshoot significantly by 2030.

A substantial skills shortage is already evident in Germany. The planned doubling of capacity by 2030 presupposes a corresponding expansion of the personnel base that cannot be delivered without targeted training and continuing-education initiatives and an easier immigration regime for qualified workers. The industry calls for the establishment of a specialized "data center technician" profession and for investment in modernizing the curricula of relevant degree programs.

11.5 Social acceptance and locational conflicts

The growing size and visibility of data centers is causing acceptance problems in some regions. Citizens' initiatives criticize high energy and water consumption, noise emissions from emergency generators and cooling plant, visual impact on the landscape and the often low local value-added per square meter of land. In Amsterdam, a citizens' movement in 2019 led to a temporary moratorium on new data centers whose effects continue to be felt today.

Comparable moratoria have not yet been imposed in Germany, but tighter siting rules are emerging in some municipalities. Frankfurt, for example, has set clear siting rules through its data center concept to avoid conflicts with residential areas. Proactive engagement of the local population, transparent information on energy and water consumption and concrete contributions to local value creation — through waste-heat use or trade taxes — are central preconditions for continued acceptance.

11.6 Cyber and physical security

As critical data and applications concentrate in data centers, so too does the risk of cyberattacks, sabotage and physical attacks. The EU NIS2 Directive and the German IT Security Act 2.0 raise resilience requirements, which are further tightened by the DORA framework that applies to the financial sector from 2025. Added to this are geopolitical risks: the sabotage of subsea cables in the Baltic Sea in 2023 and 2024 underlined the vulnerability of critical data links.

11.7 International competition and data colonization

The toughest competition comes from the United States and China. The US has ten times the capacity Germany even plans to have by 2030. By end-2025, the gap was a 16–17x factor on both stock and annual additions: FERC counted more than 50 GW operational in the US[1] versus 2.98 GW installed in Germany, with 2025 US additions of about 4.0 GW in colocation alone (Cushman & Wakefield)[2] against 250 MW in Germany. The average project size is also telling: new US data centers came online at a mean capacity of just under 80 MW in 2025, versus much smaller projects in Germany. The two markets are directly comparable on installed IT load — though differences in PUE and the statistical thresholds (US captures all sizes; Germany starts at 100 kW) deserve a footnote. China, meanwhile, is adding capacity at a pace Europe can't touch. Against this backdrop, Bitkom managing director Bernhard Rohleder has warned Germany risks becoming a "data colony" if it doesn't move on building its own capacity.

[1] **FERC, State of the Markets Report, March 2026**

[2] **Cushman & Wakefield, Americas Data Center Update H2 2025, February 2026**

12 International Comparison

12.1 Global market structure

The global data center market is highly concentrated in a few countries. The United States dominates with installed capacity of more than 50 gigawatts — more than sixteen times that of Germany. Behind the US comes China with around 12 GW, Japan and the UK with 1.5 to 1.7 GW each, and Germany at just under 3 GW. Germany thus ranks unchallenged at the top in Europe, followed by the UK, France (around 950 MW), the Netherlands (around 870 MW) and Ireland (around 700 MW).

