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Data Centers and the Legal Governance of Energy Systems: A Legal Analysis of the Energy-Sector Impacts of Artificial Intelligence Infrastructure

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Abstract

The rapid expansion of artificial intelligence has transformed data centres from conventional digital facilities into strategically significant electricity loads capable of influencing generation planning, transmission investment, electricity tariffs, system reliability, energy efficiency, resource allocation, and environmental regulation. AI-oriented computing facilities differ from many traditional commercial consumers because of their exceptionally high power density, geographical concentration, rapid development cycles, continuous operating requirements, cooling demands, and increasing capacity to alter consumption in response to grid conditions. These characteristics have generated a new category of regulatory challenges for contemporary energy systems. This study examines the legal governance of data-centre electricity demand through a comparative energy-law framework, focusing particularly on grid interconnection, transmission planning, large-load tariffs, cost allocation, stranded-asset risk, reliability obligations, energy-performance disclosure, waste-heat recovery, water consumption, demand flexibility, and institutional coordination. It draws upon recent developments in European Union energy law, regulatory proceedings of the United States Federal Energy Regulatory Commission, North American reliability regulation, and energy-system assessments of the International Energy Agency. The study finds that conventional energy-law structures were generally designed for slower and more predictable demand growth and are increasingly being adapted to accommodate AI-related loads whose scale and speed can materially alter electricity-system planning. Effective governance consequently requires transparent interconnection procedures, project-readiness standards, cost-causation principles, financial safeguards, mandatory operational reporting, flexible-load arrangements, reliability oversight, and integration of electricity, heat, water, and land-use planning. The study concludes that large data centres should not always be treated merely as ordinary electricity consumers; where their scale materially affects system planning or reliability, they increasingly function as system-significant energy actors whose responsibilities should correspond to the costs, risks, and opportunities they create.

Keywords: Data Centres, Artificial Intelligence Infrastructure, Energy Law, Electricity Regulation, Grid Interconnection, Large Loads, Cost Allocation, Energy Efficiency, Demand Flexibility, Reliability Regulation

Introduction

Artificial intelligence is often analysed as a technological, commercial, or regulatory phenomenon centred upon algorithms and digital services. Yet the physical infrastructure required to support increasingly sophisticated AI systems has created a parallel

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transformation in the energy sector. Large-scale training and inference depend upon high-performance processors, extensive server networks, cooling systems, backup power, energy-storage installations, transformers, substations, and substantial grid connections. Consequently, the expansion of artificial intelligence is also becoming an electricity-law and infrastructure-governance issue.

The International Energy Agency estimates that global data-centre electricity consumption reached approximately 415 terawatt-hours in 2024 and projects a substantial increase by the end of the present decade.[1] This demand is not geographically uniform. Data centres tend to cluster in locations offering fibre connectivity, land, favourable tax conditions, existing transmission infrastructure, and access to reliable electricity. As a result, national electricity supply may appear adequate in aggregate while particular regions experience major congestion, connection delays, transmission-upgrade requirements, or local resource-adequacy concerns.

The legal implications extend beyond the simple question of whether sufficient electricity exists. A proposed data-centre campus may trigger hundreds of millions of dollars in network investment. Regulators must determine who should bear those costs if the project proceeds, and who should bear them if it is later cancelled. Network operators must decide how speculative connection applications should be treated. Public authorities must reconcile accelerated digital-development timelines with much slower transmission and generation construction. Reliability institutions must assess whether computational loads can create system disturbances sufficiently significant to justify new operational obligations.

At the same time, data centres may offer energy-system benefits. Some computing workloads can potentially be shifted in time or across locations. Battery systems and microgrids can provide local resilience. Waste heat can potentially be reused in district-heating networks. Certain facilities may participate in demand-response programmes or agree to reduced service during system emergencies. Legal governance must therefore address both the risks and the opportunities created by AI infrastructure.

