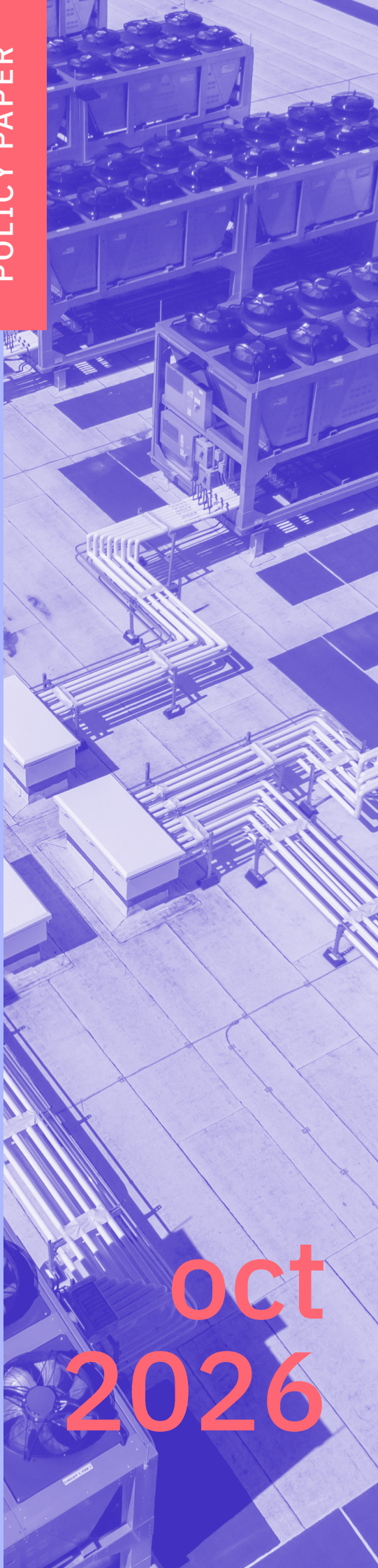


A European Compact for AI Infrastructure building capacity, sharing responsibility



oct
2026

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Executive summary

Europe's artificial intelligence (AI) ambitions and its energy transition have become part of the same infrastructure challenge. The central question is not simply how quickly Europe can add data-centre capacity, but what kind of computing capacity it needs, where it should be located, how it should be powered, who should pay for the infrastructure it requires and how the benefits should be shared.

This paper examines how Europe can develop a holistic approach to the expansion of computing capacity, creating the greatest system value, while protecting energy security, affordability and its climate goals. It proposes a European Compact for AI Infrastructure to organise shared responsibilities between public authorities, network operators, developers, energy providers and communities.

Europe should accelerate the development of AI infrastructure that is strategically important, but this should be based on shared responsibility. Public authorities should provide clearer information on planning, permits and grid capacity. Developers should show that their projects are ready, provide credible demand forecasts, contribute to the infrastructure they require, offer flexibility where possible, and use energy, water and land responsibly, creating tangible benefits for host communities. The proposed European AI Infrastructure Compact would organise this mutual commitment, by linking faster access for AI infrastructure to clear responsibility on the energy system and its relationship with local communities.

Europe faces gaps in investment and advanced computing, alongside dependence on foreign cloud providers and chips. Installing more capacity alone does not guarantee European access or strategic autonomy. Europe's strengths include interconnected electricity networks, low-carbon generation, research and industrial expertise. Public procurement, research infrastructure and targeted support should build on these strengths. Progress should be measured through computing performance, ownership and control, and access for European researchers and businesses.

Grid connections are a central constraint. Data centres can be built faster than the networks needed to supply them, while uncertain demand complicates investment. Transparent readiness criteria should prevent stalled projects from reserving capacity indefinitely. Developers should share credible forecasts, while network operators should publish information on capacity and constraints. Transparent planning models and independent European scrutiny can improve decisions. New infrastructure should be combined with storage, digital tools and flexible connections that make better use of existing grids while maintaining security.

Public and private finance will both be needed. Large electricity users should contribute fairly to the infrastructure required to serve them, with safeguards for households and smaller consumers. Projects should be rewarded for verified benefits, including reduced congestion and useful flexibility.

Location and design shape environmental outcomes. Common siting criteria should consider grid capacity, clean electricity, water stress, land use, connectivity and

realistic demand for recovered heat. Performance standards must account for trade-offs between electricity efficiency and water use under local conditions.

AI can help improve the energy system through better forecasting, planning, congestion management and permitting. European initiatives such as AI.grids support work on shared tools. Turning this potential into results requires compatible data systems, cybersecurity, combined energy and digital skills, and regulatory incentives that reward effective digital investment.

Local participation is important. Communities need clear information and opportunities to shape projects before decisions are settled. Local authorities need support to negotiate and monitor commitments on water, land, noise and community benefits. Financial contributions should complement participation, with benefits accessible across income groups.

The proposed compact brings these recommendations together around four pillars: project readiness and accountability; transparency; responsibility for system and resource use; and local legitimacy. Authorities and network operators would offer clearer requirements and faster, more predictable decisions. Developers would commit to credible projects, information sharing, fair infrastructure contributions, flexibility, efficient resource use and local benefits. Building on tripartite agreements and proposed acceleration zones, the compact would identify responsible actors, deadlines and verification methods. Commitments would be recorded in relevant permits and agreements, with corrective action and proportionate consequences if they are missed. Its purpose is to establish a whole-of-society, whole-of-economy approach to data centre expansion.

Key recommendations

- 1. Build strategically useful and accessible European computing capacity.** The European Commission should incentivise the direction of public procurement, research infrastructure and targeted support towards capabilities where Europe has strengths or clear strategic needs. Public authorities should measure progress through usable computing performance, access for European researchers and businesses, ownership and control, and infrastructure resilience and sustainability.
- 2. Make grid connections faster, more predictable and accountable.** Apply transparent project-readiness criteria and milestones so stalled applications do not reserve capacity indefinitely. Enable flexible connections where technically feasible, establish common technical requirements for significant loads and report the causes of delays and who is responsible for resolving them.
- 3. Build coordinated grid planning on reliable, shared information.** Incentivise transparency by making information on consumption and capacity reciprocal between data centre and grid operators. TSOs would be able to aggregate high-level, long-term demand signals from large users to justify grid expansion, and request system operators to publish detailed locational information, for instance as it takes place in the Irish case. Use transparent, replicable planning models and independent scrutiny at European level to assess demand, compare infrastructure options and improve investment decisions.

- 4. Allocate system costs fairly and reward verified benefits.** National authorities should establish clear agreements and incentivise developers' contributions to the infrastructure required to serve them, with safeguards for households and smaller consumers. Recognise flexibility, suitable location and other contributions according to the measurable benefits they provide.
- 5. Set data-centre performance requirements that reflect overall resource use.** The European Commission should design minimum standards that account for the relationship between electricity efficiency, water use and local conditions.
- 6. Turn AI and digitalisation into practical energy-system improvements.** Enable network operators to recover justified costs and benefit from cost-effective digital tools, grid-enhancing technologies and flexibility. The European Commission should support schemes for interoperable energy data, collaborative AI applications and the combined energy and digital skills needed to deploy them.
- 7. Guide data-centre development towards locations that deliver the greatest overall value.** Establish common siting criteria covering grid capacity, clean electricity, water stress, realistic heat demand, land use and connectivity. Require proposed acceleration zones to reflect these criteria and regional infrastructure plans, while maintaining a route for viable projects outside those zones.
- 8. Give host communities a meaningful role and a fair share of benefits.** Use locally adapted tripartite agreements to define responsibilities for local impacts, participation and measurable benefits. Equip local authorities to negotiate and monitor commitments, and establish common principles for fair benefit sharing. Faster development should preserve meaningful participation, and financial contributions should not replace it.

Introduction

Europe's AI ambitions have become inseparable from its energy choices. Every model trained and every AI-enabled service deployed will depend on physical computing capacity, electricity networks, cooling systems, land, water and skilled workers. The policy question, in addition to how much computing capacity Europe can build, is related to the kind of capacity required, where it should be located, how it should be powered and who should bear its costs and share its benefits.

Between February and July 2026, Friends of Europe convened three coordinated and bespoke meetings on AI and the energy system with the purpose of fostering new thinking, addressing bottlenecks and concerns from various stakeholders and devising recommendations to strengthen the development of AI computing in Europe. This project sat within the broader stream of activities that Friends of Europe is undertaking to bolster a competitive, fair and secure green transition. The process brought together senior representatives from European and international institutions, national and local authorities, the energy and technology sectors; grid operators and civil society.

The working group series sought to include various perspectives and create a frank discussion guided by these questions:

- As Europe faces pressure on different priorities, such as competitiveness, energy security, a shifting geopolitical environment and achieving climate neutrality, how do grids fit in this very complex equation?
- What are the roles and responsibilities of AI industry actors as large electricity users?
- What role should grid operators, utilities and other energy sector actors have in managing the expansion of AI-focused data centres and how can collaboration across the ecosystem speed up connections?
- How can the energy system become better integrated and more coherent at European level and what would be the appropriate governance models?
- How can Europe ensure that rising data centre infrastructure supports affordability, resilience and local communities?

This report distils the evidence and arguments emerging from those exchanges and tries to contextualise this evidence with the renewed calls for greater European action on AI to foster prosperity, sovereignty and security. It does not argue for speed at any cost, but it rather argues that Europe can reduce delays and expand strategically valuable computing capacity while maintaining grid security, accelerating decarbonisation, protecting consumers and creating a fair bargain with the communities that host new infrastructure.

