Issue 35 / July 2026

Energy Journal

The Power Demand Revolution

CESI
1956 - 2026
Inspired with innovation

Energy Journal
CESI's house organ
Editorial coordination
Paolo Chighine / CESI
Luana Facciolo / CESI
Davide Cospito / CESI

Project, design and translations
Cultur-e
www.cultur-e.it

via Rubattino, 54
I-20134 Milano – Italia
info@cesi.It
www.cesi.It

Editorial

Electricity Is the New Infrastructure of Growth

Paolo Chighine

According to Vaclav Smil, a leading energy historian and scholar of major economic transformations, the great transitions in history do not begin when technology changes. They begin when societies change the way they use energy. From the rise of coal to the widespread adoption of electricity, every phase of development has been shaped by a new capacity to produce, transport, and use energy.

Today, we are entering a comparable phase. This time, however, the driving force is not a new energy source, but the growth of electricity demand. A demand fueled by artificial intelligence and data centers, but also by the electrification of industry and the digital transformation of economies.

For many years, the energy transition has been described primarily through the expansion of renewable sources, with a focus on emission reduction and technological innovation. All of these elements remain fundamental and will continue to guide change. However, the center of gravity is now shifting. The issue is no longer only how to produce clean energy, but how to ensure growing volumes of electricity for an economy that is becoming increasingly digital, automated, and electrified.

This new demand is not only larger. It is different: more concentrated, more continuous, more variable, and often less predictable than in the past. Large data centers operate around the clock and require extremely high levels of reliability. Entire industrial sectors are progressively replacing fossil fuels with electricity. Cities are increasing consumption through cooling, electric mobility, and digital services. And against this backdrop, access to energy has once again become a decisive factor — not only for regional competitiveness, but also for investments and economic growth.

This is the common thread of issue 35 of **Energy Journal**. In the *Scenario* section, we explore how the growth of electricity demand is reshaping the very operation of the global energy system. The increasing distance between production sites and centers of consumption is transforming grids and interconnections into critical infrastructure for energy security, price stability, and the integration of renewables.

The *Top Story* focuses on two of the main drivers of this transformation: data centers and electrified industry. The *Industries & Countries* section examines how the United States, Europe, Asia, and the Middle East are addressing this challenge through different approaches, yet with a shared understanding: access to reliable and competitive energy is becoming a decisive condition for attracting investment and sustaining industrial growth.

In this context, the importance of system planning and management is also growing. As explored in *Future & Technology*, flexibility, digitalization, demand response, advanced simulations, and digital twins are becoming essential tools to support demand growth without compromising security, resilience, and operational continuity. It is along this trajectory that CESI's contribution is positioned: providing independent analysis, planning, testing, and technical support to governments, operators, and investors facing increasing complexity.

We conclude this issue with the *Opinions* section, which provides insight into different, yet converging perspectives. Simon Bennett of the International Energy Agency highlights that the real challenge is not only how much electricity will be needed in the coming years, but where and how this new demand will take shape. Andreas Schierenbeck, CEO of Hitachi Energy, reminds us that "the grid is the thing the entire energy transition is won or lost on," underlining the central role of networks in ensuring competitiveness and energy security. Finally, Calvin Butler, CEO of Exelon, observes that the power sector is set to undergo greater transformation in the next decade than in the past century.

Three different perspectives converging towards the same conclusion: the growth of electricity demand is one of the defining economic and industrial transformations of our time.

Enjoy the reading!

Paolo Chighine
CESI Group Communication and External Relations Executive Vice President

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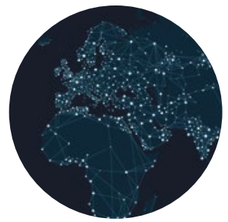
«Electricity is becoming the backbone of the global economy».

***Fatih Birol**, Executive Director, IEA*



News

Latest from CESI

Middle East

Industry and Academia Collaborate on the Energy Transition

CESI Middle East and Sultan Qaboos University (SQU) have signed a Letter of Understanding (LoU) to strengthen cooperation in engineering education, technical and scientific exchange, and applied expertise across the Sultanate of Oman and the GCC region.

The agreement was signed in Muscat by Professor Amer bin Saif Al-Hinai, Deputy Vice Chancellor for Postgraduate Studies and Research at SQU, and Pierluigi Vicini, Managing Director for the Middle East at CESI. The ceremony was also attended by the Italian Ambassador to Oman, Pierluigi D'Elia.

The collaboration includes joint activities focusing on power systems, energy infrastructure, and engineering disciplines, through seminars, workshops, specialized lectures, and knowledge transfer initiatives also aimed at postgraduate students.

CESI will contribute its international expertise in the power and energy sector, while SQU will bring its academic strength and deep understanding of the local context, further strengthening the link between industry, research, and education.

> **Bridging academia and industry to train the professionals of the energy transition.**

KEMA Labs

Smart Grid Forum 2026: Innovation and Resilient Networks

KEMA Labs, a business unit of the CESI Group, took part in the Smart Grid Forum 2026, held in March in Paris, reaffirming its role as a global reference point in testing and certification for the power sector.

The event brought together utilities, operators, and technology providers to discuss key developments in smart grids, digitalization, and the resilience of energy systems.

During the forum, KEMA Labs presented a technical paper on smart grid technologies, sharing its experience in the development of safer, more efficient, and more sustainable energy infrastructure.

The participation further reinforced the CESI Group's commitment to supporting utilities and institutions in accelerating the energy transition through technological innovation, advanced testing, and digitalization.

> **Advanced technologies and smart grids to accelerate the energy transition.**

European Union

New EU Rules for Electric Vehicle Charging

The European Union has updated the Measuring Instruments Directive (MID), introducing a clearer regulatory framework for electric vehicle charging systems, DC measurement, and digital metering solutions.

The new Directive (EU) 2026/706 updates MID 2014/32/EU to reflect the evolution of EV charging infrastructure, smart meters, and digital billing systems. It explicitly includes both AC and DC EV charging systems among the instruments subject to European metrological requirements.

