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"Green Data Centers: The Legal Imperative for Renewable Integration and Energy Storage"

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Introduction

Contemporary digital economy consists of specialized infrastructure hubs commonly known as data centres, which include servers, networking hardware and storage systems. Their expansion—fueled by cloud computing, AI, Internet of Things (**IoT**) and big data—has resulted in a substantial ecological footprint: high electricity consumption, heat emissions, and intensive water usage[1]. Around 3% of the world's electricity demand is accounted for by data centers, while the International Energy Agency estimates that by 2030, global electricity demand from data centers, AI and cryptocurrencies might more than double, reaching nearly 1,000 TWh per year[2]. Over 500 MW of large-scale projects are now under way in Greece[3]. This development necessitates the integration of data

[1] Koronen, C., Åhman, M., & Nilsson, L. J. (2019). Data centres in future European energy systems—energy efficiency, integration and policy. Energy Efficiency, 13(1), 1[1]29–144. https://doi.org/10.1007/s12053-019-09833-8

[2] Centers, B. T.-. V. P. D. (2025, June 24). Data Center Sustainability & ESG: Trends for 2025. 174 Power Global. https://174powerglobal.com/blog/data-center-sustainability-and-esg/

[3] Novak, C. (2024, November 21). Is Greece ready for energy-hungry data centers? tovima.com. https://www.tovima.com/climate/is-greece-ready-for-energy-hungry-data-centers/?utm source=chatgpt.com

centres with Renewable Energy Sources (**RES**) and energy storage —not only for sustainability but also as a legal and investment imperative.

Legal and Regulatory Framework in the EU and Greece

Under the Energy Efficiency Directive (EU 2023/1791 - **EED**), data centers with IT loads of 500 kW or more must submit an annual report to a unified EU database, covering measures such as Power Usage Effectiveness (PUE), renewable energy sharing, water usage, and heat recovery. The first deadline for submission of the aforesaid report, set for September 15, 2024, created an unprecedented standard for transparency and accountability.

To further harmonize requirements on data centers across Member States, the EU adopted the Delegated Regulation (EU 2024/1364) in March 2024, which provides concise definitions, calculation techniques, and templates for these indicators. This legislation reinforces the EU's target of reducing energy consumption by 11.7 % by 2030 and aligns with broader ESG and sustainability targets under the EU taxonomy system and CSRD[4]. The "Climate Neutral Data Centre Pact", as an initiative coming from the industry sector, sets industry-wide commitments for reducing carbon emissions and improving energy efficiency, by encouraging data center operators to prioritize the use of clean energy and invest in storage technologies that enhance grid stability and flexibility[5].

The above EU framework has been enacted and supplemented by national legislation. Law 5069/2023 defines "data centers" under national zoning and fast-track licensing regulations. Subsequently, Joint Ministerial Decision (**JMD**) 96038/2024[6], taking effect on 1 March 2025, establishes operational notification requirements: facilities offering third-party services at ≥200 kW, or private-use centers at ≥1,000 kW. This includes submitting formal declarations and complying with technical and safety regulations, to be consistent with the EU reporting regulations.

Greece has accelerated infrastructure licensing, per Law 4951/2022 establishing a digital platform thereto (PSAPE), which provides fast-track approval of RES and energy storage projects, while licensing 4.7 GW of storage grid capacity. Collectively, these initiatives not only ensure compliance with EU requirements, but also establish a legal framework favorable to data centers integrating renewable energy and storage technologies.

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[4] Corporate Sustainability Reporting Directive (EU 2022/2646)

[5] Climate Neutral Data Centre Pact – The Green Deal need Green Infrastructure. (n.d.). https://www.climateneutraldatacentre.net/

[6] Εφαρμοσαννου. (2025, March 14). Ολοκληρώθηκε το Θεσμικό Πλαίσιο για τα Data Centers - Open Business Portal. Open Business Portal. https://openbusiness-portal.mindev.gov.gr/oloklirothike-to-thesmiko-plaisio-gia-ta-data-centers/?utm_source=chatgpt.com

Renewable Energy Integration in Data Centres

Data centers have become significant energy consumers worldwide, prompting a critical need to reduce their carbon footprint in line with global climate goals. One of the most effective ways to achieve this is by integrating RES directly into their energy supply. This can be accomplished either through on-site generation—such as installing solar photovoltaic (**PV**) panels or small-scale wind turbines within or near the data center facility—or through contractual arrangements like corporate Power Purchase Agreements (**PPAs**)[7]. PPAs allow corporations, including data centers, to purchase electricity directly from renewable energy producers, ensuring that their consumption is matched with clean energy production and ESG standards. This not only significantly reduces the carbon footprint of data centers but also provides long-term price stability, insulating operators from volatile energy markets[8].

In this regard, JMD ΥΠΕΝ/ΔΗΕ/124788/4301/2022 has accelerated the licensing procedures for private renewable energy stations. This decision governing RES projects intended for self-consumption or for sale of electricity to third parties, enables data centers and other large electricity consumers to engage more easily with renewable energy producers, either by directly investing in onsite RES or by entering long-term supply contracts that support the development of new renewable projects, thereby facilitating the implementation of corporate PPAs.