A European Compact for AI Infrastructure

This paper calls for the development of a European Compact for AI Infrastructure, which can be understood as a common framework of commitments between public authorities, network operators, AI and data-centre developers, energy providers and affected communities.

This compact supports the renewed calls for greater European action on artificial intelligence by including a concept of shared responsibilities among the key actors involved in this process, by which Europe can accelerate the development of AI infrastructure in Europe while maintaining the direction of the clean energy transition, maintaining grid security, accelerating decarbonisation, protecting consumers and creating a fair bargain with the communities that host the new infrastructure.

This European Compact for AI infrastructure is organised around four key pillars:

- 1.** Project readiness and accountability
- 2.** Transparency between developers and public authorities
- 3.** Responsibility for system and resource use
- 4.** Local legitimacy

Public authorities would offer more predictable and faster decisions. In return, developers would commit to project readiness, transparency, a fair contribution to system costs, flexibility, efficient use of resources and local benefits. Such a compact would have the objective of detailing requirements across all responsible actors to ensure a better coordinated process, fewer avoidable delays and clearer requirements, so that the planning process can be evaluated with a holistic approach.

In the application of this compact, which would be coordinated by the European Commission in collaboration with public authorities, each commitment should be linked to a specific deadline and verification method, to be recorded in the relevant permit, connection agreement, funding agreement or local agreement. Missed commitments should trigger corrective action and proportionate consequences defined by the agreement among the responsible actors.

The compact would provide a common framework for implementing the Commission's tripartite agreements and the data-centre acceleration zones proposed under the Cloud and AI Development Act. Tripartite agreements would bring the relevant parties together to agree local commitments. Acceleration zones would support coordinated planning and faster development in suitable locations. The compact would connect these processes through shared responsibilities and a consistent approach to monitoring delivery.

Its added value would be accountability on both sides of the bargain. Developers would demonstrate progress on project readiness, resource use and local benefits. Public authorities and network operators would report on their own commitments, including decision dates, capacity information and infrastructure delivery. Each participating project would have a coordinated record of these commitments, with a named responsible party, deadline and verification method. The record would identify the permit, contract or agreement governing each obligation and the steps to take if it is missed.

This framework could be used within acceleration zones and for projects elsewhere. It would follow projects from planning through construction and operation, allowing commitments to be reviewed when circumstances change. This monitoring process would allow investors, authorities and communities to understand what has been promised and what has been delivered.

Pillar	What public authorities and network operators offer	What developers and their partners commit to	Indicators of delivery
1. Project readiness and accountability	Permitting authorities provide coordinated procedures, clear requirements and predictable decision dates. Network operators provide connection milestones and transparent rules for allocating capacity to credible projects.	Developers demonstrate site availability, credible financing and a realistic delivery schedule. They meet agreed milestones, disclose delays and release capacity they no longer need.	Time taken to decide complete applications; milestones met by developers and network operators; capacity commissioned against capacity reserved; unused reservations released.
2. Transparency between developers and public authorities	Public authorities and network operators publish decision criteria, usable information on grid capacity and constraints, and expected infrastructure developments. They provide a secure route for sharing commercially sensitive information.	Developers and operators provide standardised demand forecasts, phased connection needs and information on resource use and flexibility. They update these when plans materially change.	Completeness and timeliness of disclosures; frequency of network-information updates; forecast demand compared with actual demand, with explanations for differences; availability of public performance information.
3. Responsibility for system and resource use	Network operators and regulators assess options for using existing capacity and offer flexible connections where feasible. Public authorities provide clear environmental requirements and transparent cost-allocation rules. Verified system benefits receive appropriate recognition.	Developers, energy suppliers and service partners contribute fairly to enabling infrastructure, deliver agreed flexibility, use electricity and water efficiently, and fulfil clean-energy and viable heat-reuse commitments.	Agreed infrastructure contributions paid; flexibility delivered when requested; separate efficiency indicators for water and energy use; clean-energy commitments fulfilled; useful heat supplied; compliance with operating limits.

Pillar	What public authorities and network operators offer	What developers and their partners commit to	Indicators of delivery
4. Local legitimacy	Local and regional authorities organise early participation, coordinate relevant services and provide transparent planning decisions. They help communities assess proposals and monitor agreed commitments	Developers and project partners involve communities while choices remain open, address local impacts and deliver agreed benefits. Commitments continue through construction and operation	Evidence that participation influenced decisions; local impacts against agreed limits; community benefits delivered against promises; access to benefits across income groups; complaints addressed and commitments fulfilled.

1. Development of computing in Europe for the “AI Race”

The approach of the European Union to Artificial Intelligence (AI) has been multifaceted, centred on a risk-based framework developed through the AI Act. The European Commission and national authorities have recently started the enforcement of measures that ensure transparency, the protection of fundamental rights, and safety in the development and utilisation of AI systems¹.

At the same time, the approach of European institutions has also addressed the benefits and opportunities offered by the transformative potential of AI technology and what Europe stands to lose by not investing in this technological revolution. With the publication of the AI Continent Action Plan, the European Commission “is committed and determined to become a global leader in artificial intelligence, a leading AI continent”, positioning AI as a critical question of competitiveness, security and innovation². A key objective of the Action Plan is to triple data centre capacity in Europe by 2035, demonstrating how data centres are increasingly viewed by policymakers as critical infrastructure to reap the benefits of the AI economy.

The risks of increasing dependence on third-country providers and inability to benefit from digital transformation are well represented in the proposal for a Cloud and AI Development Act, published by the Commission in June 2026. This proposal presents various actions in three key areas:

- **Research, development and innovation;**
- **Capacity;**
- **Autonomy³.**

In these three areas, the European Union faces important constraints to close the gap with other global actors and to become competitive across the whole AI value chain:

Research, development and innovation

In the current context, Europe lags severely behind in the development of foundational models and in the capacity of European AI companies to attract investments from the EU’s capital markets, which makes Europe at risk of depending on AI models designed abroad. Europe is well below United States and Chinese firms for R&D expenditure in software and internet, technology hardware and electronic equipment. Equally, even though the EU cloud market size is projected to rise, EU providers maintain a very low market capitalisation and market share compared to the main US providers⁴.

¹ Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act), [2024], OJ L, 2024/1689, <https://eur-lex.europa.eu/eli/reg/2024/1689/oj>

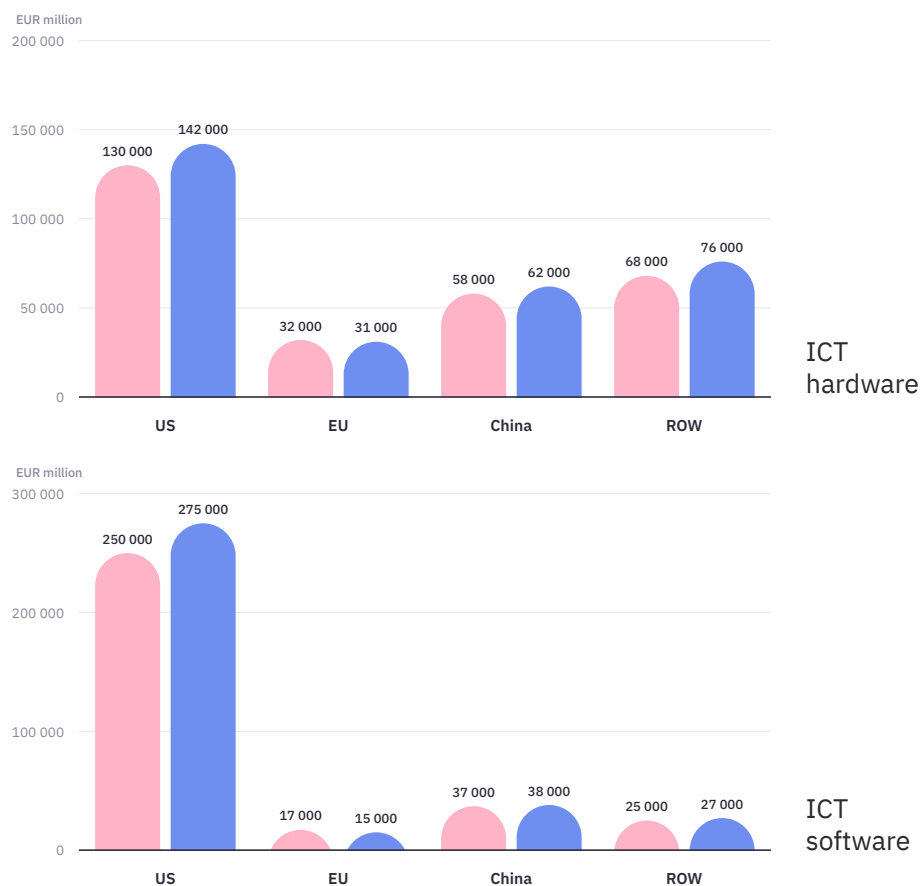
² COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS AI Continent Action Plan, [2025], COM/2025/165 final, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52025DC0165>

³ Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing a framework of measures for strengthening Europe’s cloud and AI ecosystem (Cloud and AI Development Act), [2026], COM/2026/502 final, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52026PC0502>

⁴ Draghi, M. (2024). “The Future of European Competitiveness—A Competitiveness Strategy for Europe”. September.

The graph below shows the latest data available from the 2025 EU Industrial R&D Investment scoreboard, which provides detailed financial information about the world's top 2000 corporate R&D investors. As of the 2025 Scoreboard, these 2000 investors account for 90% of global business R&D.