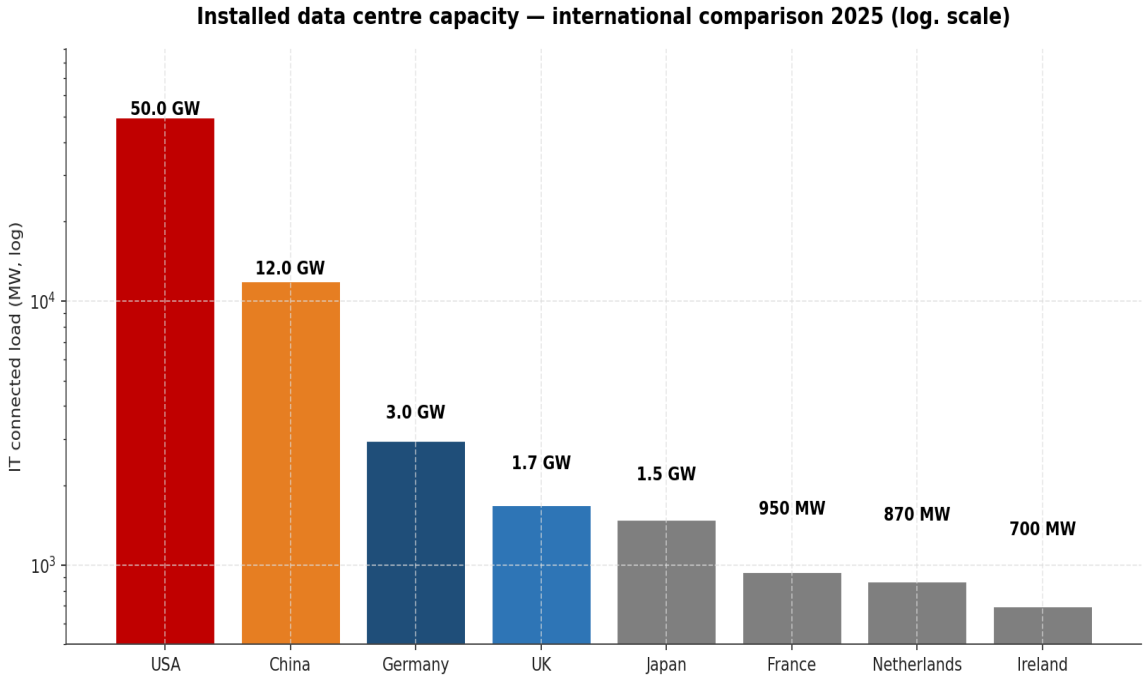


Figure 8: Installed data center capacity — international comparison 2025 (in MW, logarithmic scale). Source: FERC, Synergy Research, Bitkom, own analysis8

12.2 Locational comparison of the FLAP-D region

Inside Europe, the FLAP-D region dominates market activity: Frankfurt, London, Amsterdam, Paris and Dublin together account for more than 70 percent of European data center capacity. The locations differ substantially, however, in their growth rates, vacancy rates and regulatory frameworks.

Location	Capacity (MW)	Growth p.a.	Vacancy	Specific locational features
Frankfurt	approx. 1,131	**approx. 14 %**	approx. 3 %	DE-CIX, financial center, established ecosystem
London	approx. 1,100	approx. 9 %	approx. 4 %	Brexit effects, high electricity prices
Amsterdam	approx. 870	approx. 6 %	approx. 5 %	AMS-IX, moratorium aftermath, water scarcity
Paris	approx. 950	approx. 12 %	approx. 4 %	Nuclear electricity, AI strategy, public support
Dublin	approx. 700	approx. 4 %	approx. 6 %	Grid bottlenecks, tax advantages

Table 6: Comparison of FLAP-D locations in Europe (as of 2025). Source: CBRE, JLL, Cushman & Wakefield, own analysis6

12.3 Emerging European locations

Outside the FLAP-D region, new locations offering significant advantages have been emerging for several years. The Scandinavian countries — Sweden, Finland and Norway — score with low-cost green electricity (mostly hydropower), natural cooling benefits, transparent approval procedures and ample available land. For those reasons SAP has operated a large data center in Sweden since 2018. Microsoft has built another major site in Finland with the Heumos facility.

Poland is developing into an important Tier-2 location for companies seeking a geographically diversified yet cost-effective and well-connected EU site. Microsoft, Google and AWS have built new data centers in Poland in recent years. Analysts project growth to around 181 MW in 2026. Latencies from Frankfurt to the key Polish economic centers of Poznań and Warsaw range from single to low double-digit milliseconds — values that pose no problem for most use cases.

Spain (Madrid), Italy (Milan, Rome), Switzerland (Zurich) and Austria (Vienna) are also gaining importance, in particular as locations for AI gigafactories and for the hyperscalers' regional cloud regions. Vienna, for instance, has bid — with the support of the Austrian federal government — for one of the up-to-five European AI gigafactories.

12.4 USA and China: the benchmarks of global scale

The comparison with the US and China illustrates the orders of magnitude at which the global contest for data center capacity is being played out. In the US, five large hyperscaler clusters dominate: Northern Virginia (the world's largest hub at over 7 GW), Dallas, Phoenix, Silicon Valley and Atlanta. In Northern Virginia alone, several additional gigawatts of capacity will be installed over the next two years — more than Germany's entire current capacity.

Investment amounts are on a different scale. In 2025 Microsoft announced 30 billion US dollars of investment in AI infrastructure and existing operations in the UK through 2028 — this single project exceeds total German hyperscaler investment over the last ten years. Google plans roughly 6.8 billion US dollars for AI, R&D in the UK over the next two years. In the US itself, OpenAI, together with SoftBank and Oracle, has announced the "Stargate" project with an investment volume of 500 billion dollars.