The central research question of this study is how energy law should allocate the rights, obligations, risks, and costs arising from the rapid integration of large AI-oriented data centres into electricity systems.

Section One: Data Centres as a New Category of System-Significant Electricity Demand

Modern data centres challenge several assumptions upon which electricity regulation has historically been based. Conventional demand growth was often dispersed across households, commercial buildings, and industrial consumers and developed relatively gradually. Large AI facilities can instead create concentrated demand in a single location and may seek energisation much faster than the grid can be expanded. The resulting legal problems concern scale, timing, interconnection, planning, and reliability.

1. Scale and Concentration of Data-Centre Electricity Demand

The scale of modern data-centre demand is the starting point for understanding its regulatory importance. Data-centre electricity use is growing faster than general electricity consumption, and AI-oriented facilities may require very high electrical capacity within relatively compact geographic areas.

The International Energy Agency states:

[1] International Energy Agency, *Energy and AI* (Paris: IEA, 2025), "Energy Demand from AI," estimating approximately 415 TWh of global data-centre electricity consumption in 2024.

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> "Data centres accounted for around 1.5% of the world's electricity consumption in 2024."[2]

This figure appears modest when considered purely as a global percentage, but its legal significance changes when demand is examined regionally. Electricity networks are not governed as one undifferentiated global system. A large facility connects at a specific transmission node, distribution network, and jurisdiction. Consequently, even a limited global share can produce major local legal consequences involving transmission reinforcement, new substations, cost allocation, permitting, and resource-adequacy planning.

The same report further projects:

> "Data centre electricity consumption is set to more than double to around 945 TWh by 2030."[3]

This projection changes the nature of regulatory planning. Electricity law cannot respond effectively if large-load demand is treated only after facilities request immediate connection. Generation, transmission, and network reinforcement often require years of advance planning. A projected doubling of consumption therefore creates a legal need for better demand forecasting, more transparent project pipelines, and rules distinguishing credible projects from speculative development announcements. Importantly, the projection should not be treated as a guaranteed outcome; it is a base-case estimate subject to technological efficiency, AI adoption, and infrastructure constraints. Its regulatory significance lies in demonstrating the scale of plausible demand growth that planners must be prepared to manage.

The geographical concentration of this demand is equally important. Data-centre clusters can produce infrastructure requirements comparable with major industrial facilities while concentrating those requirements in already congested regions. This makes location a regulatory variable rather than merely a private commercial choice.

Energy regulators may therefore increasingly need to consider locational incentives, regional capacity availability, and whether new projects should bear additional costs associated with choosing constrained network areas. Where less congested locations are technically feasible, tariff design may legitimately encourage development where existing infrastructure can accommodate growth more efficiently.

2. Grid Interconnection and the Mismatch Between Digital and Energy Infrastructure Timelines

A central governance problem arises from the difference between the speed of data-centre development and the speed of electricity-infrastructure expansion. Computing facilities can sometimes be planned and constructed far more quickly than high-voltage transmission lines, major substations, or new generation.

The International Energy Agency observes that:

> "a data centre can be operational in two to three years."[4]

This relatively short development period creates a regulatory challenge because electricity infrastructure rarely moves at the same speed. A data-centre developer may possess commercial incentives to seek connection quickly, while a network operator must consider engineering studies, permitting, procurement, land rights, transformers, substations,

[2] International Energy Agency, *Energy and AI*, "Energy Demand from AI."
[3] International Energy Agency, *Energy and AI*, "Energy Demand from AI," Base Case projection of around 945 TWh of data-centre electricity consumption by 2030.
[4] International Energy Agency, *Energy and AI*, "Energy Demand from AI," discussion of data-centre development timelines and longer lead times for energy infrastructure.

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transmission corridors, and long-term reliability. The legal system therefore becomes the mechanism through which two different development timelines must be reconciled. Interconnection law must provide sufficient speed for genuine projects without compelling utilities to undertake major irreversible investment on the basis of uncertain or speculative demand.