**Figure 1 –
Business
Investment in
ICT hardware
and ICT
software of top
2000 global
companies (in
EUR Millions)**



Source: 2025 EU Industrial R&D Investment scoreboard

The rate of digital investments in the euro area has shown a substantial positive growth between 2014 and 2024, surpassing the overall GDP growth rate by more than three times and showing a higher growth rate compared to the rate of total business investment growth⁵. However, the share of digital investment over total investment in the euro area remains only 13%, compared to the 27% of the United States by 2025⁶. The gap is considered to be a major factor in explaining why the United States has been able to outperform other OECD economies in productivity and accumulation of digital capital, which is currently considered one of the key drivers of productivity growth⁷.

⁵ Lane, P. (2026). "[AI and the euro area economy](#)". Keynote speech at ECB-SAFERCEA International Conference on the Climate-Macro-Finance Interface (3CMFI). 23 March.

⁶ Ferrando, A., Lamboglia, S., Rariga, J., & Schmidt, M. (2026). "[Adoption and investment in AI across the euro area](#)". European Central Bank, No 395.

⁷ Gal, P. et al. (2026). "[Business investment in the face of the digital transformation: Initial evidence](#)", OECD Economics Department Working Papers. No. 1859. OECD Publishing. Paris. 10 March.

Capacity

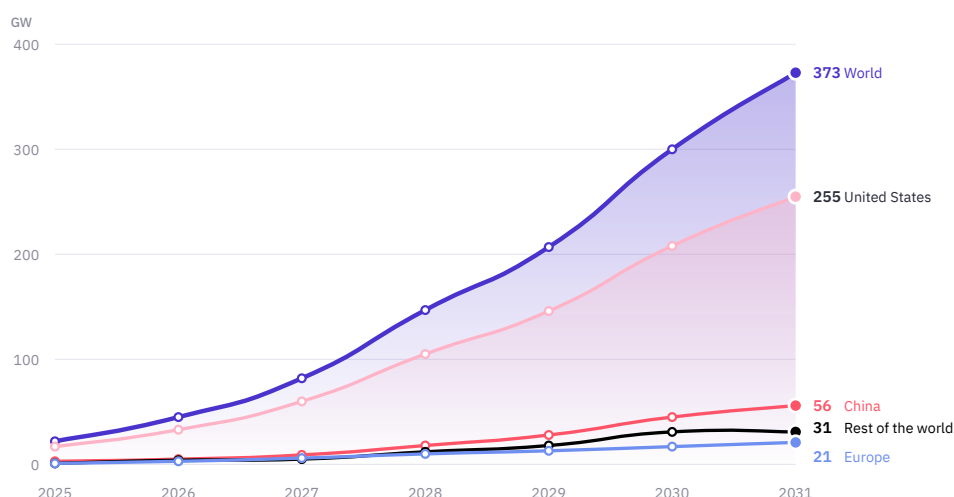
The share of data centre capacity in Europe has been decreasing in the last decade, as other key actors like India, China and the United States have shown a sustained strong momentum. According to data from the International Energy Agency (IEA), installed data centre capacity in the United States is 4.5 times the capacity installed in Europe⁸. Even though the publication of the AI Continent Action Plan has marked an increase in planned hubs in Europe, estimations point to an increase of about 70% of the current installed capacity by 2030 due to project delays and grid congestion⁹.

In addition, traditional data centre operations are different from those of AI data centres. The conventional servers operating traditional enterprise workflows have much lower requirements, while the current trend is showing an acceleration of specialised and optimised data centres for AI training and inference¹⁰. Projections of McKinsey & Company highlight that about 70% of the overall demand increase in data centre capacity by 2030 might be driven specifically by AI workloads¹¹.

This poses important questions for Europe's strategic position on AI uptake. In addition to the overall data centre capacity gap, AI uptake in Europe will depend on increasing its share of specialised high-end chips, such as the Graphics Processing Units (GPUs) made by US multinational companies NVIDIA, AMD and Intel, and Chinese companies Moore Threads and Jingjia Micro, or specific AI accelerator cards, such as neural processing units (NPUs) and the tensor processing units (TPUs) developed and produced by Google. In this area, the gap between Europe and the United States is expected to be larger than the overall data centre capacity gap, as US technology companies are set to drastically increase their AI investments¹². Indeed, recent data from the Europe2031.ai dataset point at Europe having about 5% of the global installed capacity, with the United States having about 18 times as much¹³.

**Figure 2 –
AI compute
forecast,
2025-2031
(in GW)**

AI compute
forecast
2025-2031



Source: Europe2031.ai (Juijn et al, 2026).

⁸ International Energy Agency. (2025). "Energy and AI Observatory". IEA. Paris.

⁹ Jacamon, V., Dallard, J., & Spencer, T. (2025). "Overcoming energy constraints is key to delivering on Europe's data centre goals". International Energy Agency. 16 November

¹⁰ International Energy Agency (2026). "Key questions on energy and AI". World Energy Outlook Special Report. IEA, Paris. pp. 40-43.

¹¹ McKinsey & Company. (2025). "The cost of compute: A \$7 trillion race to scale data centers". 28 April

¹² Bratton, L. (2026, February 6). "Big Tech set to spend \$650 billion in 2026 as AI investments soar". Yahoo Finance.

¹³ Juijn, D. et al. (2026). "Europe 2031. What getting AI wrong means for us". 11 June. A limitation of this dataset is however that it does not include AI compute capacity in existing cloud data centres operated by US hyperscalers in the European Union.

The technological breakthroughs in specialised AI chips are changing the architecture of data centres. The latest NVIDIA architecture in production, called Rubin, has almost five times the power density of the previous architecture. The functioning and characteristics of AI servers thus require associated auxiliary equipment to manage the heat produced by server racks, while the power swings created by their workload require appropriate planning for grid stability¹⁴. While Europe has the most advanced and interconnected grid in the world¹⁵, grid capacity, lack of modernisation and severe delays in connection queues are increasingly presented as roadblocks on Europe's path¹⁶.

Autonomy

The security and trade dimensions of artificial intelligence are shaping geopolitical dynamics¹⁷. Earlier this year, national security concerns have driven the government of the United States to issue an export control directive instructing Anthropic, one of the leading US AI companies, to suspend access to its latest models to foreign nationals. This has resulted in the company shutting down access to all its customers. The suspension lasted less than three weeks, but it gave rise to concerns on this side of the Atlantic related to the geopolitical dimensions of the AI race. In particular, these concerns have been directed to the reliance of both European public and private actors on AI models the US could quickly restrict for matters of national security¹⁸.

In addition, the US is tightening restrictions on AI chips and semiconductors directed to China¹⁹, and the rapid global uptake is highlighting important shortages and vulnerabilities in global supply chains. Indeed, there currently is a massive concentration in China of critical raw materials needed for data centre expansion, with the exception of copper, where the concentration is lower compared to other minerals²⁰.

Additional concerns on the dimension of autonomy are related to the sizeable dominance of non-EU hyperscalers, which control over 70% of the European cloud market. This dominance exposes the continent to the risk of operational discontinuity as in the case described above, in addition to potential differences between the legislative frameworks the largest market players are subjected to and the European data protection frameworks²¹.

For these reasons, increased European strategic autonomy in AI computing goes beyond the build-up of additional data centres. The objective of the European

¹² Bratton, L. (2026, February 6). "[Big Tech set to spend \\$650 billion in 2026 as AI investments soar](#)". Yahoo Finance.

¹³ Juijn, D. et al. (2026). "[Europe 2031. What getting AI wrong means for us](#)". 11 June. A limitation of this dataset is however that it does not include AI compute capacity in existing cloud data centres operated by US hyperscalers in the European Union.

¹⁴ International Energy Agency (2026). "[Key questions on energy and AI](#)". World Energy Outlook Special Report. IEA, Paris. pp. 40-41.

¹⁵ ENTSO-E. (2026). "[Market Design Options for Congestion Management](#)". June.

¹⁶ Cremona, E., & Czyzak, P. (2025). "[Grids for data centres: ambitious grid planning can win Europe's AI race](#)". Ember. 19 June.

¹⁷ Allen, G. & Chan, T. (2017). "[Artificial Intelligence and National Security](#)". Harvard Kennedy School Belfer Center for Science and International Affairs. July.

¹⁸ Küsters, A. (2026, June 15). "[US Access Ban on Anthropic's Fable/Mythos 5: More of a Geopolitical Signal than a Necessary Security Measure](#)". Centres for European Policy Network.

¹⁹ Hansbrough, T. (2026, August 31). "[Blocking Even Remote Access: U.S. Expands Regulatory Net Against China's Circumvention of AI Chip Procurement, While Nvidia Uses Whitelist to Screen Customers](#)". The Economy.

²⁰ Amoah, M. et al. (2026). "[Mineral demand from AI data centers: Infrastructure intensity, processing bottlenecks, and supply competition](#)". Resources Policy. Volume 119. August.

²¹ Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing a framework of measures for strengthening Europe's cloud and AI ecosystem (Cloud and AI Development Act), [2026], COM/2026/502 final, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52026PC0502>

Commission to triple data centre capacity by 2035 should be accompanied by a process of measurement of quality and strategic value, taking into account indicators such as:

- the number and characteristics of advanced accelerators installed in Europe,
- their computing performance available for training and inference,
- the proportion of capacity owned directly by European companies,
- the access available to European researchers, start-ups, scale-ups and public bodies.