China runs a top-down national strategy under the East-Data-West-Computing (EDWC, 中国东数西算) program, designed to pair the data demand of the eastern cities with the cheap renewable generation of the western provinces — hydropower in Sichuan, solar and wind in Xinjiang and Inner Mongolia. The scale of ambition is best seen in the numbers: China ended 2025 with around 32 GW of installed IT load, eleven times Germany's total. By 2030, this is to rise to more than 60 GW, while Germany targets capacity of around 5 GW over the same period. [1]

For comparison: US data centers already reached 48 GW of capacity in 2024 — 16x that of Germany. The ten largest US facilities alone add up to Germany's entire installed base.

EDWC's central direction — binding rules on where to build, mandatory minimum 80% renewables for new builds across the eight National Computing Hubs, and prescribed use cases — stands in sharp contrast with the more market-driven model in the US and Europe. For investors this means: Germany and Europe are growing dynamically but operate on a different order of magnitude than the leading digital economies.

[1] **The figures are directly comparable on the basis of installed IT connected load (watts). Two caveats apply: first, China's average PUE of around 1.49 is above Germany's 1.43, so total electricity draw at the same IT capacity is higher in China. Second, the Rystad figure (32 GW China) captures all data centers including enterprise facilities; the Bitkom figure (2.98 GW Germany) covers data centers from 100 kW and above. The comparability is methodologically defensible but not complete.**

13 Outlook: development scenarios 2029, 2031 and 2036

What follows projects the German market across three horizons: short-term through 2029 (three years), medium-term through 2031 (five years), and long-term through 2036 (ten years). The forecasts draw on Bitkom/Borderstep, the 2026 federal data center strategy, announced hyperscaler plans, and international benchmarks. The usual caveats apply — the pace of AI adoption, regulatory shifts, and energy-policy choices can all speed things up or slow them down considerably.

13.1 Short-term outlook: to 2029 (3-year horizon)

In the short-term horizon to 2029, the high investment and growth dynamic of 2024–2026 will continue seamlessly. The major projects already announced and under construction will come online progressively in 2027–2029 and substantially increase the installed IT connected load in Germany.

13.1.1 Capacity development to 2029

Based on approved and under-construction projects and historical growth rates, installed IT connected load is expected to rise from around 3,000 MW at the start of 2026 to 4,000–4,500 MW in 2029. This implies an average annual growth rate of 10 to 14 percent and an absolute capacity increase of 1,000–1,500 MW within three years.

Key drivers are: (1) the second and third phases of AWS investment with additional modules in Frankfurt and the first commissioning of the Sovereign Cloud Region in Brandenburg, (2) the ramp-up of Microsoft's North Rhine-Westphalia site with full cloud region and local AI compute infrastructure, (3) the commissioning of the first modules of the Telekom/NVIDIA Industrial AI Cloud in Munich, (4) the start of several large colocation projects in Frankfurt and the Berlin area, and (5) the realization of Apple sites in Bavaria.

Hesse will very likely consolidate its leading position and is expected to reach around 1,500–1,600 MW of installed connected load in 2029. Bavaria will grow strongly thanks to the major AI projects — in particular the Telekom/NVIDIA Industrial AI Cloud and complementary chip and R&D investments by Apple — and consolidate as the second-largest location, with North Rhine-Westphalia likely on a par. Driven by the AWS project, Brandenburg will become the most important new growth location and could reach the 200 MW mark by 2029.

13.1.2 AI as the dominant growth driver

In the three-year horizon, AI-driven demand will remain the principal growth driver and will account for an ever larger share of newly installed capacity. While roughly 450 MW or 15 percent of connected load was AI-specific in 2025, this share is set to rise to 30–35 percent by 2029, corresponding to roughly 1,300–1,500 MW of AI capacity. The size of individual AI projects will continue to increase: where 50–100 MW per site counts as typical hyperscale size today, 200–400 MW per site will become the new normal.

The first AI gigafactory under the EuroHPC initiative is expected to come online by 2028/29. The 805 million euros earmarked in the special-purpose infrastructure fund for a German AI gigafactory should be deployed by then, and one of the bidding sites — Munich, Stuttgart, Cologne/Bonn and Magdeburg/Saxony-Anhalt are under discussion — is expected to be realized. The facility will be designed for compute in the multi-hundred-MW range and will be equipped with tens of thousands of GPUs of the latest generation.

13.1.3 Energy consumption and efficiency

German data centers' electricity consumption will move toward around 28–30 TWh in 2029, from 21.3 TWh in 2025. This equates to about 5 percent of total German electricity consumption — an increase of roughly one-third within four years. Energy efficiency will improve noticeably as EnEfG requirements take effect: average PUE will fall from 1.43 (2025) to about 1.40 (2029), driven by obligations on new facilities, voluntary modernisation and the growing use of liquid cooling.