KEMA Labs has supported manufacturers and operators in interpreting the new measures, offering testing, compliance, and certification services for EV charging systems, smart metering, and DC measurement technologies.

The new rules entered into force on April 9, 2026, while Member States are required to adopt them by April 2028. The objective is to ensure greater transparency for users and a more harmonized European market for electric mobility.

> **A decisive step toward a more transparent, digital, and interoperable EV charging ecosystem.**

CESI Space

Energy at the Core of Future Lunar Habitability

CESI took part in the conference "Living in Space: The Moon Case," promoted by the Italian Space Agency (ASI) and the Ministry of Enterprises and Made in Italy (MIMIT), and held in Rome at Palazzo Piacentini.

During the event, which brought together institutions, industry, and research representatives to discuss the prospects for a stable human presence in space, CESI CEO Nicola Melchiotti highlighted the strategic role of energy as a fundamental prerequisite for extraterrestrial habitability.

In his speech, Melchiotti emphasized that high-efficiency solar cells currently represent the only reliable source of energy for space missions and future lunar settlements. He also addressed the industrial challenges related to building a resilient European supply chain and scaling up production for the commercial space market.

CESI reaffirmed its strategic positioning in the sector, backed by 70 years of experience in the electrical field and around €20 million in investments — also supported by Italy's National Recovery and Resilience Plan (PNRR) — for the development of germanium-based space solar cells and a highly integrated production chain.

> **Energy will be the key prerequisite for living in space.**

Scenario

A New Era of Electricity Demand

The growth of global electricity demand is reshaping grids, infrastructure, and the geography of energy. Indeed, the real challenge is no longer simply generating electricity, but delivering and managing it where it is most needed.

The energy sector is entering a profoundly different phase from the past. For years, the transition has been framed primarily as a supply-side revolution: more renewables, more efficient technologies, lower emissions. Today, however, the center of gravity is shifting. The force redefining global dynamics is energy demand itself. And it is set to grow, evolve in nature, and become increasingly electrified.

At the height of what the International Energy Agency has defined as the "age of electricity," global power consumption is rising faster than overall energy demand. IEA scenarios, from *World Energy Outlook 2025 to Electricity 2026*, point to sustained structural growth over the next decade, driven by a new combination of factors: the electrification of industry and mobility, the expansion of data centers and artificial intelligence, rising demand for urban cooling, and the ongoing digitalization of economies.

However, it is not only the volume of electricity demand that is increasing. The very profile of consumption is changing. Demand is becoming more continuous, more concentrated, and harder to predict. Large industrial and digital hubs require stable and constant flows of energy, while heatwaves are increasingly reshaping peak demand in urban areas. A single large data center can consume as much electricity as a mid-sized city. As a result, system pressure is shifting from generation to infrastructure.

In recent years, global renewable capacity has continued to expand rapidly, as confirmed by IRENA's *Renewable Capacity*

For further information on this topic, please contact:
Bruno Cova (Power System Excellence Director – CESI Consulting)

Statistics 2026. The challenge, however, is no longer just about producing clean energy. It is about transmitting, distributing, and managing it within a system that is becoming increasingly electrified, variable, and decentralized.

Production and Consumption Drift Apart

For over a century, power systems were built around a relatively simple principle: generating energy close to where it is consumed. Today, this geography is changing rapidly. Renewable sources are developed where natural conditions are most favorable — deserts for solar and offshore areas for wind — while demand is increasingly concentrated in large urban, industrial, and digital hubs. This shift is redrawing the global map of energy.

Large data centers are emerging near strategic telecommunications nodes and key economic corridors, while energy-intensive industries continue to cluster in the most advanced production hubs. At the same time, the electrification of transport, cooling, and residential consumption is placing further pressure on local grids.

In some cases, this gap reaches enormous proportions. Solar energy generated in the deserts of the Middle East or North Africa is intended to power cities and industrial districts located hundreds of kilometers away. Major offshore wind farms in the North Sea must deliver electricity to continental Europe's industrial regions. In the United States, the rapid growth of AI-driven data centers is creating new regional imbalances in electricity demand.

The result is a system increasingly dependent on the ability of grids to connect distant regions and manage complex energy flows in real time. Signs of strain are already visible across many markets: grid congestion, delays in connection processes, price differences between neighboring areas, and growing difficulties in ensuring sufficient capacity during peak demand.

In Europe, electricity price disparities increasingly reflect the physical limits of transmission infrastructure. In the United States, thousands of gigawatts of new renewable and storage projects remain stuck in interconnection queues. In Asia, meanwhile, a growing number of initiatives aim to integrate regional power systems through large cross-border energy corridors.

The energy transition is therefore not only transforming the generation mix, it is reshaping how the global power system operates. In a world in which production and consumption are moving further apart, the ability to connect regions and infrastructures is becoming essential for energy security, price stability, and industrial competitiveness.

The Transition Bottleneck

In this evolving landscape, power grids are becoming one of the most strategic assets in the global energy economy. As the distance between production and consumption grows, the ability to transmit electricity reliably and flexibly gains increasing economic and geopolitical importance. Interconnections are no longer just tools for exchanging power between neighboring countries; they are emerging as system-level infrastructure, linking large renewable generation hubs with areas of high industrial and urban demand.

High-voltage direct current (HVDC) technologies now make it possible to transmit large volumes of electricity over long distances with limited loss, enabling the development of new continental-scale energy corridors.

From the ASEAN Power Grid initiative in Southeast Asia to the strengthening of European interconnections, networks are playing an increasingly central role in energy security and market stability. Greater integration helps reduce price volatility, improve overall system efficiency, and better leverage renewable generation across different regions. Where infrastructure remains insufficient, however, congestion, price disparities, and systemic vulnerabilities continue to grow. Industrial competitiveness, in turn, is increasingly tied to access to stable and competitively priced electricity.

