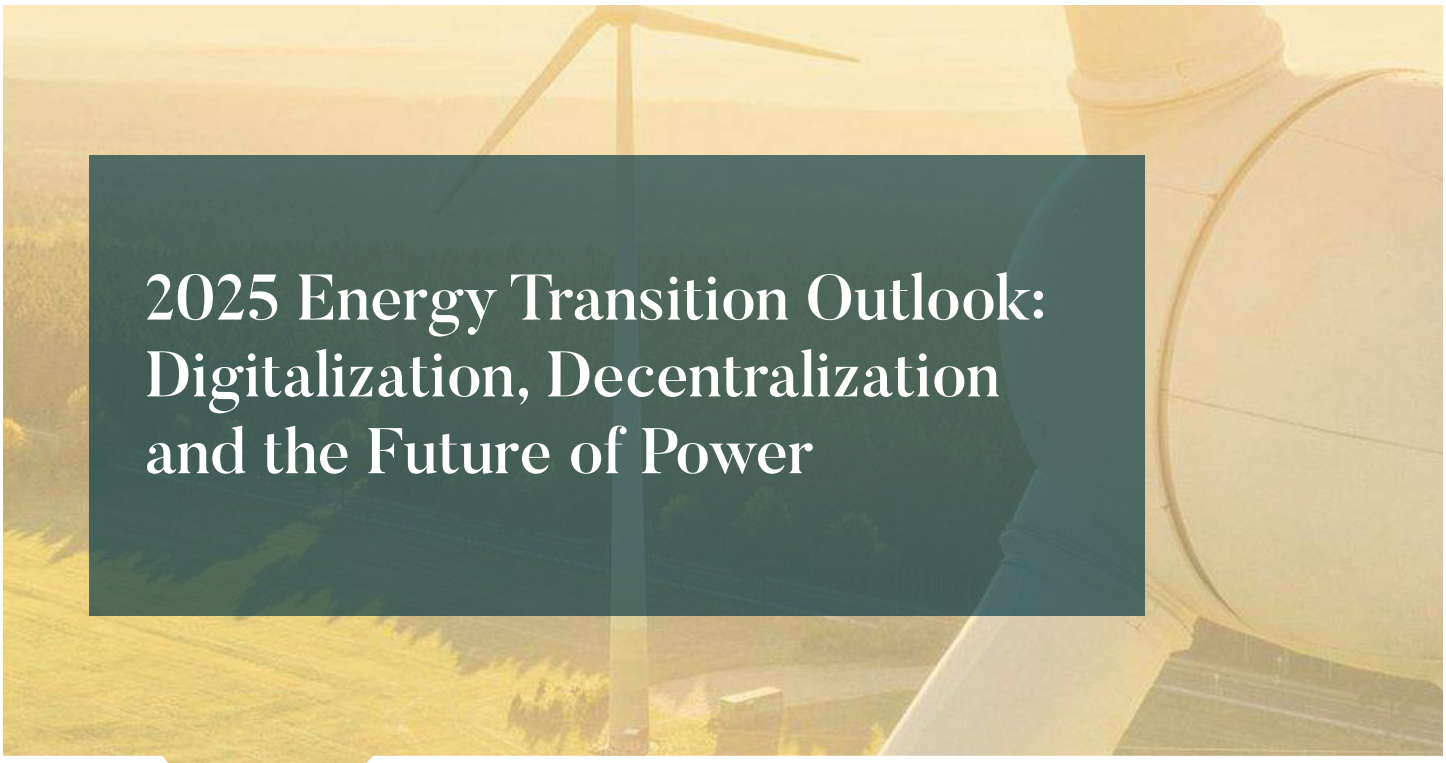

2025 Energy Transition Outlook: Digitalization, Decentralization and the Future of Power

The global energy transition is being shaped by two interconnected forces: digitalization and decentralization. These pillars are not only reshaping how energy is produced, managed and consumed but are also unlocking vast opportunities for investment and innovation.

A shift from traditional fossil fuels to renewable and sustainable energy sources has been occurring for the past 15 years, driven by regulatory imperatives, technological breakthroughs and shifting consumer preferences. With the convergence of digitalization and decentralization, a new era of opportunities for investors, corporations and policymakers is dawning. From clean energy funding and smart grid innovation to decentralized storage and AI-driven energy solutions, the interplay between these trends is shaping energy markets worldwide.