FERC Commissioner Lindsay See described the broader issue as follows:

> "The pace and scale of emerging large loads create new circumstances that require us to adapt."[5]

This observation has substantial legal significance. Existing tariffs and planning procedures were often created before electricity demand from individual digital facilities reached contemporary levels. Adaptation may therefore require changes not only in administrative processing times but in the substantive rules governing project readiness, interconnection studies, deposits, queue priority, network upgrades, and curtailment arrangements. The challenge is to avoid two opposite regulatory failures: excessive delay that prevents viable investment, and excessive accommodation that socialises the costs of uncertain private projects. A well-designed framework should therefore connect faster processing with stronger evidence of commercial maturity, technical preparedness, and financial commitment.

Connection queues are especially important. Developers may submit applications in several regions while deciding where ultimately to build. Such behaviour may be commercially rational but can distort grid planning if every application is treated as fully committed demand.

A more mature legal framework could therefore require escalating financial security, site control, credible construction schedules, and withdrawal penalties as a project advances through the interconnection process. Such rules would make queue positions reflect genuine development intention more accurately.

3. Reliability Risks and the Operational Characteristics of Computational Loads

Large computational facilities may also create reliability concerns distinct from traditional commercial demand. Their internal power electronics, backup generation, control systems, and rapid changes in computing activity can produce operating characteristics relevant to bulk-power-system stability.

In July 2026, FERC directed NERC to develop standards addressing:

> "the reliability risks associated with the integration of computational loads into the Bulk-Power System."[6]

This regulatory step represents an important shift in the legal treatment of electricity demand. Reliability law traditionally concentrated heavily upon generators, transmission operators, and other entities responsible for supplying or moving electricity. Very large computational loads challenge that supply-side orientation. Where demand is sufficiently large or operationally distinctive to affect bulk-system stability, the consumer itself may acquire obligations relating to telemetry, modelling, disturbance behaviour, registration, or communications with system operators.

The development continued rapidly. In September 2026, NERC reported that preliminary results indicated that:

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[5] Federal Energy Regulatory Commission, Commissioner Lindsay S. See, "Remarks on the Large Load Show Cause Orders, E-7 to E-12," June 18, 2026.

[6] Federal Energy Regulatory Commission, *Reliability Standard(s) Pertaining to Computational Load Integration*, Docket No. RD26-7-000, Order Directing the North American Electric Reliability Corporation to File Reliability Standard(s) Pertaining to Computational Load Integration, July 16, 2026.

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> "the foundational Computational Loads Reliability Standards have passed initial ballot."[7]

The importance of this statement lies less in the fact of the ballot itself than in the direction of regulatory evolution. The standards remain under development and should not yet be described as final enforceable law. Nevertheless, their progress indicates that large computational loads are increasingly being recognised as active participants in reliability governance. If finalized and approved, such standards could formalise obligations that previously applied mainly through individual utility agreements or system-operator procedures. This development supports a broader legal principle: regulatory classification should follow system impact rather than traditional labels. A facility may be contractually classified as a customer yet still warrant direct reliability duties if its behaviour can materially affect the wider grid.

The distinction between ordinary customer status and system-significant load is likely to become increasingly important. Legislatures and regulators may therefore need objective thresholds based upon capacity, voltage level, operational behaviour, or potential system impact rather than applying identical rules to all commercial electricity users.

Section Two: Legal Instruments for Governing the Energy Impacts of Data Centres

The energy impacts of AI infrastructure are governed through a combination of interconnection rules, electricity tariffs, network-planning obligations, reliability standards, energy-efficiency requirements, and environmental controls. These mechanisms increasingly determine how the costs of digital expansion are distributed and what obligations large facilities must satisfy.

1. Interconnection Tariffs, Cost Allocation and Consumer Protection

Perhaps the most politically and economically significant legal question is who pays for infrastructure required to serve new large loads. Utilities may need to invest in transmission, substations, generation, transformers, or network reinforcements before a data centre becomes operational. If those costs are added to general tariffs, customers with no connection to the project may subsidise its infrastructure requirements.