The strategic geographic positioning of Greece's evolving data infrastructure complements this trend. Recent projects in regions such as Attica, Central and South Greece have increasingly combined large-scale solar parks with hyperscale data centers located near areas with high electricity demand and close to key grid nodes[9]. This proximity reduces transmission losses and grid congestion, improving overall system efficiency. Moreover, it fosters synergy between energy generation and consumption, supporting grid stability and enabling data centers to operate in a more sustainable and cost-effective manner.

The role of Energy Storage in the Viability of Data Centres

Considering that solar and wind power are inherently intermittent, energy storage solutions are essential to enable data centres to run consistently on renewable energy

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[7] Z. Skidmore, (2025, February 10). Do PPAs have a future in the data center sector? https://www.datacenterdynamics.com/en/analysis/do-ppas-have-a-future-in-the-data-center-sector/?utm_source=chatgpt.com

[8] Centers, B. T.-. V. P. D. (2025, June 24). Data Center Sustainability & ESG: Trends for 2025. 174 Power Global. https://174powerglobal.com/blog/data-center-sustainability-and-esg/

[9] David, A. (2024, September 20). Data4 Announces Major Investment of 300 million euros in Greece to Develop New Data Center Campus. DATA4 - Smart Data Centers at Scale.https://www.data4group.com/en/news-data4/data4-announces-major-investment-of-300-million-euros-in-greece-to-develop-new-data-center-campus/,
ΔΕΗ. (n.d.). Η EDGNEX Data Centers της DAMAC και ο Όμιλος ΔΕΗ ανακοινώνουν τη δημιουργία νέου Data Center στην Αττική. https://www.ppcgroup.com/el/omilos-dei/grafeio-typou/deltia-typou/prosfata/deltia-tipou-2024/dekemvrios-2024/dei-edgnex-data-center-atiki/
https://www.energymag.gr/energeia/110352_relans-tis-kybernisis-me-mparaz-egkriseon-gia-data-centers-sti-megalopoli-apo

sources. The Greek regulatory framework on energy storage has been significantly amended, thus enabling the integration of storage systems with data centers and encouraging their active involvement in energy markets.

Under Law 4951/2022, energy storage facilities can function alongside renewable energy projects, connect to the grid as separate entities[10] and offer support services like demand management and frequency regulation. Energy storage is now formally acknowledged by this law as an active market participant that is necessary for maintaining grid stability and system flexibility. The Regulatory Authority for Energy (**RAAEY**) Decision 1163/2022 further specifies licensing and operational requirements for storage systems, including technical and safety standards and grid connection protocols. This decision ensures that storage facilities operate in compliance with national grid codes and harmonize with energy market regulations. Moreover, JMD 96038/2024 establishes a comprehensive legal framework for hybrid renewable energy and storage systems, introducing the rules for dispatch and participation of storage units in the balancing market, including operational procedures, dispatch priorities, and remuneration mechanisms[11]. This Decision enables data centers with integrated storage to offer flexibility services such as load shifting and peak shaving, thereby generating additional revenue streams.

The legislation outlined above enables data centers in Greece to enhance energy autonomy, reduce operational costs, and contribute to grid stability. The capacity to monetize flexibility services aligns with the EU Clean Energy Package's objectives, promoting demand-side participation and market integration[12]. As Greece develops competitive tenders and capacity remuneration mechanisms, hybrid data centers combining RES and storage are positioned as pivotal actors in the evolving energy landscape[13].

Conclusion

To meet the EU's climate goals and regulatory obligations, the integration of data centers with renewable energy and storage systems is becoming more and more crucial. The tightening regulatory frameworks, notably under the EED and the European Green Deal, require data center operators to ensure not only high energy efficiency but also sustainability, grid flexibility, and reduction of greenhouse gas emissions. By enacting cutting-edge legislation and encouraging green infrastructure through its National Plan for Energy and Climate (**NECP**), Greece is emerging as a competitive and appealing location for data centres investments that adopt clean energy and storage. Compliance with European regulations, such as the EU Taxonomy Regulation (2020/852) and the

[10] Art. 14,15.
[11] Art. 5.
[12] RAAEY National Report 2023, Regulation and performance of the electricity market and the natural gas market in Greece, in 2022.
[13] ESG News. (2025, April 4). Greece's PPC Launches €5.75 Billion Green Energy and Data Center Transformation Plan. https://esgnews.com/greeces-ppc-launches-e5-75-billion-green-energy-and-data-center-transformation-plan/?utm_source=chatgpt.com

Renewable Energy Directive (**RED II**), renders this integration not merely optional but a necessary condition for safeguarding legality, competitiveness, and long-term resilience of IT infrastructure[14].

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[14] Jessica Commins and Kristina Irion, Towards Planet Proof Computing: Law and Policy of Data Centre Sustainability in the European Union, Technology and Regulation, 2025, 1-36 https://doi.org/10.71265/c1nnwh92
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