Renewable shares will increase, although the EnEfG's "100 percent renewable from 2027" requirement will be met purely on a balance-sheet basis through green-power certificates. Physical supply with renewable electricity — particularly at times of low solar and wind — will in part continue to draw on grid electricity that includes fossil shares. Self-supply models (PPAs, own generation) will grow but remain difficult and expensive, especially for mid-sized sites.

13.1.4 Infrastructure and permitting

Structural bottlenecks — grid connection, urban land-use planning and fiber access — will be only partly eased within the three-year period. The federal government's measures from the 2026 data center strategy will start to take effect by 2027/28, but the structural problems — particularly in the high-voltage grid — cannot be solved within three years. Tennet and the other transmission system operators will expand grid capacity with substantial investment, but full removal of today's connection bottlenecks will only be achieved in the 2030s.

The positive signal: the EnEfG amendment of April 2026 and the parallel acceleration initiative could shorten approval times for new facilities from today's average of 24 to 36 months to 12 to 18 months — but only if the procedural simplifications foreseen in the strategy are truly implemented.

13.2 Medium-term outlook: to 2031 (5-year horizon)

In the five-year horizon to 2031, the structural transformation of the German data center market will deepen. AI demand will become the dominant market force, new locational patterns will assert themselves, and energy and heat integration will become an integral part of siting planning.

13.2.1 Capacity: doubling vs. 2025

By 2031, installed IT load should reach 5,000–6,000 MW — close to twice as much as 2025 (3,000 MW) and in line with the federal government's "double capacity by 2030" target. That implies average annual growth of 10–13% over five years — a historically unprecedented pace, only sustainable on the combined pull of the AI boom, cloud migration, regulatory demand (GDPR, NIS2), and the broader digitization of industry.

Bitkom and Borderstep assume in their forecasts that the AI share will rise to around 40 percent by 2030 (approximately 2,020 MW) — a fourfold increase from 2025. By 2031 this share will likely climb to 45–50 percent. The remaining capacity is distributed across classical cloud workloads (about 30 percent), enterprise-owned and colocation applications (about 15 percent) and edge and specialty data centers (about 10 percent).

13.2.2 Liquid cooling as the new standard

By 2031, liquid cooling — particularly direct-to-chip — will have become the industry standard in the hyperscale and HPC segments. Where less than 20 percent of newly installed hyperscale capacity is liquid-cooled today, the share will rise above 60 percent by 2031. Rack densities will evolve accordingly: where 80–150 kW per rack counts as typical for AI workloads today, 1 MW per rack will be possible by 2028, with average values of 500–800 kW per rack realistic in the AI segment by 2031.

This development has several important implications. First, building-infrastructure requirements change fundamentally — large air-handling ducts will give way to liquid lines, pumping stations and heat exchangers. Second, heat recovery and reuse becomes significantly easier, as outgoing temperatures of 50–70 °C are markedly higher than with air cooling (typically 25–30 °C). Third, maintenance and service concepts change substantially — leakage, water quality and pumping engineering become central topics.

13.2.3 Heat integration as a standard requirement

With the EnEfG waste-heat requirements taking effect from 2027 — 15 percent from mid-2027, 20 percent from mid-2028 — and heat extraction made markedly easier by liquid cooling, heat integration will become a standard part of new data center projects by 2031. Early lighthouse projects such as the Telehouse data center in Frankfurt (supplying heat to the Frankfurt municipal nursery and swimming pool), the Eurotheum tower or the heat extraction at Norderstedt will become the rule rather than the exception.

Economic viability, however, depends critically on the availability of suitable heat off-takers — residential neighborhoods, commercial parks, swimming pools, greenhouses or low-temperature industrial processes. In rural regions without such off-takers, the 20 percent quota will remain achievable only with considerable effort. The federal government therefore plans, in its 2026 strategy, to support "energy hubs" — integrated concepts combining the data center, district heating and possibly hydrogen production.

13.2.4 Geographic diversification

The strong concentration around Frankfurt will weaken by 2031. Where Hesse accounted for almost 38 percent of total connected load in 2025, its share is likely to fall to around 30–32 percent by 2031. Drivers are: (1) grid bottlenecks and rising land prices around Frankfurt, (2) targeted siting policy by structurally weaker federal states such as Mecklenburg-Western Pomerania, Saxony-Anhalt and Brandenburg, (3) latency requirements for edge and industrial AI applications that force geographic distribution, and (4) the policy goal of concentrating capacity in regions with high renewable shares.