The United States Department of Energy identifies as a major regulatory objective:

> "Fair allocation of electricity system costs to large-load customers without unfair shifting of costs to other customers."[8]

This principle is grounded in cost causation. If a particular customer materially causes the need for new infrastructure, energy regulators have a strong basis for allocating an appropriate share of those costs to that customer. Yet the analysis is not always straightforward. Network upgrades may create benefits for multiple users, improve reliability, or support future regional growth. Therefore, legal cost allocation should distinguish customer-specific facilities from broader system improvements rather than assuming that either the data centre or general consumers must automatically bear the entire cost.

FERC Commissioner Rosner observed that regulators and ratepayers must be able to understand:

> "who pays?"[9]

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[7] North American Electric Reliability Corporation, "Computational Loads Standards Advance Following Initial Ballot," September 19, 2026.

[8] United States Department of Energy, *Electricity Rate Designs for Large Loads: Evolving Practices and Opportunities* (Washington, DC: Department of Energy, January 17, 2025).

[9] Federal Energy Regulatory Commission, Commissioner David Rosner, "Remarks on the Large Load Show Cause Orders, E-7 to E-12," June 18, 2026.

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Although brief, this question captures one of the central distributive issues in contemporary data-centre regulation. The answer determines whether rapid AI infrastructure development produces private benefits supported by broadly socialised infrastructure costs, or whether project developers bear responsibility proportionate to the investments their projects require. Transparency is essential because even a technically sophisticated cost-allocation methodology may lose legitimacy if consumers cannot understand why their bills are changing. Regulators must therefore make network-upgrade costs, responsible projects, tariff treatment, and stranded-asset protections sufficiently visible to permit public and regulatory scrutiny.

Appropriate legal instruments may include minimum-demand charges, capacity reservations, deposits, termination payments, long-term service commitments, construction milestones, and cost-recovery agreements.

Such requirements should not be designed to penalise new investment. Their purpose is to align investment risk with the parties best positioned to manage it. Data-centre developers control project timing, scale, and site selection and are therefore often better able than ordinary ratepayers to assess commercial cancellation risk.

2. Mandatory Energy-Performance Reporting and Regulatory Disclosure

Effective energy regulation depends upon reliable information. Governments cannot design realistic efficiency standards, grid forecasts, or sustainability policies if they lack comparable data concerning actual data-centre consumption and performance.

Commission Delegated Regulation (EU) 2024/1364 applies to:

> "operators of data centres with an installed information technology power demand of at least 500 kW."[10]

The threshold is legally important because it distinguishes facilities considered sufficiently significant for mandatory sustainability reporting from smaller installations. Rather than applying the same regulatory burden to every server room, the EU framework directs disclosure obligations toward facilities with material energy characteristics. Such thresholds also illustrate a broader principle of proportional regulation: reporting duties should be calibrated according to scale and policy relevance. However, thresholds require periodic review because rapid increases in computing density can alter the relationship between installed IT capacity and actual energy-system impact.

The Regulation further provides that reporting operators:

> "shall communicate to the European database the information and key performance indicators."[11]

This requirement transforms sustainability information from voluntary corporate disclosure into structured regulatory data. The importance lies not simply in publication but in comparability. Standardised indicators allow public authorities to analyse efficiency across facilities, identify trends, evaluate policy outcomes, and develop better energy forecasts. Regulatory databases can also reduce reliance upon self-selected sustainability claims because operators must report according to common definitions and methodologies. At the same time, legal safeguards remain necessary for commercially sensitive information, particularly where disclosure might reveal operational or security characteristics.

The Regulation also requires operators to:

> "keep a record of the measurement points and measurement devices used, for a period of at least 10 years."[12]

[10] European Commission, 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, art. 1.