Lincoln International's dedicated team of bankers specializes in navigating the complex and ever-evolving landscape of the Energy Transition, Power and Infrastructure sector. Our bespoke advisory processes help position our clients for growth, source funding opportunities and assess strategic options amid shifting market trends.

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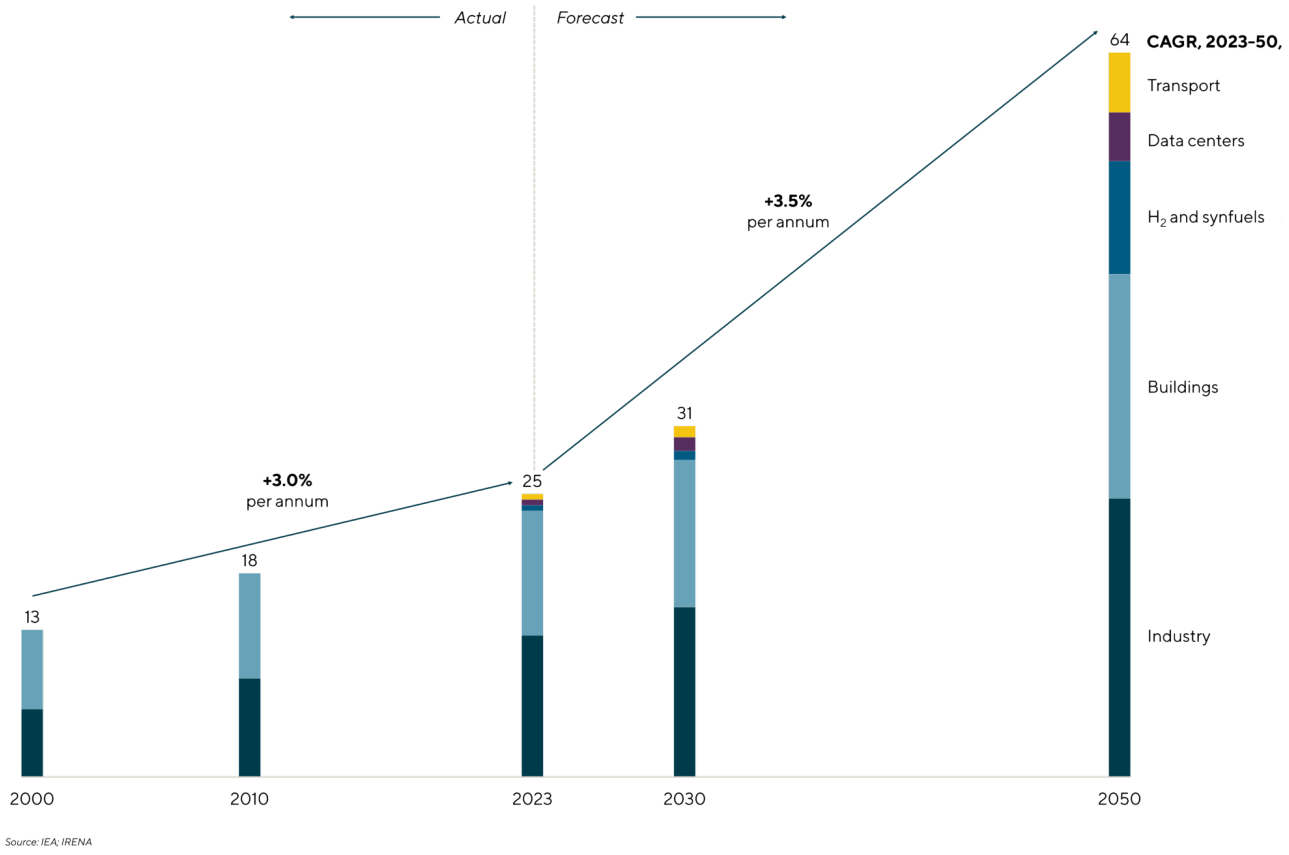
Digitalization: Driving Demand and Efficiency

Digitalization is one of the pivotal forces driving the transformation of the global energy sector. Escalating energy demands from digitalization will require **more than a 250% increase in the quantum of electrons in the grid by 2050**, according to studies by both McKinsey and Princeton. This surge is primarily attributed to the rapid expansion of data centers, AI applications and connected devices, all of which require substantial electrical capacity.