Even as their strategic importance rises, grids are also emerging as the main constraint of the energy transition. While investment in generation capacity has accelerated in recent years, grid development continues to lag. Building new transmission lines requires long timelines, complex permitting processes, and significant capital investment. In many cases, more than a decade may pass between planning and commissioning.

This imbalance is already producing tangible effects. Across multiple markets, thousands of gigawatts of new renewable projects, storage systems, and large industrial loads remain stuck in interconnection queues. Congestion is increasing, price gaps between neighboring regions are widening, and ensuring sufficient capacity during peak demand periods is becoming increasingly difficult.

The New Economy of Electricity

The challenge is not only about decarbonization. It is also about economic competitiveness. A congested power system leads to greater price volatility, reduces cost predictability, and makes long-term industrial planning more complex.

According to Eurelectric's Grids for Speed Report, the European power system will require an unprecedented expansion of infrastructure in the coming decades. Distribution networks in the EU27 and Norway alone will need annual investments of around €67 billion through 2050. The report highlights the need to shift from a reactive to a forward-looking approach: building networks ahead of demand growth, leveraging data and digitalization to optimize existing assets, and developing flexibility solutions to ease pressure during periods of peak consumption.

In this scenario — one in which the global energy system is becoming increasingly electrified, interconnected, and complex — grids and interconnections are no longer secondary components of the transition but its true enablers. The new electricity-driven economy will be shaped less by where energy is produced and more by the connections linking systems, markets, and regions.

It is along these connections that some of the key challenges of the coming years will emerge. And this is what we explore in this issue's articles: the rise of data centers and new industrial demand, global competition to attract energy and investment, and the need to build smarter, more flexible, and more resilient networks. Ultimately, the real differentiator will not simply be who generates energy, but who can manage, transport, and integrate it into an increasingly complex global system.

Top Story

The New Drivers of Power Demand: Data Centers and Industry

For over a century, global economic growth followed a relatively simple rule: more production meant more coal, more oil, more gas. Today, that relationship is gradually breaking down as an increasing share of global industrial and technological development is powered by electricity.

The world is entering a new phase that is often referred to as the "age of electricity." Globally, electricity demand is growing faster than overall energy demand, putting increasing pressure on power generation, grids and system flexibility. And this shift is not only about the expansion of renewables or the rise of electric mobility. The primary drivers of new demand are large-scale electrified industrial hubs and the rapid expansion of digital infrastructure linked to cloud computing and artificial intelligence.

For years, the energy transition has been framed primarily as a supply-side revolution: more solar, more wind, fewer emissions. Today, however, the global power system must also contend with an equally profound transformation on the demand side. New industrial processes, AI applications, and digital infrastructure are introducing highly energy-intensive loads concentrated in specific geographic areas.

According to scenarios envisaged by the International Energy Agency, global electricity demand is set to continue growing in the coming years, supported by the electrification of both homes and industry, as well as the rapid expansion of data centers. This growth is no longer driven solely by population increases or urbanization, but by the transformation of economic activities that are becoming increasingly energy intensive. From steel production to advanced computing systems, a growing share of the global economy now requires vast flows of electricity.

The pace of this transformation is also reflected in energy transition figures. In 2025, global energy production increased by nearly 700 gigawatts of new renewable capacity, according to IRENA's *Renewable Capacity Statistics 2026*. Solar photovoltaic capacity continues to lead global expansion, thanks to falling costs and rapid deployment. According to Ember's *Global Electricity Review*, low-carbon sources are meeting an increasing share of new electricity demand, with solar representing the main driver of global capacity growth.

The real shift, however, lies in the nature of the emerging consumption profile. Large data centers require vast amounts >

For further information on this topic, please contact:

Matteo Biello (Italy Market Director – CESI Consulting)

of energy and advanced cooling systems, while industry is progressively replacing fossil fuels and traditional heat with electricity to power increasingly automated and digitalized processes. The result is mounting pressure on power infrastructure and grid ability to handle new, simultaneous loads.

New Power Giants: AI and Data Centers

Amongst all the types of new demand reshaping the global energy system, no source is expanding as rapidly as data centers. Cloud computing, streaming, digital services — and above all artificial intelligence — are generating a fundamentally different kind of electricity demand than in the past.

The expansion of generative AI has further accelerated this trend. Training large language models and scaling computational capacity require enormous amounts of energy, processing power, and increasingly sophisticated cooling systems. The International Energy Agency projects that electricity consumption by data centers will rise significantly by the end of the decade, particularly in the United States, where a substantial share of the new global digital infrastructure is concentrated.

Beyond sheer consumption, what makes these facilities so strategic is their electrical profile. A hyper-scale data center may require hundreds of megawatts of power and demand near-continuous operation. Unlike many traditional industrial activities, these loads cannot easily be curtailed or adjusted without immediate economic consequences. Thus, data centers are rapidly becoming the "blast furnaces" of the 21st century. They have become the core infrastructure of the digital economy, shaping grids, energy investments, and industrial planning. The difference is that, instead of steel, they produce computing power.

Their growth is also highly concentrated in specific geographic areas, often near major telecommunications hubs and advanced economic corridors. Northern Virginia, Texas, Ireland, and Scandinavia are emerging as some of the world's leading hubs in the data economy. In these regions, however, digital infrastructure is often expanding faster than the power grids needed to support it. Grid-connection waiting times are increasing on several markets, grid congestion is rising, and ensuring available capacity for new industrial and digital facilities is becoming increasingly challenging. Some grid operators are already revising their planning strategies to account for demand that is far more concentrated and inflexible than in the past.

Major tech companies are also redefining their role. Whereas Microsoft, Google, and Amazon once primarily purchased electricity on the market, they are now directly investing in renewable capacity, energy storage systems, and, in some cases, new nuclear projects. Energy is becoming as strategic to the digital economy as computing power itself.