In recent years, there have been various initiatives making recommendations on how Europe should build up digital infrastructure, for instance by supporting measures that can address strategic autonomy in the cloud layer with public procurement options, supporting the uptake of open-source software for public services and critical infrastructure, and also creating incentives for their private adoption, building a European data ecosystem to support the training of sovereign AI models²², and capitalising on the successes of European supercomputers²³.

If the European Union is serious about boosting AI capabilities, substantial additional efforts and new approaches must be mobilised to be a meaningful actor in the AI race. There should not be the expectation that the gaps in AI computing capacity can be closed in a vacuum and all at the same time, but a European model for AI uptake should include novel models based on more coordinated EU planning of energy grids, addressing lagging digital investments, and create participatory models for social acceptance. Openness, transparency and genuine analysis of the already present comparative advantages across Europe should guide the build-up of digital infrastructure, in addition to recognition of important nodes of the AI value chain where Europe can maintain relevance and strategic autonomy.

Recommendation

Build strategically useful and accessible European computing capacity.

Direct public procurement, research infrastructure and targeted support towards capabilities where Europe has strengths or clear strategic needs. Measure progress through usable computing performance, access for European researchers and businesses, ownership and control, and infrastructure resilience and sustainability.

²² Bria, F., Timmers, P. & Gernone, F. (2025). "[Eurostack – A European Alternative for Digital Sovereignty](#)".

²³ [JUPITER](#) is the fastest supercomputer in Europe and 5th in the world by June 2026.

2. Electricity grids

In recent years, increased attention has been dedicated to increasing the capacity and modernising electricity grids for the energy and digital transition in Europe. Analysis has pointed out that without proper modernisation, 40% of the power distribution grid assets will be over 40 years old by 2030²⁴.

Physical network bottlenecks are a major obstacle, leading to slower renewable energy generation because of insufficient expansion and modernisation of electricity grids²⁵. The latest EU proposal has sought to improve the planning of cross-border projects to help identify and fill interconnection gaps, and also includes new guidance on strategically addressing grid connection queues to support member state implementation, as long permit-granting procedures and grid connection procedures are a critical challenge for energy developers and investors²⁶.

a. The relevance of speed for data centre facilities

There is a mismatch in the development process timeline between data centre facilities and transmission networks, which can be at times twice as long for energy infrastructure²⁷. The primary challenge for energy grids and data centres is therefore represented by the fact that a significant load can be built much faster than the grid infrastructure it requires. In addition, this build-up happens with uncertainty on whether the load, the investment and the demand for AI computing will materialise and remain over the long-term.

The fact that development of grid infrastructure requires many years also has a negative effect on the development of renewable energy, as seen with recent curtailment of record amounts of solar electricity²⁸ (curtailment is the process whereby generation of a solar or wind farm is partially or completely limited to reduce the amount of electricity added to the grid, supporting its balance and reducing grid congestion). In 2024, €7.2bn in renewable electricity was curtailed across just seven countries²⁹, while at least 120 GW of planned renewables are at risk due to a shortfall in EU grid capacity³⁰.

For data centres, recent analysis shows that speed, meaning the time from planning until the moment a data centre is up and running, is the most important driver of economic returns. Modelling on a hypothetical 100 MW US data centre indicates that each year of delay would cause losses of about 5.5% of its total life cycle value, and these losses would be much more prominent than any other factors such as tariffs, local taxes or even power costs. The significance of these losses is tied to the fact that during delays the capital remains idle and, especially in the fast-paced

²⁴ Eurelectric, Monitor Deloitte. (2021). "[Connecting the dots: Distribution grid investment to power the energy transition](#)". January 2021.

²⁵ Draghi, M. (2024). "[The Future of European Competitiveness—A Competitiveness Strategy for Europe](#)". September.

²⁶ Commission Notice – Guidance on efficient and timely grid connections. C/2025/8473. <http://data.europa.eu/eli/C/2025/6703/oj>

²⁷ United Nations, Economic and Social Council. (2026). "[Aligning data centres and large load growth with grid resilience](#)". Economic Commission for Europe, Committee on Sustainable Energy. 20 July.

²⁸ Brussels Signal. (2026, May 13). "[Europe wastes record solar power as ageing grids fail to keep pace](#)".

²⁹ Beyond Fossil Fuels (BFF), Ember, E3G, Institute for Energy Economics and Financial Analysis (IEEFA). (2025). "[How Europe's grid operators are preparing for the energy transition](#)". May.

³⁰ Cremona, E. (2026). "[Crossed wires: Grid capacity could block EU energy security](#)". Ember. 1 April.

AI environment, computational power cannot be used for training and research of future breakthroughs, losing competitiveness for the model developers. Compared to the United States, where the first operation would take place after 24 months, a data centre in France or Germany would respectively lose 7.7% and 19.4% of its total life cycle value due to permitting and grid connection delays³¹.

The acceleration of permitting and grid connection is thus rightly placed as a key objective; for instance, the June 2026 proposal for the “Cloud and AI Development Act” aims to reach the point where, by 2030, operators should be able to get a data centre up and running in less than 18 months throughout the European Union³². Analysis from Bruegel shows however that Europe would currently lack the enforcement mechanisms to make sure coordination between national, regional and local authorities can effectively speed up the permitting process in the proposed “Data Centre Acceleration Zones”³³. In addition, establishing such acceleration zones can be a lengthy and complex process that creates risks such as political motivations for designation, and the creation of “no-go areas” outside of these acceleration zones.

b. Better and longer-term planning will be required to free-up grid capacity

Long-term planning is extremely relevant for the sustainable integration of data centres in the energy system. Such planning will however require a better understanding of the expected demand drawn from reliable assessments that can allow for informed planning choices. In addition, AI and hyperscalers present an opportunity to mobilise the needed investment and make the most use of our existing grids, and especially at distribution level, with the opportunity to leverage flexibility and demand-side response by both data centres and other network users.

With the European Grids Package, the European approach is moving towards a more integrated model for infrastructure planning, which would have a stronger EU-level direction with a ‘Union strategic scenario’, increase transparency by requesting the modelling tools and methodologies to become open source and replicable by third parties, and giving a stronger role to the European Union Agency for the Cooperation of Energy Regulators (ACER).

A novelty of the current proposal is the possibility for the European Commission to propose an Independent European System Planner with the mandate of developing the Union strategic scenarios. The reasoning behind this independent actor comes from the understanding that the current regulatory framework would mostly favour capital expenditure to build more physical assets, in place of other solutions that would provide more structural advantages, such as strategically located battery storage that can react rapidly when faults occur, or demand-side management that can reduce or shift consumption during congestion.

³¹ Phillips-Robins, A., Tawil, T., & Winter-Levy, S. (2026). “[The Compute Coalition: How to Build the Future of AI in the Free World](#)”. Carnegie Endowment for International Peace. June.

³² Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing a framework of measures for strengthening Europe’s cloud and AI ecosystem (Cloud and AI Development Act), [2026], COM/2026/502 final, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52026PC0502>

³³ Martens, B., & Schenk, T. (2026). “[How can Europe address its pressing AI compute infrastructure shortfall?](#)”. Bruegel. 10 September.

A planning institution at EU level would also provide benefits in reducing the current fragmentation that affects the current system, where individual transmission system operators propose projects that are beneficial in their specific case. A better connected and more integrated EU energy system would result in benefits driven by more efficient and improved operations, less need for additional infrastructure and lower capital costs³⁴. The same actor would provide guidance on where energy infrastructure and demand infrastructure will be needed, which will also allow for realistic expectations for investors.

While outside the scope of the current paper and requiring a much more detailed analysis, regional electricity pricing would be another system to support the reduction of grid congestion and to direct investments where they are most beneficial to the system. Research from the European Commission Joint Research Centre (JRC) shows that locational price signals can provide annual EUR 26-61bn in savings and be a solution when grid build out is insufficient³⁵.

Data centres are projected to account for 28% of the increase in European electricity demand by 2030³⁶; such a fast-paced increase will thus require new approaches and coordinated long-term planning integrating AI data centres in the process of national and regional grid development. In addition to smart siting, where capacity is available and there is an abundance of renewable energy³⁷, grid management will need to be supported with better information, increased digitalisation, and grid-enhancing technologies, which are projected to unlock enough capacity to connect between 450 and 700 GW of projects³⁸.

AI-powered tools for modelling and grid planning

A growing set of AI applications is being developed to improve forecasting, congestion analysis, renewable integration, scenario testing and the identification of connection options. Their value will depend on access to high-quality system data, common standards and regulatory incentives that allow network operators to invest in digital solutions alongside physical infrastructure.

An example is represented by Tapestry, which is developing a unified platform of AI-powered tools that make the grid—and the energy resources connecting to it—fully visible and manageable to grid operators, planners, and utilities. Tapestry's tools use AI to improve grid awareness, offering transmission and distribution customers important new insights about the functioning of their grid and the health of the grid's underlying assets (including the ability to identify potentially defective equipment before it fails). Other Tapestry tools use AI to transform day-to-day operations, like managing assets and load forecasting, as well as long-term planning; in testing, planners for Chile's national grid operator found that Tapestry's planning tool helped it run simulations 86% faster, and

³⁴ Roth, A., Tagliapietra, S., & Zachmann, G. (2026). "[Better coordination for a more efficient European energy system](#)". Bruegel. 16 February.

³⁵ Thomassen, G. & Fuhrmanek, A. (2025). "[Locational Price Signals in Europe - Future-proofing the European power market](#)". European Commission. JRC Publications. 15 October.