[11] Commission Delegated Regulation (EU) 2024/1364, art. 3(1).

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This long record-retention requirement is significant for regulatory accountability. Energy performance is not merely a snapshot; facilities evolve as servers, cooling systems, workloads, and efficiency technologies change. Preserving measurement information enables longitudinal analysis and supports later verification of reported performance. From a legal perspective, such records may also improve enforceability because regulators can investigate whether changes in reported efficiency result from genuine technical improvement, altered measurement boundaries, or methodological inconsistency. Long-term records therefore support both policy evaluation and evidentiary reliability.

The EU framework includes indicators relating to energy consumption, power utilisation, water use, waste-heat reuse, and renewable energy. This multidimensional approach is especially appropriate because a facility can improve one sustainability indicator while worsening another.

For example, some cooling technologies may reduce electricity consumption but increase water use. A governance framework focused exclusively upon electricity could therefore encourage environmentally undesirable substitution effects.

3. Waste-Heat Recovery, Cooling and Integrated Resource Governance

Electricity entering a data centre ultimately becomes heat, making thermal management a fundamental component of its environmental and energy impact. The legal treatment of data centres is therefore expanding beyond electricity consumption toward waste-heat recovery and cooling efficiency.

Directive (EU) 2023/1791 requires Member States to ensure that:

> "data centres with a total rated energy input exceeding 1 MW utilise the waste heat."[13]

The requirement is subject to technical and economic feasibility, but it represents an important regulatory innovation. It treats data-centre heat not merely as an unavoidable by-product but as a potentially recoverable energy resource. This changes the legal logic of facility design. A developer may need to consider nearby district-heating networks, industrial heat demand, temperature levels, and future heat-recovery connections before construction. As a result, energy-efficiency law begins to influence land-use decisions and site selection rather than operating only after a facility becomes operational.

European guidance further requires assessment of:

> "technical feasibility, cost-efficiency and the impact on energy efficiency and local heat demand."[14]

This qualification is crucial because mandatory heat recovery would be inefficient if imposed without regard to local conditions. A data centre located far from heat users may face excessive infrastructure costs, while a facility near a dense urban heating network may possess substantial recovery potential. The legal framework therefore adopts a conditional rather than absolute obligation. This approach is preferable because it recognises that energy efficiency depends upon system context. However, feasibility assessments should be transparent enough to prevent developers from invoking economic infeasibility without credible evidence.

Water use must also form part of integrated regulation. Cooling choices can shift environmental pressure from electricity systems to local water resources. This creates

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[12] Commission Delegated Regulation (EU) 2024/1364, annex II.

[13] European Parliament and Council, Directive (EU) 2023/1791 of 13 September 2023 on energy efficiency, art. 26(6).

[14] Directive (EU) 2023/1791, art. 26(7)(d); European Commission, Commission Recommendation (EU) 2024/2395 of 2 September 2024 concerning the interpretation of Article 26 of Directive (EU) 2023/1791.

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particular concern in water-stressed regions where data-centre development may compete with municipal, agricultural, or industrial demand.

Future legal frameworks may therefore increasingly require joint assessment of electricity availability, water intensity, waste-heat potential, land use, and local climate. Regulating these resources separately risks approving facilities whose combined environmental burden exceeds what any single permitting authority initially anticipated.

Section Three: Toward a Modern Legal Framework for AI-Energy Infrastructure

A modern regulatory framework should not treat large data centres exclusively as sources of additional demand. Certain facilities may also provide system flexibility, storage, local generation, or controllable load. The legal challenge is to create rules that capture these benefits without weakening reliability or transferring commercial risk to the public.

1. Demand Flexibility, Curtailment and Grid-Supportive Operation

Electricity systems were historically designed on the assumption that supply should continuously follow demand. Increasing electrification, renewable integration, and digital control technologies are creating opportunities for demand itself to become an operational resource.