The Electrification of Industry

Data centers may be the most visible face of new energy demand. However, the transformation that is reshaping the global power system most profoundly is taking place within industry itself. Steel mills,

chemical plants, refineries, advanced manufacturing, and large production hubs are progressively replacing fossil fuels and traditional heat with electricity.

According to the International Energy Agency, nearly half of global electricity demand growth in the coming years is expected to come from the industrial sector alone. This marks a historic shift as, for decades, heavy industry relied primarily on coal, oil, and gas to remain competitive. Today, electrification is becoming a central lever to reduce emissions, increase efficiency, and make production processes more flexible and automated.

This transformation is particularly evident in the most energy-intensive sectors. In steelmaking, investments in electric arc furnaces are on the rise. In the chemical industry, technologies based on industrial heat pumps, high-temperature electric systems, and thermal storage technologies are gaining ground. At the same time, production processes are increasingly integrated with software, sensors, and advanced energy management systems.

As a result, electrified factories require more stable, digital, and interconnected infrastructure. Electricity no longer powers just machinery, but the entire industrial ecosystem: from robotics and automated logistics to cooling systems, control centers, and data management platforms.

According to Bloomberg NEF's *Energy Transition Outlook*, growing industrial electrification will be one of the main drivers of global energy demand over the next decade, alongside electric mobility and the expansion of digital infrastructure. This trend also has

direct implications for industrial competitiveness. On many markets, the cost and availability of electricity are once again becoming decisive factors in attracting manufacturing investment.

Indeed, it is no coincidence that an increasing number of companies are seeking direct access to dedicated renewable capacity, long-term supply contracts, and more resilient energy systems. Many industrial groups are investing directly in solar plants, storage systems, and local energy infrastructure to reduce exposure to market volatility.

Grids at the Heart of the Transition

And what about power infrastructure? As noted, the global expansion of renewables, the electrification of consumption, and the growth of new industrial and digital loads are transforming power grids into an increasingly strategic element of the energy transition.

On many advanced markets, access to electricity capacity now depends on increasingly complex planning processes

and timelines that reflect the scale and technical complexity of the necessary operations — particularly in the regions where large industrial hubs, new data centers, and energy-intensive infrastructure are concentrated.

Transformers, high-voltage lines, storage systems, and other critical components are therefore playing an increasingly central role in enabling new investments and supporting the evolution of the power system.

The result is a system that is far more complex and interconnected than in the past, where the ability to plan, strengthen, and digitalize infrastructure is becoming essential to ensure reliability, continuity, and competitiveness.

In this context, smart grids, storage solutions, and digital tools for managing energy consumption are taking on a strategic role — complementary to the development of new generation capacity and fundamental to making the energy transition tangible, orderly, and sustainable.

Energy Resilience in the 21st Century

Ultimately, one key point cannot be overlooked: the more electrified the global economy becomes, the higher the potential cost of any disruption will be. Automated factories, digital infrastructure, telecommunications, logistics, and essential services now depend on the uninterrupted operation of the power grid.

"Energy security is fundamentally about the resilience of the entire power system," note the authors of the *GridEx VIII Lessons Learned* report by the North American Electric Reliability Corporation. The report highlights how modern grids have evolved into increasingly interconnected systems and are therefore more exposed to simultaneous crises. Cyberattacks, blackouts, communication failures, or extreme weather events can trigger cascading effects across the economy and essential services. "The power grid is taking on a strategic importance comparable to that of pipelines, ports, and large-scale fossil infrastructure in the 20th century."

As global competition increasingly hinges on the ability to reliably power electrified industries, data centers, and energy-intensive AI systems, a key question is emerging among analysts: in the new electricity-driven economy, will simply producing more energy be enough?

The answer, in all likelihood, is no. What will truly make the difference is the ability to transmit, manage, and protect that energy within a system that is becoming ever more industrial, digital, and interconnected.

For further information on this topic, please contact:

Andrea Meola (Global Markets & Business Development Director – CESI Consulting)

Industries & Countries

The New Geography of Electricity Demand

Rising electricity demand is redrawing the map of global competitiveness. The United States, Europe, Asia, and the Middle East are responding in different ways, but they share a common understanding: reliable, affordable, and competitively priced electricity is becoming essential to attract investment, develop new industrial value chains, and sustain economic growth.

For more than a century, the world's economic geography was shaped by access to energy resources. Coal, oil, and gas determined where industries were built, influenced trade routes, and helped define the global geopolitical balance.

Today, however, the energy system is entering a new phase. In the age of electrification, competitive advantage increasingly depends not simply on possessing energy resources, but on the ability to turn them into electricity and deliver that power reliably, affordably, and where needed.

Global electricity demand is therefore redrawing the economic map of the world. According to scenarios developed by the International Energy Agency, electricity will remain the fastest-growing component of global energy consumption over the next decade. Growth will be driven by the electrification of industrial processes, the spread of digital technologies, and the transformation of production systems.

But this growth is not happening at the same speed or in the same way everywhere. Instead, increasingly marked differences are emerging between regions and countries, creating a new geography of energy.

For many years, regional competitiveness was assessed primarily on the basis of factors such as labour costs, taxation, logistics infrastructure, and proximity to end markets. Now, another factor is becoming increasingly important: access to electricity.

Against this backdrop, the United States, Europe, Asia, and the Middle East are following different paths, creating new energy hubs and new centres of industrial competitiveness. Some economies are

accelerating through large-scale investment in infrastructure and generation capacity. Others are being held back by regulatory constraints, lengthy permitting procedures, and power grids struggling to keep pace with change.

United States: The Race for Power

In the United States, electricity demand has returned to the centre of the economic and industrial debate.

After more than a decade of relatively stable consumption, the country is entering a new period of expansion, driven by the reshoring of manufacturing, investment in advanced technologies, the digitalisation of the economy, and major industrial policy programmes.

According to the International Energy Agency's *Electricity 2026* report, US electricity demand rose by 2.1% in 2025 and is expected to grow by almost 2% a year until 2030. Over the next five years, this could add more than 420 terawatt-hours (TWh) to current demand. Around half of this increase will be linked to the rapid expansion of data centres.