³⁶ Eurelectric. EY Parthenon. (2026). "[Powering data centres in Europe](#)".

³⁷ One example of better coordination between transmission system operators (TSOs) and distribution system operators (DSOs) has been the launch of a digital portal to provide an overview of publicly available grid hosting capacity information across Europe. The portal can be accessed here: <https://www.tsodsplatform.eu/capacitypedia>

³⁸ International Energy Agency. (2026). "[Electricity 2026](#)". Grids. IEA. Paris.

run 30 scenarios simultaneously, instead of one at a time. Tapestry is also collaborating with North America's largest grid operator to build and deploy new AI-enabled tools, including one that has reduced a critical bottleneck down to minutes of processing time.

In the European Union, the "AI.grids" initiative was launched in June 2026 and brought together European network operators, researchers and technology providers to develop shared AI tools for grid planning and operation. The objective of the initiative is that of developing a foundation AI model trained on varied grid data that can support several tasks. These include forecasting electricity supply and demand, identifying congestion, monitoring equipment and testing options for future network development. Operators would contribute data and practical knowledge, while research organisations would develop and test the models. The initiative also plans to draw on European AI Factories for computing resources and the Common European Energy Data Space for secure data sharing. Its ambition is to build tools that can be adapted across different networks and tested against real operating needs, providing a concrete framework for European cooperation on more efficient and reliable grids³⁹.

It is important to note however that, as part of the AI Act, the utilisation of AI tools as a safety component in critical infrastructure such as electricity supply is characterised as high risk. This entails, for instance, the establishment of a risk management system, a data governance system, and making specific design choices that can allow the implementation of human oversight, and achieve appropriate levels of accuracy, robustness and cybersecurity⁴⁰. The dimension of cybersecurity is particularly relevant, as critical energy infrastructure is increasingly exposed to risks that have the potential to disrupt energy supply across several EU countries.

c. A tight connection between investment for AI and energy grids

Mobilising enough investment will be critical in the current situation, as the planned investment needs in the EU's energy infrastructure are expected to grow significantly, reaching about EUR 1.2tn in the next 15 years⁴¹.

The Grids Package identifies various instruments that can provide public finance to support the substantial investment needs, such as the funding reallocation from the current cycle of Cohesion policy (about EUR 35 bn⁴²), an increased budget for the Connecting Europe Facility in the next seven-year budget of the Union (from EUR6bn to almost EUR 30bn⁴³), and a Clean Energy Investment Strategy, whereby the EIB

³⁹ Cresym. (2026). "AI.grids".

⁴⁰ Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act), [2024], OJ L, 2024/1689, <https://eur-lex.europa.eu/eli/reg/2024/1689/oj>

⁴¹ European Commission Directorate-General for Energy. Trinomics. Artelys. LBST. Finesso, A. et al. (2025). "Investment needs of European energy infrastructure to enable a decarbonised economy – Final report". January.

⁴² European Commission. (2026, March 25). "€34.6 billion in cohesion policy funds reallocated to address EU's strategic priorities".

⁴³ Gullentops. M. (2025). "Connecting Europe Facility 2028-2034. Financing EU infrastructure networks". European Parliamentary Research Service. December.

would deliver about EUR 75bn over 3 years⁴⁴, and support the de-risking of private investment and improving access to capital markets for electricity grid operators. Additional EU funding has been deemed necessary because, as a better integrated EU electricity market requires cross-border grid investments, the current framework does not properly allow for fair cost-sharing between countries that bear the costs and countries that reap the benefits of projects with European or regional value⁴⁵. These resources will however not be enough to achieve the investment needs and will require stronger interaction between public and private finance.

In addition, among the tools in the package, congestion revenues to support financing infrastructure still remain a contentious political point, where the European member state would opt for the allocation to be phased in over time, while the Parliament would require an immediate and more substantial allocation dedicated to EU-wide planning.

Connection between public and private finance matters for AI infrastructure as well, for instance in the case of the Important Projects of Common European Interest (IPCEI), and the AI Gigafactories initiative, where the EU intends to mobilise EUR 20bn of private finance for AI gigafactories⁴⁶. The largest technology companies are driving a massive surge in data centre investment, where global capital expenditure is expected to exceed USD 700bn in 2026⁴⁷. Such an increase in capital expenditure can represent the opportunity to draw capital into grids, renewable generation, storage, geothermal projects, higher-capacity grid cables and new cooling technologies.

New approaches are increasingly being put into place to support the grid connection of large energy users. For example, French transmission system operator RTE has established an alternative and faster procedure whereby large-scale consumption facilities would get access to the high-voltage network in select locations in 3-4 years by providing a 10% first-demand bank guarantee for the amount required by the network extension work, in addition to a down payment of 30% of the total grid connection costs, supporting grid operators in investing while being covered by speculative demand⁴⁸. This is a similar system to the Capacity Commitment Framework (CCF) used in some areas of the United States, where large energy users guarantee the funding for new power and infrastructure required to serve them⁴⁹, with the potential of going beyond the currently available electricity to support new and renewable energy generation. Bring-Your-Own and Clean Transition Tariffs (CTF) are also being increasingly used to establish rates that can account for the impact of large loads on the grids and reduce the risks of cost increases for other ratepayers. As part of these systems, large electricity consumers fund the development of system resources (clean energy in the case of CTFs) and have faster opportunities to connect to the grid, while insulating other customers from new generation procurement⁵⁰, and also provide large demand customers with the assurances they need to commit to major long-term investments.

⁴⁴ COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Clean Energy Investment Strategy. COM/2026/116 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52026DC0116&qid=1773310237995>

⁴⁵ European union Agency for the Cooperation of Energy Regulators. (2026). “[Sharing of costs and benefits of electricity network infrastructure arising from cross-border trade](#)”. 18 May.

⁴⁶ European Commission. “[AI Factories](#)”. Accessed 15 September 2026.

⁴⁷ International Energy Agency (2026). “[Key questions on energy and AI](#)”. World Energy Outlook Special Report. IEA, Paris. pp. 40-43.

⁴⁸ RTE (2025). “[Article 1.4.3 – Raccordement d’installations de consommation dans le domaine de tension HTB3 sur des sites propices préalablement identifiés](#)”. Documentation Technique de Référence, Chapitre 1. Version 1. 9 May.

⁴⁹ Peterson Corio, A. (2026). “[Supporting the White House Ratepayer Protection Pledge: Google’s approach for responsible energy growth](#)”. Google, The Keyword. 4 March.

⁵⁰ Perez, A., Wang, S., & Cannon, C. (2026). “[New ways to power data centers and other large energy users](#)”. RMI, Brief. 6 February.

Additional systems to capture existing, distributed capacity while also making the most of the flexibility potential of data centres include the connection between a Virtual Power Plant (VPP) and data centre operators. Recent examples show that the VPP can aggregate energy resources from batteries and other flexible assets and pay the customers who are willing to participate in the programme, thus unlocking additional capacity on the electricity grid which will in turn be used to run data centres in that location^{51 52 53}. These systems can also be expanded to create a system where ratepayers or households could even gain benefits in terms of household upgrades, which would draw benefits from increased energy efficiency, lower electricity costs for households, improve resilience to power outages, and drive down upfront costs by maturing the growing market for home energy upgrades.

d. What “culture” for the future energy system: speed or security?

Europe’s constraint on connection speed is both legal and technical. System operators are mandated to preserve the integrity of the system rather than to connect customers quickly, and operational rules codify this priority. Indeed, the current energy system is built on redundancies that ensure the system maintains its stability even if single elements fail. For this reason, it is important to weigh the acceleration of increasing connections to the grid with the importance of maintaining system safety, which comes from a century and a half of engineering culture.

For data centres, the corollary is that system relevance requires the creation of a relationship of trust with energy sector actors. System operators argue that the more system-relevant a load becomes, the more responsibility it should carry, and that in the absence of common European requirements the risk is the current emergence of a fragmented picture of national conditions which will not interoperate as data centre growth will reach its targets.

The solution for Europe is not to trade security for speed, but to reduce the connection delays that are caused by mechanisms and checks that add no safety and reliability value. Several of these have been identified, for example in relation to connection queues managed on a first come, first served basis allowing immature projects to block capacity for years, where applications run in parallel for the same site with only one ever proceeding. Energy experts propose to experiment with soft or non-firm connections, under which a data centre might receive a connection more quickly in return for accepting slightly lower guaranteed availability, for instance 99% rather than near-continuous service. This type of connection will of course depend on the flexibility capacity of AI workloads⁵⁴. In addition, the establishment of flexible or non-firm connections should be backed by information on when electricity use may be reduced and which back-up arrangements may be required.

⁵¹ <https://www.technologyreview.com/2026/06/03/1138350/virtual-power-plants-data-centers/>

⁵² Cohen, J., Shwisberg, L., & Dyson, M. (2025).

⁵³ “How virtual power plants can help the United States win the AI race”. RMI, Report. 6 November.

Skidmore, Z. (2026). “Google signs 100MW Bring Your Own Capacity agreement with Voltus”. Data Center Dynamics (DCD). 3 June.

⁵⁴ There is building evidence that load flexibility of LLM workload can lead to lower power consumption while maintaining the computing performance of GPUs through coordinated scheduling frameworks, as in Wang, Y., Guo, Q., & Chen, M. (2025). “Providing load flexibility by reshaping power profiles of large language model workloads”. *Advances in Applied Energy*. Volume 19, 100232. September. However, as model training and model inference have different hardware architectures and flexibility potentials, as explained in Chen, Y., & Zheng, X. (2026). “To defer or to shift? The role of AI data center flexibility on grid interconnection”. arXiv preprint, arXiv:2604.05376. 7 April., more evidence for optimal decisions on expansion of capacity and computing.