Concretely, by 2031 the following new data center clusters are expected to have gained substantial weight: the Berlin/Brandenburg cluster (AWS Sovereign Cloud, local hyperscalers), the Munich region (Industrial AI Cloud; Apple as adjacent chip / R&D infrastructure), the Cologne/Bonn–Düsseldorf axis (Microsoft, Google) and, as a new location, northern Germany with large projects in Mecklenburg-Western Pomerania (Dummerstorf) and Schleswig-Holstein.

13.2.5 Electricity consumption approaches the 40-TWh mark

German data centers' electricity consumption will reach 35–40 TWh by 2031 if capacity grows in line with the assumptions above. The share of total German electricity consumption thus rises to 6–7 percent. Although specific energy intensity per MW of installed IT load falls thanks to improved efficiency, this is more than offset by absolute capacity growth.

This development will further sharpen the debate on energy infrastructure. The Federal Network Agency and the TSOs will be forced to allocate larger reserves for data centers in their grid development plans. By 2031 the first pilot projects for direct use of baseload energy from geothermal or small modular reactors (SMR) may already be at concept stage — even if actual commissioning is expected only after 2031.

13.3 Long-term outlook: to 2036 (10-year horizon)

The 10-year horizon to 2036 allows only statements with considerable uncertainty bands. From today's vantage point, however, plausible trajectories can be sketched out that delineate the corridor of possible developments.

13.3.1 Capacity: a 8–12 GW target corridor

By 2036, installed IT connected load in Germany will lie in a range of 8 to 12 GW. The lower bound of 8 GW reflects a continuation of the historical growth trend with moderate flattening; the upper bound of 12 GW would require sustained high growth of 10 to 12 percent per year, driven by broad AI adoption across all sectors, significant edge-computing demand in industrial applications, and the success of the politically intended European sovereignty strategy.

The lower scenario (8 GW) would represent a sixfold increase from 2010 and around a tripling from 2025. Even in this conservative case, Germany would exceed the around-4.8-GW level for 2030 forecast by industry association eco. In the upper scenario, German capacity would be at the level of today's Northern Virginia (US) and would make Germany the clear leading data center location in Europe.

13.3.2 Post-FLAP: structural shift in the European hub landscape

The currently dominant FLAP-D constellation (Frankfurt, London, Amsterdam, Paris, Dublin) will shift in character by 2036. Several factors contribute: (1) grid bottlenecks and political siting moratoria in Amsterdam, Dublin and parts of Frankfurt are pushing growth to secondary locations; (2) AI demand requires more flexible, larger facilities that can no longer be built at the dense inner-city sites; and (3) strategic diversification — cloud sovereignty — leads to deliberate distribution of compute capacity across more locations.

By 2036, Europe will likely develop a two-tier model: at the top, the FLAP-D locations continue as connectivity and latency hubs, supplemented by Madrid, Milan and Berlin as new peer-level connectivity nodes. Beneath them a second tier of compute-oriented locations will establish — in the German context above all Mecklenburg-Western Pomerania, Brandenburg, Bavaria and Saxony-Anhalt — attractive mainly through energy availability, land and public-support programs.

13.3.3 AI sovereignty as a long-term strategic factor

By 2036, the question of European AI sovereignty — the ability to train and operate AI models independently — will largely be settled. The AI gigafactories now being launched with substantial public funding (EuroHPC initiative with up to five European sites) will by then either be established and enable independent models and applications, or they will have been overtaken by the momentum of US and Chinese hyperscalers.

In the success scenario, Germany has three to five gigawatt-scale AI gigafactories in 2036, embedded in European research and industrial applications and used commercially. In the pessimistic scenario, by contrast, these facilities are filled with US hardware (NVIDIA) and Chinese software (or vice versa) and serve primarily as compute capacity for global hyperscaler models. Which scenario materializes is crucially dependent on the political consistency with which the sovereignty measures announced in the 2026 data center strategy are implemented.

13.3.4 Energy infrastructure: new concepts and the SMR debate

At the assumed growth to 8–12 GW of IT load by 2036, German data centers' electricity consumption will rise to 60–90 TWh — equivalent to 10–15 percent of projected total German electricity consumption after the energy transition. The long-term Borderstep forecast of 80 TWh by 2045 would thus be significantly exceeded.