The implications extend well beyond the energy sector. Access to power is once again becoming a decisive factor in where companies choose to invest. For advanced manufacturing, semiconductors, artificial intelligence, and digital infrastructure, businesses need electricity supplies that are reliable, predictable, and available within the timescales of their investment plans.

Analyses by Reuters also reveal how the race to secure power capacity is reshaping corporate strategy. In June 2026, Reuters reported that data-centre investors were accelerating their acquisition of energy developers, as the power requirements of North American data centres were forecast to rise from 31 gigawatts (GW) in 2025 to 66 GW in 2027.

Reuters also reported on the Chevron–Microsoft project in Texas: a 2.67 GW facility designed to supply Microsoft's campus in Pecos, West Texas, with delivery expected to begin in 2028.

The pressure is not confined to the digital economy. According to analysts at ICF International, a US consulting firm specialising in energy, infrastructure, and public policy, peak electricity demand in the United States could increase by 120 GW over the next five years.

Around 24 GW of this growth could come from industrial consumption.

The fastest increases are expected in areas served by ERCOT in Texas and PJM, the major regional electricity system covering parts of the Mid-Atlantic and Midwest.

Calvin Butler, CEO of Exelon and Chairman of the Edison Electric Institute, has described the current period as an unprecedented transformation for the US electricity sector. According to Butler, the industry will experience more profound change over the next ten years than it has over the past century.

In a recent interview with the *Financial Times*, he warned that the United States could face blackout risks as early as 2027 if the rise in demand—partly driven by artificial intelligence—is not matched by sufficient generation capacity and grid infrastructure.

A new industrial map of the United States is beginning to emerge. Texas, Virginia, Arizona, Georgia, and Ohio are no longer competing solely on taxation, industrial land, and incentives. They are also competing on their ability to provide power.

In the new electricity economy, regions able to offer sufficient power capacity at competitive costs and within timelines that meet investors' requirements will have a growing advantage in attracting the next wave of industrial and digital investment.

Europe: Where Electrification Meets Competitiveness

While the main challenge for the United States is managing rapid growth in electricity demand, Europe faces a different issue: how to combine electrification and decarbonisation with industrial competitiveness.

In recent years, the EU has accelerated the development of renewable energy and strengthened its energy security following the 2022 gas crisis. Nevertheless, it continues to face slower economic growth and energy costs that are generally higher than those in other major industrial regions.

According to the International Energy Agency, electricity demand in the European Union increased by around 0.9% in 2025, exceeding 2,800 TWh after the recovery recorded in 2024. Growth, however, remains significantly slower than in the United States and many Asian economies.

The IEA also notes that much of the electrification expected over the coming years will depend on Europe's ability to accelerate investment in infrastructure and reduce the time required to authorise new energy and industrial projects.

Energy competitiveness has consequently become one of the central issues in the European debate.

In his report on the competitiveness of the European Union, Mario Draghi highlighted that the electricity prices paid by European companies remain, on average,

higher than those faced by their US and Chinese competitors. This directly affects the ability of European industry to attract investment and develop new production value chains.

According to the report, the difference in energy costs is now one of the main competitive disadvantages facing Europe's industrial system.

The Agency for the Cooperation of Energy Regulators (ACER) also stresses in its latest *Energy Market Monitoring Report* that greater integration between electricity markets and stronger cross-border interconnections are essential to reduce price volatility and improve the overall efficiency of Europe's energy system.

At the same time, outlooks published by ENTSO-E indicate that the increasing electrification of the economy will require substantial investment not only in transmission grids but also in energy storage. Without this investment, local network bottlenecks could restrict economic and industrial growth.

For Leonhard Birnbaum, CEO of E.ON and President of Eurelectric, the European challenge goes beyond the energy transition itself. It also concerns the continent's ability to preserve its industrial base.

Birnbaum has repeatedly argued that modern grids, faster permitting procedures, and timely investments to meet future demand are essential to sustaining European competitiveness in an increasingly electrified global economy.

Asia and the Middle East: Building Ahead of Demand

While the United States and Europe are trying to adapt established energy systems to rapidly changing demand, much of Asia and the Middle East is taking a different approach: developing electricity capacity, infrastructure, and industrial growth in parallel.

In these regions, rising electricity demand is not viewed simply as a consequence of economic development. It is also being used to accelerate economic development.

According to IEA data, around 80% of the increase in global electricity demand over the coming years will come from emerging and developing economies.

China alone continues to account for more than half of worldwide demand growth, driven by industrial expansion, the electrification of consumption, and the development of new technology value chains.

In its *Electricity 2026* report, the IEA notes that Chinese electricity consumption continues to grow much faster than in the world's major advanced economies. In 2025, demand exceeded 10,000 TWh, confirming China as the world's largest electricity market.

According to the Agency, growth is expected to remain at around 5% a year until 2030, supported by industrial expansion, the electrification of the economy, and the development of new technology sectors. The main difference compared with many Western economies lies in the way this growth is planned.

As highlighted in the IEA's *World Energy Outlook 2025*, China is developing new generation capacity, ultra-high-voltage transmission networks, energy-storage systems, and industrial clusters at the same time. This reduces the risk that infrastructure constraints will slow economic growth. It is a model designed to ensure that energy availability and industrial competitiveness advance together across the entire value chain.

In 2025, India's electricity consumption exceeded 2,000 TWh, approaching the European Union's total consumption, although Indian demand per person remains significantly lower. According to the IEA, the country's

electricity demand will continue to grow by more than 6% a year, making India one of the main engines of global electricity growth over the next decade.

This expansion is being driven by urbanisation, manufacturing growth, and government industrialisation programmes. At the same time, New Delhi is investing heavily in electricity grids, renewable energy, and generation capacity to support the country's economic transformation.

A similar trend can be seen in the Middle East.

Saudi Arabia, the United Arab Emirates, and Qatar are using revenues from hydrocarbons to accelerate economic diversification and build new energy and industrial hubs.