Across all issues raised in the current chapter, the core question lies on the decision of a clear governance and regulatory framework where AI and data centre rollout does not reinforce dependence on fossil fuels, raise energy costs, and compound the inequalities of the energy transition. If well-managed and planned strategically, AI adoption can support faster deployment of a high-renewables, electrified and efficient energy system that shares benefits equally.

Recommendations

- **Make grid connections faster, more predictable and accountable.** Apply transparent project-readiness criteria and milestones so stalled applications do not reserve capacity indefinitely. Enable flexible connections where technically feasible, establish common technical requirements for significant loads, and report the causes of delays and who is responsible for resolving them.
- **Build coordinated grid planning on reliable, shared information.** Incentivise transparency by making information on consumption and capacity reciprocal between data centre and grid operators. TSOs would be able to aggregate high-level, long-term demand signals from large users to justify grid expansion, and request system operators to publish detailed locational information, for instance as it takes place in the Irish case. Use transparent, replicable planning models and independent scrutiny at European level to assess demand, compare infrastructure options and improve investment decisions.
- **Allocate system costs fairly and reward verified benefits.** Establish clear agreements and incentivise developers' contributions to the infrastructure required to serve them, with safeguards for households and smaller consumers. Recognise flexibility, suitable location and other contributions according to the measurable benefits they provide.

3. Integrating computing into Europe's energy system

a. How should data-centre performance be measured and improved?

The first mandatory reporting obligation for the data centre sector in Europe covers every facility with at least 500 kilowatts of installed IT power demand⁵⁵. A European database receives these reports, representing the first phase of a common rating scheme built on four indicators.

The four indicators are:

- power usage effectiveness (PUE), total facility energy divided by energy delivered to computing equipment;
- water usage effectiveness (WUE), litres of water consumed per kilowatt hour of computing energy;
- the energy reuse factor (ERF), the share of a facility's energy recovered and exported, typically as heat;
- the renewable energy factor (REF), the share of consumption met from renewable sources⁵⁶.

The European Commission organises its work for digitalisation and AI in the energy sector around three pillars: powering data centres sustainably, deploying AI to accelerate the energy transition, and the data on which both depend⁵⁷.

The first assessment of that data established a European baseline in July 2025, and its most useful finding is the performance gap between the average facility and the best⁵⁸. The International Energy Agency estimates that raising older and enterprise-operated sites to hyperscale efficiency would cut their total energy use by about a quarter, but adds that the strongest levers are locked in at design stage, so retrofitting captures only a fraction of what correct specification and siting can deliver⁵⁹. It must be noted however that the first reporting period captured only around 36% of facilities in scope⁶⁰.

The consultation on the draft scheme has highlighted various recommendations to optimise the indicators with the objective of improving transparency, comparability and sustainability in the sector. Some highlighted risks include treating water sources

⁵⁵ European Parliament & Council of the European Union (2023). "[Directive \(EU\) 2023/1791 of 13 September 2023 on energy efficiency and amending Regulation \(EU\) 2023/955 \(recast\)](#)". Official Journal of the European Union, L 231, pp. 1–111. 20 September.

⁵⁶ European Commission (2024). "[Commission Delegated Regulation \(EU\) 2024/1364 of 14 March 2024 on the first phase of the establishment of a common Union rating scheme for data centres](#)". Official Journal of the European Union, L series. 17 May.

⁵⁷ European Commission (2026). "[Strategic roadmap for digitalisation and AI in energy](#)". COM(2026) 501. 3 June. See also the Council of the European Union (2026). "[Strategic roadmap for digitalisation and AI in energy – Presentation by the Commission](#)". ST 10101/26. 4 June.

⁵⁸ European Commission, Directorate-General for Energy, EY, AIT & Borderstep (2025). "[Assessment of the energy performance and sustainability of data centres in EU: First technical report](#)". Publications Office of the European Union. 8 July.

⁵⁹ International Energy Agency (2026). "[Key questions on energy and AI](#)". World Energy Outlook Special Report. IEA, Paris. April, p. 30.

⁶⁰ European Commission, Directorate-General for Energy, EY, AIT & Borderstep (2025). "[Assessment of the energy performance and sustainability of data centres in EU: First technical report](#)". Publications Office of the European Union. 8 July.

as equivalent, rating water from a stressed aquifer identically to water from an industrial canal, and warned that implicitly rewarding mechanically cooled facilities would raise consumption and peak demand. Another risk is related to the relationship between PUE and WUE, which can trade off against one another. As water cooling improves power usage effectiveness while worsening water usage effectiveness, regulators and host communities need to be able to evaluate the trade-offs in the contextual climatic conditions.

The European Commission has moved towards the development of a common rating scheme for data centres and recently opened a new consultation for minimum performance standards for data centres. Such a reporting scheme, by increasing coverage and improving the availability of data, can offer increased transparency and drive the sector to adopt the best possible technologies for the development of data centres in Europe.

b. Where can computing infrastructure deliver the greatest overall value?

Location determines most of a data centre's environmental and system consequences: its carbon intensity; the cost to the network, by determining whether it relieves or aggravates congestion; the water footprint, since identical cooling has different consequences in different basins; and whether waste heat can be recovered for local communities. Siting will be an important environmental lever available to European policymakers.

For instance, as part of the Cloud and AI Development Act, each member state must designate at least one data centre acceleration zone within six months of entry into force, integrated into local plans, taking account of grid availability and network capacity, with a stated preference to reuse pre-existing sites, and permitting inside those zones is capped at twelve months⁶¹. As mentioned in the first section of this report, the risk with these designations is that the rest of the territory can be treated as a no-go zone.

Heat coupling should be an important consideration for an appropriate siting process. Data centres account for a sizeable share of electricity consumption, which, according to the International Energy Agency, has been slightly more than 1.5% of global electricity demand in 2025⁶². The computations produced by the chips in data centres produce heat in relation to this electricity consumption and require extensive cooling systems to maintain appropriate performance.

Heat coupling thus represents the opportunity to connect the heat rejected by a cooling system to a district heating network, so energy leaves the site as a product rather than a loss. An important constraint is proximity, since low-grade heat cannot travel far economically, and also the fact that district heating networks are not equally developed across Europe⁶³. Recent geospatial analysis finds that around 10% space heating demand in Europe's buildings is located within five kilometres of a data

⁶¹ European Commission (2026). "[Proposal for a Regulation of the European Parliament and of the Council establishing a framework of measures for strengthening Europe's cloud and AI ecosystem \(Cloud and AI Development Act\)](#)". COM(2026) 502 final, 2026/0138 (COD). 3 June.

⁶² International Energy Agency (2026). "[Key questions on energy and AI](#)". World Energy Outlook Special Report. IEA, Paris. April, p. 17.

⁶³ Yuan, X., Liu, J., Sun, S., Lin, X., Fan, X., Zhao, W., & Kosonen, R. (2025). "[Data center waste heat for district heating networks: A review](#)". Renewable and Sustainable Energy Reviews. Volume 219, 115863. September.

centre already inside a district heating service area, which could potentially offset 5 Mt of CO₂⁶⁴. Coupled with other major industrial processes, waste heat reuse is a vast but underutilised resource where major barriers still remain, and where it will be important to drive initiatives both for policy and technology.

Water use represents another crucial environmental dimension where further research, engagement and collaboration between the data centre industry, water industry, regulators and experts are strongly recommended to increase collaboration in water resource planning. The European Water Resilience Strategy identified data centres as a specific concern, and as mentioned before, water use will be part of the efficiency rating scheme for data centres.

Taken together, these factors suggest that siting should be treated as a system-planning decision rather than only as a permitting decision. In addition, as industrial electrification progresses in Europe, other significant loads can be expected to add strain to the grid, and will thus require a longer-term system-wide analysis of congestion that addresses the electrification of the European economy. The best location is not necessarily the place that can issue a permit fastest, but the place where compute can be connected with the lowest combined cost to the electricity system, climate, water resources and host community.

c. How can computing help improve the energy system?

The efficiency of the data centre itself is the smaller part of the question. The larger one is what the computing it houses can do for the energy system and for the wider economy. Here the evidence has improved considerably in recent years. Data from the International Energy Agency points at the fact that widespread adoption of currently known AI applications can lead to potential savings of 13.5 EJ across all end-use sectors in 2035, specifying that this would already be possible with existing AI applications⁶⁵.

In addition, recent estimates suggest that AI applications in three sectors alone, power, meat and dairy, and light road vehicles, could reduce global emissions by 3.2 to 5.4 GtCO₂e annually by 2035 against a business-as-usual trajectory, moving the world roughly 36% closer to an ambitious reduction pathway. In the power sector, AI applied to the forecasting of supply and demand and to the management of distributed energy resources could raise the load factor of solar and wind by up to 20% and deliver 1.8 GtCO₂e of annual reductions by 2035. The same study puts the emissions increase from all AI activity, data centres included, at 0.4 to 1.6 GtCO₂e, so that the reductions available from three sectors would more than offset the total footprint of the technology⁶⁶.

According to the authors, this assessment is conservative as it only considers the direct impact of AI, for instance excluding the contribution that AI can provide to

⁶⁴ International Energy Agency (2025). “[Energy and AI](#)”. World Energy Outlook Special Report. IEA, Paris. April, p. 248.