Global Power Consumption by Sector, Continued Momentum ('000 TWh)



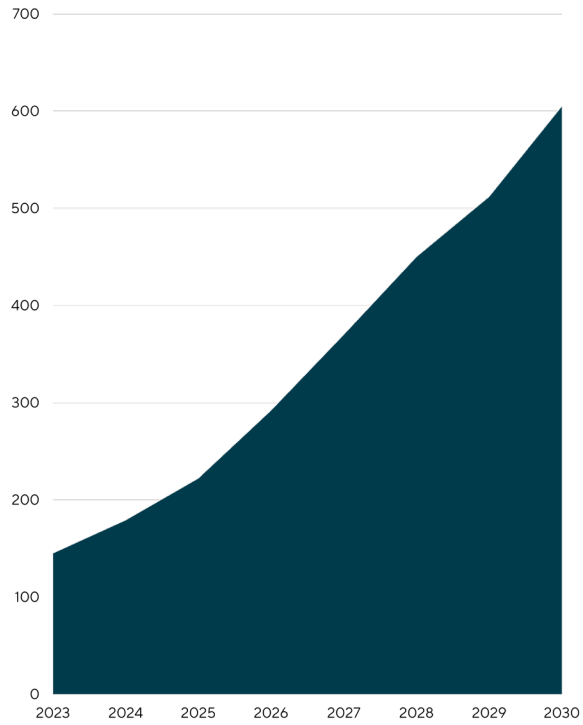
Source: IEA; IRENA

Data centers are the heart of the digital economy, supporting a vast array of services, from cloud computing to AI processing. Data centers currently account for approximately 2% of global electricity consumption, a figure that is expected to rise significantly.

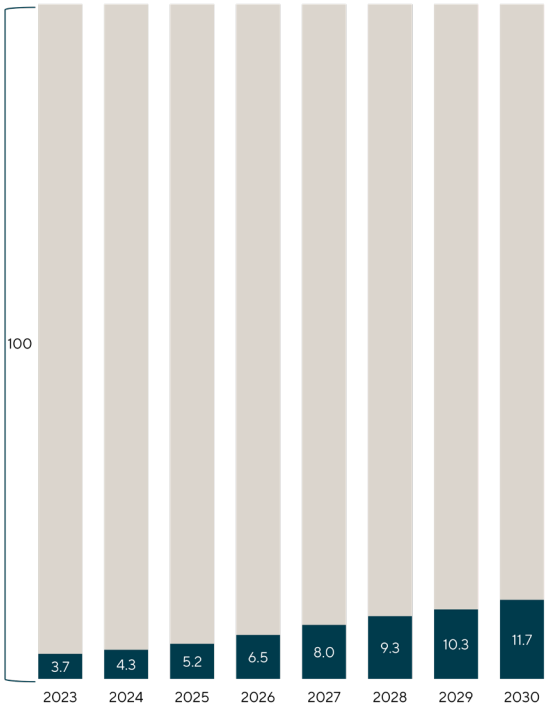
The proliferation of AI technologies further amplifies this demand. Training advanced AI models involves processing massive datasets, necessitating high computational power and, consequently, increased energy consumption. The power demand for U.S. data centers is projected, for example, to reach 606 terawatt-hours (TWh) by 2030, up from 147 TWh in 2023, accounting for 11.7% of total U.S. power demand.

Demand for power for data centers is expected to rise significantly in the United States

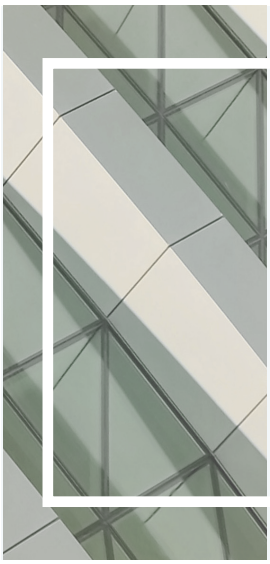
Projected US Data Center Energy Consumption (Medium Scenario) (TWh)



Projected US Data Center Share of Total Power Demand (Percent)



Source: Global Energy Perspective 2023, McKinsey, Oct 18, 2023; McKinsey analysis



Sayta Nadella, Microsoft CEO, posits that increasingly sophisticated AI technology is a modern reinterpretation of the Jevons paradox, saying that, "As AI gets more efficient and accessible, we will see its use skyrocket, turning it into a commodity we just can't get enough of."

The Internet of Things (IoT), Smart Devices, Electric Vehicles (EVs) and the Electrification of Transport

The expansion of IoT devices contributes to the rising electricity demand. As homes, businesses and industries adopt smart technologies—ranging from connected appliances to automated industrial systems—the cumulative energy consumption will continue to materially increase. Each device may individually consume a modest amount of power, but collectively, they represent a significant load on the electrical grid.