According to various Reuters analyses of the region's energy sector, Gulf countries are investing billions of dollars in large-scale solar plants, electricity networks, hydrogen, and energy-intensive industries. Their aim is to strengthen their role in the post-oil economy.

Saudi Arabia is a particularly significant example. Through its Vision 2030 programme, the Kingdom aims to turn energy into a driver of industrial and technological development, supporting new production centres, advanced infrastructure, and major projects such as NEOM.

The United Arab Emirates is following a similar path, combining investment in renewable energy with strategies designed to attract capital and industrial activity.

The direction of travel is clear. Rising electricity demand is redrawing the map of global competitiveness.

The United States, Europe, Asia, and the Middle East are responding to this transformation in different ways. Yet they all face the same underlying reality: the ability to provide reliable, affordable, and competitively priced electricity will increasingly determine where investment goes, where new industries develop, and which economies are best placed to grow.

Future & Technology

Shaping the System Around Demand

Flexibility, digitalization, and data centers are reshaping global power system planning. CESI acts as a trusted technical partner, supporting operators and institutions with independent analyses on the feasibility and optimal integration of data centers into the electricity system.

For decades, power systems were built around a relatively linear model: large-scale generation plants, predictable demand, and grids primarily designed to transport electricity from production to end use. Today, this model is showing increasingly clear limitations. The rapid growth of intermittent renewables, the electrification of consumption, the expansion of data centers, and the rising variability of demand are fundamentally transforming how grids operate.

According to scenarios developed by **IEA, ENTSO-E, BloombergNEF, and Terna**, in the next decade, power systems will need to manage loads that are more dynamic, more concentrated, and harder to predict. In this context, the grid is no longer just physical infrastructure. It is becoming the key enabler of the energy transition.

As a result, demand-side management is taking on an increasingly central role, through tools such as flexibility, demand response, and the digital integration of energy infrastructure. As highlighted by the IEA in its report on *The Value of Demand Flexibility*: "Demand flexibility – the ability to adjust the timing or amount of electricity usage in response to system needs – is central to help achieve this balance. Advances in digitalization, including the growing use of AI tools, are further enhancing the ability to deploy flexibility effectively."

At the same time, there is a growing need to make the system more observable, coordinated, and responsive, leveraging advanced sensors, automation, digital platforms, and predictive analytics tools capable of monitoring and managing energy flows in real time. Advanced simulation models and digital twins are also becoming increasingly important. The ability to create digital replicas of power systems allows the simulation of complex scenarios, the assessment of the impact of new loads or infrastructure, and support to both operational and planning decisions in a context of rapid transformation.

At the same time, the rising complexity of power systems calls for stronger standards of reliability and security. As highlighted in recent IEA studies on the digitalization of the energy sector, increased connectivity and automation improve efficiency, observability, and system management capabilities, but also expand exposure to cyber risks. Grid resilience is now being tested not only by more demanding operating conditions and the effects of climate change, but also by growing cybersecurity threats, particularly in highly digitalized infrastructure.

Flexibility as a Strategic Resource

In power systems that are increasingly shaped by intermittent renewables and more variable consumption patterns, flexibility is emerging as a strategic asset. According to analysts, the ability to adjust demand, generation, and storage will become essential to ensuring system balance, operational continuity, and the efficient integration of new energy technologies.

For decades, system stability was achieved primarily by aligning generation with demand. Today, as mentioned earlier,

For further information on this topic, please contact:

Luca Migliorini (Energy Transition Project Center Director – CESI Consulting)

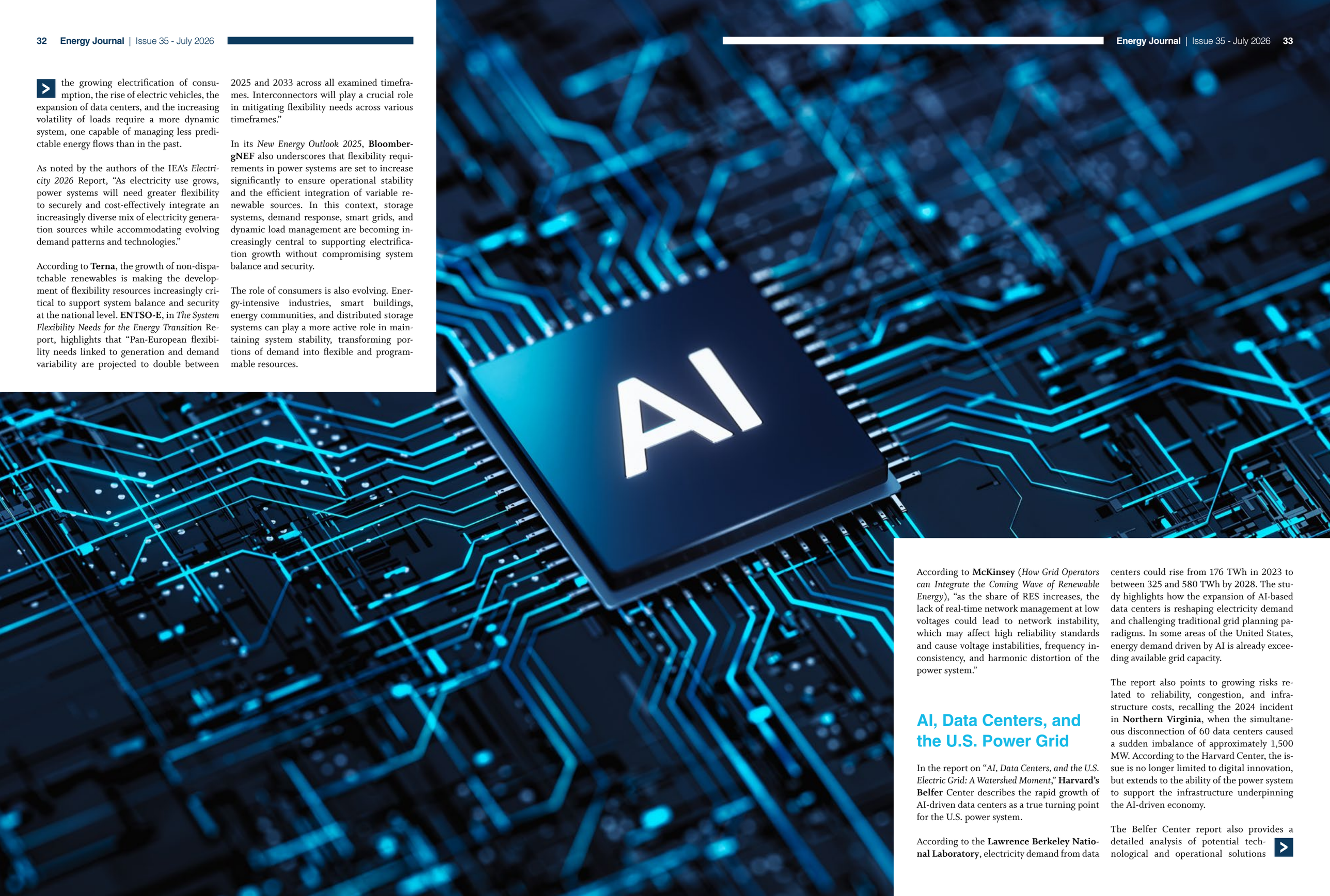
the growing electrification of consumption, the rise of electric vehicles, the expansion of data centers, and the increasing volatility of loads require a more dynamic system, one capable of managing less predictable energy flows than in the past.