⁶⁵ International Energy Agency (2026). “[Key questions on energy and AI](#)”. World Energy Outlook Special Report. IEA, Paris. April, p. 80.

⁶⁶ Stern, N., Romani, M., Pierfederici, R., Braun, M., Barraclough, D., Lingeswaran, S., Weirich-Benet, E., & Niemann, N. (2025). “[Green and intelligent: The role of AI in the climate transition](#)”. npj Climate Action. Volume 4, 56. 23 June. and CRESYM (n.d.). “[AI grids](#)”. Collaborative Research for Energy SYstem Modelling. Retrieved 30 September 2026.

faster capital deployment and better policymaking. At the same time, it also does not consider any rebound effects, which can be negative where efficiency gains in AI lead to increased consumption, and positive when AI unlocks better optimisation in energy use. Its conclusion is addressed to policymakers, as the authors argue that leaving the applications and governance of AI to markets alone is risky, and that an active state is required to direct the technology towards public goods and high-impact areas⁶⁷.

In the European context, alongside the publication of Strategic Roadmap for Digitalisation and AI in Energy of June 2026, an industry-led initiative launched a community of practice in which various European transmission and distribution operators have committed to train foundation models for grid planning and operation jointly using their own data and leveraging initiatives such as the Common European Energy Data Space⁶⁸.

AI applications can unlock increased efficiency by acting on grid capacity, providing better planning to connect more renewable energy generation, and providing substantial support in permitting processes. These new initiatives under development face various constraints. For instance, more consideration should be given to how rates of return on capital expenditure can appropriately drive a system of incentives for investments to deliver better system benefits more optimally. In addition, energy firms identify the shortage of internal digital skills as the single largest barrier to adopting AI-led optimisation⁶⁹. Finally, energy experts also argue that the tools used for long-term planning in the energy system are largely outdated, whereas the current system dominated by variable generation requires much more complex modelling, which AI could support.

Finnish data centre expansion

Finland illustrates how local conditions can support the integration of computing infrastructure into the energy system. In 2024, 95% of its domestic electricity production came from renewable sources and nuclear power⁷⁰. Its extensive district heating networks also create opportunities to use heat recovered from data centres. These advantages provide a useful starting point, although the benefits depend on where and how projects are developed.

Location remains a central challenge. According to Fingrid, over 70% of Finnish electricity generation is concentrated on the west coast and in the north, while more than half of consumption takes place in the south. Its September 2026 study finds that locating new demand closer to generation could increase the connection capacity delivered by its planned grid investments. Fingrid also stresses the need for flexible connections and additional balancing capacity as electricity demand grows.

⁶⁷ Stern, N., Romani, M., Pierfederici, R., Braun, M., Barraclough, D., Lingeswaran, S., Weirich-Benet, E., & Niemann, N. (2025). [“Green and intelligent: The role of AI in the climate transition”](#). npj Climate Action. Volume 4, 56. 23 June. and CRESYM (n.d.). “AI grids”. Collaborative Research for Energy SYstem Modelling. Retrieved 30 September 2026.

⁶⁸ European Commission (2026). [“Strategic roadmap for digitalisation and AI in energy”](#). COM(2026) 501. 3 June.

⁶⁹ International Energy Agency (2026). [“Key questions on energy and AI”](#). World Energy Outlook Special Report. IEA, Paris. April.

⁷⁰ Statistics Finland (2025). [“Share of fossil-free electricity production rose to 95 per cent in 2024”](#). Production of electricity and heat 2024, Official Statistics of Finland. Helsinki. 27 November.

Heat recovery offers another opportunity. In Kajaani, the data centre hosting the European LUMI supercomputer occupies a former paper mill and supplies recovered heat to the local district heating network. Research from Aalto University adds an important qualification. Studies of Espoo and Seinäjoki show that the value of recovered heat depends on the heating sources it replaces, electricity and carbon prices, and the incentives available. Heat recovery therefore needs a viable local arrangement, including investment in heat pumps and connections⁷¹.

Another recent example is Google's September 2026 announcement of €13bn in investment in Finnish digital infrastructure, clean energy and local partnerships over the following two years. According to the company, the plans include a 22-year agreement supporting the continued operation of the Loviisa nuclear plant, additional onshore wind capacity and a new 94 MW battery system. Google also announced €31mn for community programmes over four years, including education and vocational training. The package brings computing investment, energy supply and local development into the same programme. Its wider value will depend on delivery, including how the new demand affects grid capacity and whether the energy and community commitments produce measurable benefits⁷².

Recommendations

- **Set data-centre performance requirements that reflect overall resource use.** Design minimum standards that account for the relationship between electricity efficiency, water use and local conditions.
- **Turn AI and digitalisation into practical energy-system improvements.** Enable network operators to recover justified costs and benefit from cost-effective digital tools, grid-enhancing technologies and flexibility. Support interoperable energy data, collaborative AI applications and the combined energy and digital skills needed to deploy them.
- **Guide data-centre development towards locations that deliver the greatest overall value.** Establish common siting criteria covering grid capacity, clean electricity, water stress, realistic heat demand, land use and connectivity. Require proposed acceleration zones to reflect these criteria and regional infrastructure plans, while maintaining a route for viable projects outside those zones.

⁷¹ Tervo, S., Hiltunen, P., & Syri, S. (2025). "Data center waste heat utilization in district heating in a volatile low-carbon electricity market". Cleaner Environmental Systems. Volume 19, 100373.

⁷² Koley, B. (2026). "Google deepens its commitment to Finland with a €13 billion investment in AI infrastructure". Google, The Keyword. 9 September.

4. AI governance and social acceptance

Europe's ambitions to expand computing capacity will take shape in towns, cities and regions. New data centres can place pressure on electricity and water networks, change land use and cause disruption during construction. They can also bring investment and supply heat to nearby homes and businesses. Local authorities and communities need a role in shaping these outcomes from the outset. This means having clear information, opportunities to influence decisions and a say in how benefits are shared.

a. Interaction with local authorities in the tripartite agreements

Tripartite agreements are a novel type of voluntary agreements in the European context between three parties, a public authority, which may be national, regional or local; the demand side, meaning data centre operators and their supply chain; and the supply side, meaning energy companies, utilities and grid operators, covering grid integration, clean energy supply, flexibility, energy performance and waste heat reuse. Fourteen European industry associations signed a declaration of intent on 3 June 2026, and several companies signed declarations of support as early implementers⁷³.

Although voluntary, it represents a novel opportunity for the European Commission to engage directly with local authorities on energy matters. Bringing the three parties together, the European Commission is taking a two-phase approach: in a first phase there would be the definition of a list of possible commitments to provide local benefits. In the second phase, policymakers would be looking for concrete projects on the ground to produce agreements signed locally on some of those commitments, with the objective to define and obtain benefits for all three parties.

In the current form, the agreement would however remain inside the energy system, so water, noise and land use would fall outside its scope, even though these are the issues that most often mobilise local opposition. Even if the tripartite agreements are currently of voluntary nature, they could become an impactful model to engage at local and municipal level and could for instance contain the definition of community benefits as a precondition to faster permitting in the acceleration zones created under the Cloud and AI Development Act. This would however require assessing the resource and capacity availability of local authorities to participate in these agreements.

For example, in London, there are currently 99 data centres operating and a further 26 in the planning system⁷⁴. Associated energy demand is expected to increase tenfold by 2050, while permitting periods running from seven to thirteen years.

⁷³ European Commission (2026). "[Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Strategic roadmap for digitalisation and AI in the energy sector](#)". COM(2026) 501 final. 3 June.

⁷⁴ Dufresne, A. (2026). "[London's 99 data centres collide with housing and water limits](#)". AI Weekly. 3 August.

The city's spatial planning framework is being revised specifically to accommodate data centre growth and heat reuse⁷⁵.

Local planning across much of Europe still operates as a binary approval exercise and moving to a model in which authorities actively direct where capacity and storage should sit represents a substantial institutional shift, which is achievable in cities with a strong planning tradition, but considerably harder in more remote areas of the continent. For this reason, effort must be put into the development and application of participatory mechanisms that can effectively integrate local administrations and affected communities.

b. Models for social compensation

What a host community receives in exchange for hosting digital infrastructure has moved to the centre of the debate. Data centres took 23% of Ireland's metered electricity consumption in 2025, up from 22% in 2024 and 5% in 2015, approaching the 28% consumed by all Irish households combined⁷⁶. Around 97% of them sit in the Dublin region, where they take roughly half of metered consumption, and existing contracts imply a national share of 31% by 2034⁷⁷. With a concentration of this order, looking at electricity consumption on a national level is not an appropriate measure to define what happens at the local level.

In December 2025, the Irish Commission for Regulation of Utilities replaced the de facto moratorium on new Dublin connections with a regime in which facilities at or above one megavolt-ampere must bring dispatchable, market-participating generation or storage, and procure additional renewable electricity generated in the State equivalent to at least 80% of annual demand over a six-year glide path⁷⁸. It addresses the energy system consequences directly and says nothing about the distributional question. Ireland imposes no obligation on a data centre to contribute anything to the community that hosts it, although it already operates one of Europe's most developed community benefit architectures for a different class of energy infrastructure.

Among European member states there are some examples of models of social compensation, for instance in the case of Ireland, which has a binding Rulebook containing prescriptive elements: onshore wind projects must pay €1,000 a year to every household within one kilometre; at least 40% of the fund must go to not-for-profit community enterprises; no more than 10% may be spent on administration; and an annual report goes to the Sustainable Energy Authority of Ireland⁷⁹. In the Danish case, the focus was placed on ownership, but the mechanism has been revised repeatedly, and is now based on a tax-free annual bonus for neighbours, around DKK 5,000 near onshore wind and DKK 2,000 near solar infrastructure⁸⁰.