The transition to electric vehicles (EVs) is another crucial factor in the surge of electricity demand. As EV adoption grows, so does the need for charging infrastructure. This transition impacts both total electricity demand and load distribution, requiring advanced grid management solutions to balance supply and demand effectively.

One of the most significant drivers of persistent EV growth is the increasing affordability and performance of electric vehicles. Battery costs, which once posed a major barrier, have steadily declined due to innovations in lithium-ion and solid-state battery technologies, making EVs more cost-competitive with traditional internal combustion engine (ICE) vehicles. Additionally, major investments in charging infrastructure are alleviating range anxiety, making EVs more practical for everyday use. Governments worldwide continue to implement stricter emissions regulations, further incentivizing automakers to prioritize EV production. Meanwhile, consumer preferences are shifting as awareness of sustainability and long-term cost savings grows. Even with short-term fluctuations in sales growth, the trajectory remains clear—EVs are on track to dominate the future of transportation.

Challenges and Opportunities

The anticipated doubling of electricity demand presents both challenges and opportunities. Grid reliability, transmission expansion and storage capacity must be enhanced to accommodate this growth. However, there are clear opportunities for innovation and investment. Digital energy solutions, including AI-powered smart grids can optimize energy distribution and reduce inefficiencies to help meet increased demand.

The integration of advanced digital technologies—such as artificial intelligence (AI), the IoT and big data analytics—is enhancing operational efficiency, enabling smarter grid management and facilitating the seamless integration of renewable energy sources.

The integration of machine learning and automation into energy management systems is enhancing predictive maintenance, grid optimization and demand forecasting. As a result, digitalization is not only increasing energy demand but also improving system resilience and efficiency in managing this new energy landscape.

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Decentralization: Power Systems Shift to a More Resilient Future

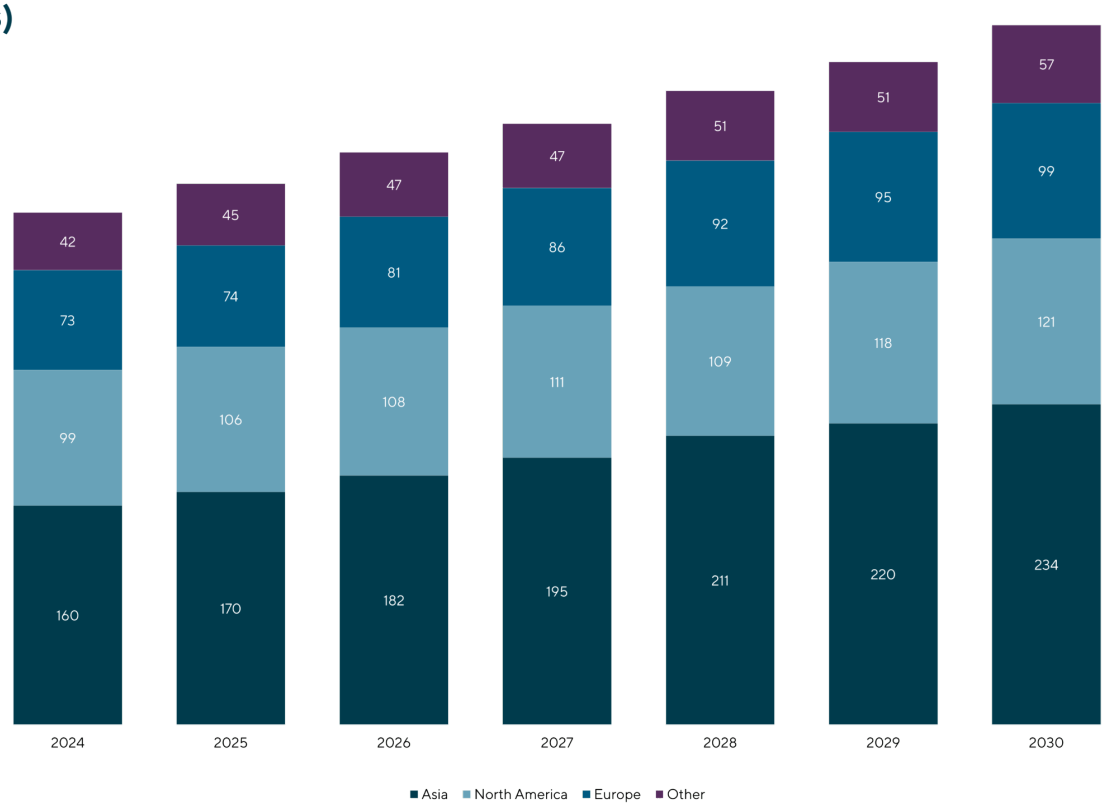
While AI can help with grid reliability and efficiency, the reality is that as of today that solution is not yet available to fully address existing issues and the problem is likely to get worse before it gets better. As centralized power systems become increasingly unreliable and costly, there will be a global shift towards decentralized energy generation and storage, which offer greater resilience, flexibility and efficiency. The trend is expected to accelerate due to a combination of technological advancements, grid vulnerabilities and economic incentives.