The International Energy Agency states:

> "demand itself can increasingly contribute to efficient system operation."[15]

This principle has particular relevance to data centres because not every computing task has identical timing requirements. Some workloads may be delayed, geographically shifted, or temporarily reduced without interrupting critical services. If appropriately contracted, flexible computing demand can support the grid during scarcity periods. From a legal perspective, this creates the possibility of differentiated service categories in which customers accepting curtailment receive faster connections or lower network charges. Such arrangements could reduce the need for expensive infrastructure built solely to satisfy rare peak-demand conditions.

A United States Department of Energy project explicitly explores:

> "Data Center Flexibility as a Grid Enhancing Technology."[16]

The project involves microgrids, onsite generation, and battery storage at data-centre locations. Its significance lies in demonstrating that the legal relationship between data centres and electricity systems need not be purely consumptive. A facility equipped with storage or controllable generation may support local resilience, reduce peak withdrawals, or participate in emergency demand reduction. However, legal rules must distinguish firm operational commitments from voluntary intentions. Network planners cannot rely upon flexibility unless contractual terms define when curtailment may occur, how much load can be reduced, for how long, and what penalties apply for non-performance.

Flexible connection agreements could therefore become an important tool in AI-infrastructure regulation. They may permit faster interconnection where full firm capacity is not immediately available, while preserving reliability through pre-agreed limitations during constrained periods.

The legal design must nevertheless protect service clarity. Data-centre operators should know precisely what level of reliability they are purchasing, and system operators should know exactly what flexibility they may call upon.

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[15] International Energy Agency, *Scaling Up Demand Flexibility* (Paris: IEA, 2026), Executive Summary.

[16] United States Department of Energy, "CX-035792: Data Center Flexibility as a Grid Enhancing Technology," April 22, 2026.

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2. Financial Security, Stranded Assets and Long-Term Cost Responsibility

Large data-centre projects can require major utility investment before commercial operation begins. If projects are cancelled or materially downsized after network construction has commenced, unrecovered infrastructure costs may remain within the regulated utility system.

The Department of Energy specifically identifies:

> "financial risks associated with stranded assets from underutilized utility system investments."[17]

This risk is especially important because data-centre development can be highly competitive and location-sensitive. A developer may change location because of power availability, commercial conditions, permitting, tax policy, or technological strategy. Utilities, however, may already have committed capital to long-lived assets in anticipation of the original project. Without appropriate contractual protection, those costs could be transferred to existing customers. Energy regulators should therefore require financial mechanisms proportionate to the degree of project-specific investment being undertaken.

FERC has similarly emphasised the need for arrangements ensuring that:

> "everyone is paying their fair share."[18]

Fairness in this context does not necessarily mean that a data centre must pay every dollar associated with a network upgrade. Some projects may create broader system benefits or accelerate infrastructure eventually required for other users. The legally appropriate approach is therefore not automatic full allocation but reasoned allocation based upon causation and benefit. Regulators should separate project-exclusive facilities, incremental network reinforcement, and broader regional improvements. Transparent methodologies reduce both the risk of consumer subsidy and the risk of discriminatory treatment of large-load customers.

Financial-security mechanisms may include deposits, letters of credit, milestone payments, minimum monthly charges, take-or-pay arrangements, termination liabilities, or contractual commitments extending over sufficient periods to recover dedicated infrastructure costs.

Such mechanisms also improve the quality of planning information. A developer willing to post substantial security is more likely to represent genuine future demand than an applicant able to reserve hundreds of megawatts at little financial cost.

3. Coordinated Governance Among Energy Regulators, Network Operators and Data-Centre Developers

AI-energy infrastructure crosses institutional boundaries. Electricity regulators oversee tariffs, system operators manage reliability and network access, local authorities control land use, environmental agencies regulate emissions and water, and private companies determine facility design and location. Fragmented decision-making can therefore create significant governance gaps.