As noted by the authors of the IEA's *Electricity 2026* Report, "As electricity use grows, power systems will need greater flexibility to securely and cost-effectively integrate an increasingly diverse mix of electricity generation sources while accommodating evolving demand patterns and technologies."

According to **Terna**, the growth of non-dispatchable renewables is making the development of flexibility resources increasingly critical to support system balance and security at the national level. **ENTSO-E**, in *The System Flexibility Needs for the Energy Transition* Report, highlights that "Pan-European flexibility needs linked to generation and demand variability are projected to double between 2025 and 2033 across all examined timeframes. Interconnectors will play a crucial role in mitigating flexibility needs across various timeframes."

In its *New Energy Outlook 2025*, **BloombergNEF** also underscores that flexibility requirements in power systems are set to increase significantly to ensure operational stability and the efficient integration of variable renewable sources. In this context, storage systems, demand response, smart grids, and dynamic load management are becoming increasingly central to supporting electrification growth without compromising system balance and security.

The role of consumers is also evolving. Energy-intensive industries, smart buildings, energy communities, and distributed storage systems can play a more active role in maintaining system stability, transforming portions of demand into flexible and programmable resources.



According to **McKinsey** (*How Grid Operators can Integrate the Coming Wave of Renewable Energy*), "as the share of RES increases, the lack of real-time network management at low voltages could lead to network instability, which may affect high reliability standards and cause voltage instabilities, frequency inconsistency, and harmonic distortion of the power system."

AI, Data Centers, and the U.S. Power Grid

In the report on "*AI, Data Centers, and the U.S. Electric Grid: A Watershed Moment*," **Harvard's Belfer** Center describes the rapid growth of AI-driven data centers as a true turning point for the U.S. power system.

According to the **Lawrence Berkeley National Laboratory**, electricity demand from data centers could rise from 176 TWh in 2023 to between 325 and 580 TWh by 2028. The study highlights how the expansion of AI-based data centers is reshaping electricity demand and challenging traditional grid planning paradigms. In some areas of the United States, energy demand driven by AI is already exceeding available grid capacity.

The report also points to growing risks related to reliability, congestion, and infrastructure costs, recalling the 2024 incident in **Northern Virginia**, when the simultaneous disconnection of 60 data centers caused a sudden imbalance of approximately 1,500 MW. According to the Harvard Center, the issue is no longer limited to digital innovation, but extends to the ability of the power system to support the infrastructure underpinning the AI-driven economy.

The Belfer Center report also provides a detailed analysis of potential technological and operational solutions

to mitigate the energy impact of data centers. According to the report, future energy policy will only be effective if it is "technically feasible, economically sound, and politically acceptable," moving beyond the traditional trade-off between grid reliability and economic development.

The study emphasizes how intelligent load management can become a strategic tool to enhance power system flexibility. In particular, researchers at **Harvard SEAS** are developing advanced models capable of linking grid reliability, congestion, price volatility, and the real-world behavior of AI-driven loads.

Other key issues include site selection based on grid capacity, transparency in infrastructure costs, and the use of forecasting tools to assess long-term impacts, congestion risks, and the operational flexibility of data centers.

CESI as a Trusted Technical Partner

In this context, the contribution of players such as **CESI** is particularly relevant. On one hand, CESI develops advanced models, simulations, and tools capable of translating system complexity into actionable decisions, supporting the development of **large-scale power interconnections** to link generation hubs with demand centers, as well as the **modernization of power grids**. On the other hand, it carries out independent **testing, inspection, and certification activities**, which are essential to ensuring that deployed technologies meet stringent requirements in terms of robustness, operational continuity, and safety throughout their lifecycle.

On the demand side, data centers represent one of the most disruptive elements in both

the current and future power system landscape. As highlighted by both the Harvard Belfer Center studies and the analyses presented by CESI and Elettricità Futura (*Technology Watch: "Data Centers and Renewables: Digital Infrastructure for the Energy Transition"*), the availability of grid capacity is becoming a decisive factor in site selection for new data centers.

Location decisions are no longer driven solely by real estate or logistical considerations, but increasingly by the ability to secure timely access to electric power, reliable infrastructure, and connection timelines aligned with development needs. In practical terms, this means assessing factors such as available capacity, short-circuit levels, local grid resilience, and connection costs and lead times.