The Limitations of Centralized Power Systems

Aging infrastructure, extreme weather events and increased energy demand have exposed the vulnerabilities of centralized grids. In many regions, the cost of maintaining and upgrading large-scale grid networks is becoming prohibitive, prompting businesses and communities to explore independent, localized energy solutions.

Investment in grid modernization has struggled to keep pace with demand, leading to supply shortages, blackouts and reliability concerns. Existing network infrastructure is unequipped to handle the distribution of hundreds of megawatts to single consumption sites, such as large data centers and industrial facilities, further driving the demand for decentralized energy solutions and spurring grid investment.(1)

Power Grid Investment by Region ($billions)



The Rise of Microgrids, Distributed Energy Resources (DERs) and Energy Storage

Microgrids and distributed energy resources (DERs)—such as solar photovoltaics (PV), battery storage and combined heat and power (CHP) systems—are reshaping power generation models. Microgrids are gaining traction as a cost-effective solution that enhances energy security while reducing dependence on centralized grids.

As decentralized energy systems expand, energy storage technologies are emerging as the key enabler of flexibility and stability. Innovations in battery storage, pumped hydro and hydrogen-based energy storage make it possible to store and dispatch power on-demand, reducing reliance on real-time grid supply.

The commercial and industrial (C&I) solar market is experiencing a resurgence due to record-low costs and strong economic incentives. Businesses are leveraging on-site solar and storage to reduce operational costs and hedge against grid price fluctuations.

The shift from grid reliance to self-sustaining power models is a global trend. Many large-scale commercial entities are transitioning their backup power systems into primary energy sources, with the grid serving as a secondary backup.

The combination of microgrids, battery storage and distributed renewable generation is empowering businesses, municipalities and households to achieve energy autonomy. This shift reduces exposure to energy market volatility while enhancing energy security and carbon reduction goals.

Looking ahead, decentralization will play a pivotal role in global energy transformation as more regions embrace localized, smart, and efficient energy solutions.

> *Private Funds Advisory Group successfully closed 12 GP-led transactions and four funds, representing $4.8 billion in enterprise value and $2.8 billion in fund size.*

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Conclusion

Global energy markets are being reshaped by the convergence of the energy transition, digitalization and decentralization. Digitalization is vastly expanding electricity demand, propelled by AI applications, data centers and IoT devices, pushing power systems toward more localized solutions such as microgrids and distributed energy resources. This shift underscores the broader resilience and growth opportunities in the energy sector, as entities across industries seek to secure stable and sustainable power.

In 2024, Lincoln achieved significant milestones, closing over 360 transactions across Mergers & Acquisitions, Capital Advisory, Private Funds Advisory and Valuations & Opinions Groups.

Lincoln's Energy Transition, Power and Infrastructure Group has completed over 55 deals over the past three years, including 21 deals in 2024. Additionally, Lincoln expanded its global reach by acquiring TCG Corporate Finance, a European boutique specializing in technology and digital economy sectors, and its Private Funds Advisory Group successfully closed 12 GP-led transactions and four funds, representing $4.8 billion in enterprise value and $2.8 billion in fund size.

These accomplishments unfolded against a rapidly changing energy and regulatory landscape.

2024's achievements underscore Lincoln International's commitment to providing top-tier advisory services and its adaptability in an evolving global market. By expanding its capabilities and geographic footprint, Lincoln remains well-positioned to guide clients through the complex intersection of regulatory change, growing demand for sustainable investments, and the ongoing transformation of the energy landscape.

Sources:
1) Rystad Energy: Enable or inhibit: Power grids, key to the energy transition, require $3.1 trillion in investments by 2030
IEA; IRENA
Global Energy Perspective 2023, McKinsey, Oct 18, 2023; McKinsey analysis
Global Energy Perspective 2024, McKinsey, September 17 2024, www.mckinsey.com

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