In June 2026, FERC ordered:

> "all six regional grid operators to justify or reform tariffs for data centers and other large energy users."[19]

This action demonstrates that large-load governance is becoming a system-wide regulatory issue rather than a series of isolated utility negotiations. Tariff reform can improve consistency in areas such as connection procedures, cost allocation, transparency, readiness requirements, and transmission service. Yet regional reform must remain sufficiently flexible

[17] United States Department of Energy, *Electricity Rate Designs for Large Loads*, discussion of stranded-asset risks.

[18] Federal Energy Regulatory Commission, Commissioner David Rosner, "Remarks on the Large Load Show Cause Orders, E-7 to E-12," June 18, 2026.

[19] Federal Energy Regulatory Commission, "FERC Launches Aggressive Targeted Action to Speed Large Load Integration," June 18, 2026.

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to reflect differences among electricity markets. A single nationwide technical solution may not suit systems with different generation mixes, network structures, market rules, and state regulatory arrangements.

The International Energy Agency estimates that:

> "grid constraints could delay around 20% of global data centre capacity planned for construction by 2030."[20]

This estimate reveals why coordination must begin before final investment decisions. If local planning authorities approve major developments without confirming realistic network availability, developers may construct facilities that cannot obtain timely power. Conversely, grid operators may plan expensive reinforcements for projects lacking land-use approval or commercial certainty. Integrated governance can reduce both forms of mismatch by requiring information exchange among planning authorities, utilities, developers, and energy regulators at early stages.

NERC's September 2026 statement notes that large computational loads possess:

> "distinctive operating characteristics and risks associated with these loads."[21]

This observation supports the need for institutional coordination beyond ordinary rate regulation. A project may simultaneously raise tariff, reliability, environmental, and land-use issues. No single authority necessarily possesses jurisdiction over all of them. Governments should therefore develop formal coordination procedures for exceptionally large projects, including shared timelines, technical-data requirements, and responsibility matrices. Such governance would not eliminate jurisdictional boundaries, but it would reduce the risk that each regulator approves only its narrow component while no institution evaluates the combined system impact.

A coherent regulatory model should therefore align at least five areas: connection approval, transmission planning, cost allocation, reliability requirements, and resource sustainability.

The central principle should be that large AI infrastructure is evaluated as an integrated energy-system development rather than as a conventional commercial building requiring a routine electricity connection.

Findings of the Study

The study demonstrates that AI-related data centres are increasingly significant actors in electricity-system governance because of the unusual combination of their scale, concentration, development speed, operational intensity, and infrastructure requirements.

First, data-centre electricity consumption is projected to grow considerably over the present decade, making demand forecasting and anticipatory grid planning increasingly important.

Second, national electricity statistics can conceal local network stress. Regulatory analysis should therefore focus on specific transmission regions and connection points rather than national supply alone.

Third, the development timeline of data centres is frequently shorter than the timeline for transmission expansion. Interconnection law must consequently balance faster processing with stronger project-readiness requirements.

Fourth, large computational loads increasingly raise reliability issues that may justify obligations traditionally applied primarily to supply-side entities.

Fifth, ordinary rate structures may inadequately address infrastructure built specifically for very large new customers. Cost allocation must therefore reflect causation, wider network benefits, and stranded-asset risk.

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[20] International Energy Agency, *Energy and AI*, "AI and Energy Security," analysis of connection delays and grid constraints.

[21] North American Electric Reliability Corporation, "Computational Loads Standards Advance Following Initial Ballot," September 19, 2026.

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Sixth, financial security is not merely a commercial matter; it is a consumer-protection mechanism where utilities undertake long-lived regulated investment for uncertain projects.
Seventh, mandatory energy-performance reporting improves evidence-based policy and allows regulators to monitor electricity use, cooling efficiency, water use, renewable-energy consumption, and heat recovery.
Eighth, waste-heat regulation demonstrates that data centres can be treated not merely as electricity consumers but as participants in broader thermal-energy systems.
Ninth, demand flexibility offers a potential mechanism for reconciling rapid data-centre growth with constrained grid capacity, but flexibility must be contractually enforceable rather than merely aspirational.
Tenth, institutional fragmentation is itself a governance risk. Planning approval, electricity connection, reliability regulation, water use, and environmental review should be coordinated for exceptionally large projects.