These orders of magnitude will force a re-evaluation of energy infrastructure. Several concepts will likely be under discussion or already in pilot deployment by 2036: (1) dedicated onshore wind farms or solar installations directly for data center campuses, often combined with hydrogen storage; (2) large-scale geothermal projects for baseload supply of large sites, particularly in geologically suitable regions such as Bavaria and Brandenburg; (3) pilot projects for small modular reactors (SMR) — politically sensitive in Germany given the nuclear phase-out, but already being implemented in the UK, France and the US; (4) integrated concepts combining the data center, hydrogen production (electrolysis with own power) and a heat network as "energy hubs" that bundle multiple supply functions.

In political debate, data centers will almost certainly have become a central topic of the energy transition by 2036. The conflicts already visible today between industrial competitiveness, climate goals and security of supply will sharpen if the sector indeed claims double-digit shares of electricity consumption.

13.3.5 Technological disruption: quantum computing and neuromorphic chips

On a ten-year horizon, technological leaps can also shift market structure. Quantum computers will become commercially relevant by 2036 for selected applications (cryptography, materials research, certain optimization problems) and will be run in specialized data centers — probably as a cloud service via the established hyperscalers. Today's first commercial quantum computers at research institutions such as Forschungszentrum Jülich or the Leibniz Supercomputing Center will be expanded into larger installations.

Neuromorphic chips — specialized processors modelled on the human brain with significantly higher energy efficiency for certain AI tasks — could partially displace today's dominant GPU architectures for inference workloads by 2036. Initial commercial vendors such as Intel (Loihi), IBM (TrueNorth) or European players such as SpiNNaker (University of Manchester) are already on the market. A broad breakthrough would drastically improve the AI-inference energy balance and thus reduce growth pressure on data center capacity.

13.3.6 Consolidation and new business models

On the ten-year view, market consolidation is also expected. Where over 2,000 data centers exist today and the market is shaped by many regional and mid-sized providers, three trends will reshape structure by 2036: (1) progressive concentration on hyperscalers and large colocation providers that can realize economies of scale; (2) the gradual decommissioning of small enterprise-owned data centers whose workloads migrate to the cloud; (3) the specialization of mid-sized providers in niches such as edge computing, high-security data centers (e.g. for government) or sector solutions (financial services, healthcare).

New business models will emerge. The merger of energy generation and data processing — "compute-to-power" or "power-to-compute" — will bring new players onto the field. Energy utilities will enter the data center market (RWE and EnBW have already signaled interest), and data center operators will build their own generation assets. Industrial companies will run their digital twins and AI applications increasingly on their own edge data centers rather than entirely in the cloud.

13.4 Summary forecast

The following table summarizes the core points of the outlook scenarios for the three time horizons.

Indicator	2025 (actual)	2029 (3 yr)	2031 (5 yr)	2036 (10 yr)
IT connected load	3,000 MW	4,000–4,500 MW	5,000–6,000 MW	8,000–12,000 MW
Energy consumption	21.3 TWh	28–30 TWh	35–40 TWh	60–90 TWh
Share of electricity consumption	approx. 4 %	approx. 5 %	6–7 %	10–15 %
AI share of capacity	15 %	30–35 %	45–50 %	55–65 %
Average PUE	1.43	approx. 1.40	approx. 1.30	approx. 1.20
Hesse share	38 %	approx. 35 %	30–32 %	25–28 %
Liquid cooling share (hyperscale)	< 20 %	approx. 35 %	approx. 60 %	> 80 %
AI gigafactories in DE	0	1 (in construction / commissioning)	1–2 operational	3–5 operational

Table 7: Forecast corridor for the development of the German data center market 2025–2036. Sources: Bitkom/Borderstep 2025, German Federal Government's Data Center Strategy 2026, own extrapolations7

14 Recommendations for action

Concrete recommendations for the central groups of actors can be derived from the preceding chapters. The recommendations are organized by addressee and prioritize measures that can take effect in the short term (within 12 to 24 months) or are of central strategic importance for Germany's medium- to long-term competitive position.

14.1 Recommendations for policymakers

Political framework conditions will largely decide whether Germany defends, expands or loses its position as Europe's second-largest data center location. The federal government's data center strategy of March 2026 sets the right thrust, but its effectiveness depends on the consistent implementation of the individual measures.

14.1.1 Accelerating permitting procedures

The average permitting time of 24 to 36 months must be reduced to a maximum of 12 to 18 months. Concrete measures include: statutory binding processing deadlines for authorities, with "deemed approval" if these are exceeded; the establishment of one-stop shops at state level in which all relevant permits (planning, immission control, water law, grid connection) are processed in a bundled manner; preparation of "DC-ready" land-use plans in cooperation with municipalities, so that investors can draw on pre-vetted sites; and recognition of data centers as infrastructure in the "overriding public interest", comparable to transmission lines or renewable-energy installations.