⁷⁵ Buro Happold (2026). "[London's data centre future growth forecasts and strategic insights: An evidence-based report for the Greater London Authority \(GLA\)](#)". Greater London Authority, London Plan evidence base.

⁷⁶ Central Statistics Office (2026). "[Data centres metered electricity consumption 2025](#)". CSO statistical release. Dublin. July.

⁷⁷ Philip Lee LLP (2025). "[Re-balancing the digital bargain: Ireland's new CRU Large Energy User Connection Policy](#)". Lexology. 22 December.

⁷⁸ Philip Lee LLP (2025). "[Re-balancing the digital bargain: Ireland's new CRU Large Energy User Connection Policy](#)". Lexology. 22 December.

⁷⁹ Sustainable Energy Authority of Ireland, "Community benefit funds". Sustainable Energy Authority of Ireland (n.d.). "[Community benefit funds](#)". SEAI. Retrieved 30 September 2026. On the near-neighbour payment and distribution rules, see

⁸⁰ Danish reform of the renewable energy compensation schemes, November 2019, introducing the neighbour bonus and municipal green pools. reNEWS (2019). "[Denmark changes renewables compensation scheme](#)". reNEWS. 19 November. On the 2023 increase in developer contributions, see Plesner (2023). "[New initiative from the Danish Government will ensure a quadrupling of solar and wind power on land](#)". Plesner Insights. 12 October.

The Danish experience is valuable as research on this case finds that co-ownership does not increase support for the project among those citizens that initially oppose it, since most of the investors already supported the project. In addition, if participation in the project requires household capital and investable savings, it is not equally accessible across socio-economic classes. Finally, financial benefits do not lead to positive results when citizens feel their values have been violated⁸¹. Comparative work across the Union shows that the forms that deliver most reliably are direct payments, in-kind infrastructure and local employment⁸².

These two examples are both related to energy, so for data centres the model would plausibly need to be attached to the grid connection or the permitting process. In addition, it will be important to define which metric should be used for a model of social compensation on data centres, which for instance could be based on its contracted capacity.

Currently, for data centres, any arrangement has been of voluntary nature, and with the current European schemes, the risk is that smaller facilities, or a colocation provider with thinner margins, will not have the same capacity to create a compensation mechanism as those that can be reached with hyperscalers.

Finally, appropriate participation and community engagement examples exist across various jurisdictions in Europe, but they represent individual cases due to the absence of a comprehensive and mandatory framework at the European level that can be used and tailored to local needs⁸³. Because of this, the effectiveness of participatory models can vary dramatically across projects and countries, jeopardising support for the clean energy transition and perpetuating inequalities.

Stockholm Data Parks, an example of a working tripartite agreement

Stockholm Data Parks illustrates how municipal planning and commercial agreements can connect data-centre development with local energy needs. Launched in 2017, the initiative brings together the City of Stockholm, Stockholm Exergi, electricity network operator Ellevio and municipal fibre provider Stokab. Its purpose is to attract computing facilities to suitable sites where electricity, connectivity and heat recovery can be planned together⁸⁴.

The partnership gives each actor a defined role. The city supports site preparation and planning, while the infrastructure providers coordinate electricity, fibre and heating connections. Data-centre operators can sell recovered heat through

⁸¹ Johansen, K., & Emborg, J. (2018). "Wind farm acceptance for sale? Evidence from the Danish wind farm co-ownership scheme". Energy Policy. Volume 117, pp. 413–422. June. Jørgensen, M. L., Anker, H. T., & Lassen, J. (2020). "Distributive fairness and local acceptance of wind turbines: The role of compensation schemes". Energy Policy. Volume 138, 111294. March.

⁸² Climate Action Network Europe (2025). "Community engagement and fair benefit sharing of renewable energy projects". CAN Europe. April.

⁸³ Climate Action Network Europe (2025). "Community engagement and fair benefit sharing of renewable energy projects: Presenting policies and practices across Europe and guidelines for developers". CAN Europe. April.

⁸⁴ Stockholm Data Parks, launched in 2017 by the City of Stockholm with Stockholm Exergi, Ellevio, Stokab and Invest Stockholm. See Invest Stockholm (2019). "Three new data centers to be built in Stockholm". Press release, Mynewsdesk. 12 November. On the commercial model, including cooling as a service above ten megawatts, see Smolaks, M. (2017). "Stockholm Data Parks welcomes data center developers". Data Center Dynamics (DCD). 24 January. On the DigiPlex retrofit, see DCNN (2018). "DigiPlex data centre to heat 10,000 Stockholm households". Data Centre & Network News. 27 March.

Stockholm Exergi's Open District Heating scheme. Payments depend on the volume and temperature of heat delivered and expected outdoor temperatures. This gives developers a commercial reason to consider heat recovery when choosing and designing a facility.

The arrangements also clarify investment responsibilities. Under the standard Open District Heating offer, Stockholm Exergi invests in pipes and network connections, while suppliers fund the equipment needed to deliver heat. The parties assess technical requirements and commercial conditions before proceeding. The wider lesson is that heat recovery needs an identified buyer, a workable price and an agreement on who funds the necessary infrastructure.

There is evidence of practical uptake, with Stockholm Data Parks having connected more than 20 data centres, supplying around 1.5% of the city's district heating demand. This demonstrates an operating contribution, while also showing that recovered data-centre heat remained a relatively small part of the overall heating system⁸⁵. The model depends on local conditions. An established heating network, nearby demand and suitable heat-recovery equipment are important. Connection costs, seasonal demand and the electricity required by heat pumps also affect whether a project is worthwhile. These factors need to be assessed for each location.

For the proposed European Compact, Stockholm offers an earlier example of the coordination that tripartite agreements could support. Public authorities help shape development, infrastructure providers define connection arrangements, and operators deliver a service with measurable local value. Replication would require clear responsibilities, realistic delivery schedules and monitoring of actual heat supplied. Community participation and the distribution of benefits would still need explicit attention: useful heat recovery alone does not establish that all affected residents have influenced or benefited from a project.

Recommendation

Give host communities a meaningful role and a fair share of benefits. Use locally adapted tripartite agreements to define responsibilities for local impacts, participation and measurable benefits. Equip local authorities to negotiate and monitor commitments and establish common principles for fair benefit sharing. Faster development should preserve meaningful participation, and financial contributions should not replace it.

⁸⁵ International Energy Agency (2025). "[Energy and AI](#)". World Energy Outlook Special Report. IEA, Paris. April, p. 248.

Conclusion

This paper has sought to capture key themes of discussion in a fast-moving debate around Europe's energy infrastructure and policymaking for AI. AI is becoming central to economic growth, scientific research, public services and security. Every model trained and every service deployed depends on physical computing capacity, electricity grids and cooling systems. Europe's digital ambitions and its energy transition need to be governed as one infrastructure challenge.

Europe starts from a mixed position. It trails the United States and China in advanced computing capacity, investment and access to high-end chips. Much of its cloud market is controlled by non-European companies, creating concerns about dependence and resilience. Yet it has major advantages: a comparatively low-carbon and highly interconnected electricity system, strong renewable energy generation, world-class research institutions, advanced industrial capabilities and a regulatory framework that can provide predictability. The objective should not be to reproduce another region's model at any cost, but to turn those European advantages into strategically useful computing capacity. In the words of European Commission President Ursula von der Leyen, Europeans "do not need to be the ones who develop the frontier technology to be the ones who draw the greatest value from it⁸⁶."

Data-centre demand can be severe for the stability of the energy systems where facilities are concentrated. Grid congestion, slow connections and weak local planning already delay renewables, industrial electrification and new computing projects. Europe therefore needs both more infrastructure and better use of existing infrastructure, combining grid reinforcement with storage, flexible connections, transparent capacity information, digital grid tools and stronger locational signals.

Siting should become a central policy lever. Training facilities can follow abundant clean electricity, available grid capacity and suitable land. Good locations can turn data centres into regional assets by supporting renewable generation and transform the waste heat into a useful resource where applicable. Poorly planned projects, however, risk not only increasing electricity costs, but also straining water resources and jeopardise climate and energy targets as well as community acceptance and buy-in. This is a substantial point to consider as local opposition can lead to delays in getting projects to completion, losing the comparative advantages that would have initially guided the investment decisions.

The paper argues for a clearer bargain between public authorities, grid operators, energy companies, data-centre developers and host communities. Faster and more predictable development should come with credible demand forecasts, appropriate financial responsibility for enabling infrastructure, clean-energy commitments, flexibility and measurable benefits for host communities. In return, authorities should provide clearer rules, better capacity information, coordinated planning and faster decisions for projects that are genuinely ready to proceed.

⁸⁶ von der Leyen, U. (2026). "[2026 State of the Union address by President von der Leyen](#)". European Commission, SPEECH/26/1868. Strasbourg, 16 September.

Europe should judge success not by megawatts of data-centre capacity alone, but by whether the computing power built in Europe is strategically useful, resilient, accessible, efficiently integrated into the energy system and widely beneficial. A European AI Infrastructure Compact built on those principles would allow Europe to pursue digital competitiveness without setting it against affordability, decarbonisation or social acceptance. Done well, AI infrastructure can become not a constraint on Europe's energy transition, but one of the forces accelerating it.



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