Recommendations

1. Energy regulators should establish dedicated interconnection procedures for exceptionally large data-centre loads.
2. Queue priority should be linked to objective evidence of project readiness.
3. Developers should provide increasing financial security as utility investment becomes more project-specific and irreversible.
4. Transmission-upgrade costs should be allocated according to transparent principles of causation and system benefit.
5. Regulators should distinguish firm electricity service from flexible or interruptible service.
6. Flexible-load customers should receive tariff incentives only where curtailment obligations are measurable and enforceable.
7. Network operators should receive timely and sufficiently detailed demand forecasts from major data-centre developers.
8. System-significant computational loads should be subject to appropriate telemetry, modelling, and reliability requirements.
9. Mandatory energy reporting should cover electricity, peak demand, cooling performance, water consumption, renewable-energy use, and waste-heat recovery.
10. Waste-heat feasibility should be assessed during planning and design rather than after construction.
11. Local development approval for very large facilities should include evidence of realistic electricity-network capacity.
12. Regulators should require contractual protection against stranded network investment where projects are cancelled or substantially reduced.
13. Commercial confidentiality should not prevent regulators from obtaining information required for grid planning or enforcement.
14. Large data-centre tariffs should be periodically reviewed as facility size and AI computing density continue to change.
15. Governments should establish formal coordination mechanisms among energy regulators, network operators, environmental authorities, water authorities, and planning bodies.
16. Data-centre developers should be encouraged to locate facilities in areas with available generation and network capacity where technically and commercially feasible.
17. Demand-response programmes should be designed specifically for large computational loads capable of shifting or reducing non-critical workloads.
18. Regulatory frameworks should recognise that large data centres can create both system costs and valuable flexibility and should allocate obligations accordingly.

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Conclusion

The expansion of artificial intelligence is reshaping the physical as well as the digital economy. The enormous computing capacity required for advanced AI increasingly depends upon data centres whose electricity requirements can materially influence network planning, generation investment, consumer tariffs, reliability standards, and resource policy.

This development requires energy law to reconsider the traditional legal identity of the electricity consumer.

Ordinary commercial customers generally receive service under tariffs designed for comparatively predictable and limited demand. Large AI computing campuses can be fundamentally different. A single project may require new high-voltage infrastructure, long-term capacity planning, dedicated substations, reliability studies, and substantial regulated investment. Once the consequences of a private load extend materially into the wider electricity system, the legal obligations associated with that load should reflect its systemic significance.

The emerging regulatory response is already visible. European Union law requires structured energy and sustainability reporting for qualifying data centres and imposes requirements concerning waste-heat utilisation above specified thresholds. United States regulators are examining tariffs, interconnection procedures, cost allocation, transparency, and stranded-asset protection. North American reliability institutions are developing dedicated rules for computational loads.

These developments demonstrate that data-centre regulation is moving from a peripheral utility issue toward a distinct field of energy governance.

Future legal frameworks should be based upon reciprocity. Data-centre developers should receive clear, predictable, and efficient pathways to electricity connection. In return, projects requiring major regulated infrastructure should provide reliable forecasts, appropriate financial commitments, operational data, and responsibility for costs they materially cause.

The most advanced governance model will also recognise that data centres are not necessarily passive burdens upon electricity systems. Flexible computing, onsite storage, microgrids, waste-heat reuse, and responsive demand may enable some facilities to support system efficiency and resilience.

The ultimate legal objective should therefore not be to obstruct AI infrastructure, nor to subsidise it without conditions. It should be to ensure that digital growth proceeds in a manner compatible with reliable, affordable, transparent, and environmentally responsible energy systems.

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