14.1.2 Grid expansion and connection capacity

Grid connection is the binding constraint of the next few years. The required measures include: bringing forward expansion of the transmission and distribution grids in the main data center regions; establishing a transparent connection-waiting-list system with clear priority criteria; supporting local self-supply models (PPAs with direct lines, own generation assets); and developing the regulatory framework further for "compute-to-power" concepts in which data centers source power directly from the producer without burdening the public grid.

Hesse's Tennet capacity situation in particular needs a focused political response.

The proposals already discussed in the Bundestag to give priority to "critical digital infrastructure" at grid connection should be implemented swiftly.

14.1.3 Promoting AI sovereignty

The EuroHPC AI Gigafactory initiative offers a unique opportunity to substantively strengthen German and European AI sovereignty. Germany would do well to step up its efforts to attract more than one of the up-to-five European facilities. The 805 million euros earmarked in the special-purpose fund should be deliberately leveraged with private funds and EU co-financing so that a facility in the single-digit billion-euro range can be realized.

In parallel, financing of AI models and AI applications of European provenance should be supported — hardware alone is worthless without them. Research funding for German and European AI players (Aleph Alpha, Mistral AI, Helsing, Black Forest Labs) should be significantly intensified.

14.1.4 Energy-policy flanking

The EnEfG requirements are in principle ambitious and right, but individual aspects — particularly the rigid waste-heat quota — should be reviewed. The April 2026 amendment slightly softening the PUE target for new facilities is appropriate. A strict separation between technically sensible efficiency requirements and political symbolic targets is advisable.

In the medium term, the debate on the energy base of data centers — including geothermal, hydrogen and, where appropriate, SMRs — must be conducted with an open outcome. An ideologically constrained debate would jeopardize Germany's competitive position, since other European countries (France, the UK, Sweden) are already acting here.

14.2 Recommendations for the private sector

14.2.1 For data center operators

Operators should commit early to liquid-cooled infrastructure: it's becoming the market standard, and pure-air-cooled facilities will lose value. For new builds, treat the EnEfG limits as a floor, not a ceiling — tighter rules in the 2030s are likely.

The development of new locations should be actively pursued beyond the established FLAP-D hubs. Early positioning in emerging regions such as Brandenburg, Saxony-Anhalt or Mecklenburg-Western Pomerania promises long-term value appreciation, provided infrastructure access can be secured. Partnerships with local energy producers and heat off-takers should be factored into site planning from the outset.

14.2.2 For corporate users

Industrial users should align their AI and cloud strategies around resilience and sovereignty. A multi-cloud approach with targeted use of European cloud providers — T-Systems, IONOS, OVHcloud, Schwarz Digits, STACKIT — cuts the dependence on US hyperscalers. Given the political risks (CLOUD Act, geopolitical tensions), it's a sensible default. For sensitive data and mission-critical workloads, European options should be the first choice, not the fallback.

Edge computing will gain growing importance in industrial applications (Industry 4.0, autonomous systems, connected production). Companies should set up pilot projects early and design their data architectures around hybrid models combining edge, private cloud and public cloud.

14.2.3 For energy utilities

The data center industry offers significant strategic opportunities for energy utilities. The development of dedicated offerings — long-term supply contracts, direct lines, integrated heat solutions, own data center investments — should be intensified. Utilities with substantial renewable-generation capacity in structurally weaker regions can use this purposefully to attract data centers, combining the two business areas synergistically.

14.3 Recommendations for public administration and municipalities

Municipalities and state authorities are often the first point of contact for investors and therefore decisive for the competitiveness of German locations. Establishing dedicated siting teams with data center expertise in the economic development agencies — accompanying investors through every phase of permitting and realization — is recommended. The proactive provision of pre-vetted industrial sites with secured grid connections substantially reduces realization times.

Municipal participation in the economic success of data centers — through trade taxes, heat integration into municipal grids, or stakes in energy companies — should be designed transparently and predictably. This increases public acceptance and creates long-term ties between investors and locations.

In rural regions, heat-integration concepts should be developed actively to make the EnEfG requirements achievable for investors. This can be done through municipal heat networks, commercial parks with integrated heat off-takers, or cooperation with agricultural operations (greenhouses, drying facilities).

14.4 Recommendations for research and education

The skills shortage is a structural problem that limits the growth prospects of the entire industy.

Recommendations include the targeted expansion of dual vocational training paths in data center technology, the establishment of specialized university degree programs (Data Center Engineering, Sustainable Computing), support for continuing-education offerings for career changers, and stronger international recruitment of qualified personnel.

Research into energy-efficient data center technologies should be intensified. Topics such as immersion cooling, heat pumps with high lift temperatures, neuromorphic and photonic computing architectures, and integrated energy-compute systems offer significant innovation potential in which German and European research can take a leading position.

15 Conclusion

Germany's data center market is at a turning point. The 3,000 MW threshold of installed IT connected load crossed for the first time in spring 2026 is more than a number — it signals a deeper shift. What used to be a latency-driven cloud market is becoming something else: An AI-centric, energy-intensive, politically shaped data center market aspiring to top positions in Europe.

This study's analysis paints a nuanced picture. On the asset side stand an unprecedented investment volume of around €12 billion of IT investment and €3.5 billion of construction investment in 2025, a strong market position in international comparison (Frankfurt as the largest European hub), substantial locational advantages (central position, strong connectivity, legal certainty, qualified workforce) and significantly improved political attention, expressed in the 2026 Data Center Strategy.

On the liabilities side stand substantial structural challenges: lengthy permitting procedures, grid-connection bottlenecks (especially in Hesse), high energy prices in international comparison, the skills shortage, and under-developed capacity in AI hardware and sovereign AI models. These weaknesses are essentially solvable but require consistent political and entrepreneurial efforts over the coming years.

The outlook for the next three, five, and ten years is cautiously optimistic. Doubling capacity by 2030/31 looks realistic; tripling by 2036 is within reach. The AI share will quadruple or quintuple. Efficiency will improve noticeably. New site patterns beyond the traditional FLAP-D region will establish themselves. The question isn't whether Germany grows — it's how fast, and with how much strategic substance.

Against the US and China, Germany only has a competitive position by acting through Europe. The levers are clear: the EuroHPC AI Gigafactory initiative, the cloud sovereignty push, and active support for European AI ecosystems. A purely national play, at the scale of the global game, would be doomed to failure from the start.

For the German economy — operators and industrial users alike — the strategic imperatives are clear. Invest early in the technologies that win the next round (liquid cooling, AI infrastructure, heat integration). Diversify beyond the established hubs. Build sovereign European cloud and AI capabilities. And get actively involved in shaping the policy environment, rather than waiting for it.

The next ten years will decide Germany's place in the global data center market. The starting conditions are good, the opportunity is substantial, and the obstacles are equally so. Whether Germany takes this chance to consolidate and extend its European lead comes down to three things: how quickly and decisively the projects in the Data Center Strategy get done, whether the energy infrastructure can keep pace with digital demand, and whether the political will for European sovereignty holds up as the geopolitics shift around it.

This study sketches an industry on the move — with real opportunity, identifiable risks, and a future that is genuinely up for grabs. The next few years will set the direction.

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Methodological note

The figures, trends and forecasts cited in this study were prepared on the basis of information available as of the cut-off date of 4 May 2026. Some investment figures concern announced but not yet fully realized projects; actual implementation may occur over a longer time frame, at different amounts or in altered configurations. Forecast figures are subject to the usual uncertainties of trend extrapolation and expert-based estimates. Where possible, data points were cross-checked against multiple independent sources. The study does not claim completeness of source coverage; rather, it presents an integrated analysis based on the essential information available.

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List of abbreviations

AI — Artificial Intelligence

AWS — Amazon Web Services

BMDS — Federal Ministry for Digital Affairs and State Modernization

BMWE — Federal Ministry for Economic Affairs and Energy

CapEx — Capital Expenditure

DC — Data Center

GDPR — General Data Protection Regulation (German: DSGVO)

EnEfG — Energy Efficiency Act (Energieeffizienzgesetz)

ERF — Energy Reuse Factor

EuroHPC — European High Performance Computing Joint Undertaking

FLAP-D — Frankfurt, London, Amsterdam, Paris, Dublin

GPU — Graphics Processing Unit

HPC — High Performance Computing

IaaS — Infrastructure as a Service

SMEs — Small and medium-sized enterprises

MW / GW — Megawatt / Gigawatt

NIS2 — Network and Information Security Directive 2 (EU directive)

PaaS — Platform as a Service

PPA — Power Purchase Agreement

PUE — Power Usage Effectiveness (data center efficiency metric)

DC — Data Center (German: Rechenzentrum)

SaaS — Software as a Service

SMR — Small Modular Reactor

TWh — Terawatt-hour