Opinions

The New Power Behind the Energy Transition

Data centers, artificial intelligence, and digital infrastructure are reshaping electricity demand, turning energy into a strategic asset for growth, competitiveness, and technological sovereignty.

For many years, the energy transition has been primarily framed from the supply side. It has been about new renewable sources, clean technologies, and the decarbonization of production systems. Today, however, an increasing share of change is being driven by demand.

The expansion of artificial intelligence, data centers, and digital infrastructure is generating new patterns of electricity consumption — more concentrated, continuous, and strategic than in the past — bringing issues such as grid capacity, system flexibility, and the availability of adequate infrastructure to the forefront.

The perspectives of **Simon Bennett** (IEA), **Andreas Schierenbeck** (Hitachi Energy), and **Calvin Butler** (Exelon) — representing, respectively, the worlds of global energy analysis, grid technologies, and large-scale utility operations — converge on a key point: electricity demand is entering a new historical phase.

From the impact of data centers on the digital economy to the need to strengthen power networks, as well as the investments required to ensure system reliability and security, a common challenge emerges: turning electricity into the enabling platform for economic, industrial, and technological growth in the decade ahead.

Simon Bennett

Head of Energy Technology Policy, International Energy Agency (IEA)

The New Demand Is Not Only About How Much Energy Is Needed, but Where It Is Needed

For many years, electricity demand in advanced economies remained broadly stable. Today, however, the rapid expansion of data centers and artificial intelligence is fundamentally reshaping this landscape, introducing a new category of highly energy-intensive consumption.

According to **Simon Bennett**, Head of Energy Technology Policy at the International Energy Agency (IEA), this phenomenon should be interpreted not only in quantitative terms, but above all from a systemic perspective.

“Data centers are becoming a major driver of demand growth,” Bennett notes. In its Energy and AI report, the IEA estimates that global electricity demand from data centers could increase by around 500 TWh by 2030, largely driven by the expansion of artificial intelligence. This is certainly a significant growth, but not one that alone fully captures the scale of the transformation underway.

“What really matters is where and how that demand shows up,” Bennett emphasizes. Data centers, in fact, are not evenly distributed. They tend to concentrate in specific geographic areas, often close to major economic and digital hubs. “In some regions, they already account for more than 20% of electricity demand,” while the scale of new facilities continues to grow.

The IEA analyst notes that “some of the largest data centers under construction today will consume as much electricity as two million households.” Unlike many other industrial loads, they operate continuously — 24 hours a day, seven days a week. As a result, in many advanced economies, the electricity required by digital infrastructure is becoming one of the main drivers of demand growth.

This trend is particularly evident in the United States. According to Bennett, around half of the increase in electricity demand expected by 2030 could be attributed to data centers. A shift that is redefining the relationship between energy and economic growth: “Data centers in the United States are on track to consume more electricity than the combined US demand of heavy industries like chemicals, steel, and aluminum.”

For Bennett, the real challenge therefore extends beyond simply adding new generation capacity. It lies in the ability to plan grids, infrastructure, and flexibility solutions that will be capable of managing a demand that is increasingly concentrated, continuous, and strategically critical for the digital economy.

In closing the interview, Bennett also highlights how rapidly electrification solutions have evolved in recent years: “In areas like high-temperature heat and building heating, we now see more viable pathways than we did even five years ago. That has led to a more balanced view of how we can decarbonize sectors that were previously considered very difficult.”

Andreas Schierenbeck

CEO Hitachi Energy

The Grid as Critical Infrastructure in the New Electric Era

For a long time, the energy debate focused primarily on the ability to generate power. Today, however, according to **Andreas Schierenbeck**, CEO of Hitachi Energy, the real challenge is shifting toward the infrastructure required to transmit, distribute, and deliver electricity where it is needed. In a context shaped by the electrification of consumption, the rapid growth of data centers, and rising electricity demand, grids are emerging as the decisive factor for the success of the energy transition.

"The grid is the thing the entire energy transition is won or lost on," Schierenbeck states. A remark that clearly captures the increasingly strategic role of power infrastructure: without adequate grids, neither the expansion of renewable energy nor the electrification of industry and transport can progress at the pace required by economic and climate goals. "For the first time in a while, we are acknowledging that energy means safety and security, yet it also poses a risk. And the magnitude of energy safety and security is probably bigger than any EU member state can handle on its own."

According to the CEO of Hitachi Energy, electricity demand is growing at a pace not seen in recent history. "Electricity demand is growing faster than ever before, much faster than primary energy," he notes. A trend driven not only by the electrification of sectors traditionally reliant on fossil fuels, but also by the expansion of digital infrastructure and the emergence of new AI-driven consumption patterns.

In this scenario, investments in grids should not be seen merely as infrastructural costs, but as a driver of competitiveness. "Every euro you spend on the grid saves two to three euros over the long term," Schierenbeck argues, highlighting how more robust, digitalized, and interconnected networks help reduce inefficiency, congestion, and system costs. "European grid planning was done in a completely different time, for a different purpose. Now we need to take interconnectivity, resiliency, and energy exchange [into account]. So, we need a different grid, and we have to agree on how to build it."

Schierenbeck believes that today energy and industrial competitiveness are more closely linked than ever. "Electricity is responsible for economic growth, and cheap energy is a prerequisite for being competitive." The ability to ensure reliable, affordable, and accessible electricity where new demand is concentrated is therefore becoming a key enabler of economic development, innovation, and energy security.

As the economy becomes increasingly electrified, grids are evolving far beyond their traditional role as technical infrastructure. They are becoming a strategic platform underpinning industrial growth, digital transformation, and regional competitiveness. According to Schierenbeck, the energy transition will not be determined solely by the capacity to generate clean energy, but by the ability to transmit and manage it efficiently within an increasingly complex and interconnected system.

Calvin Butler

CEO Exelon

Electricity Demand Reshapes the Role of Utilities

For those managing power grids and infrastructure on a daily basis, rising demand is no longer a future scenario. It is already a reality. This is the perspective of **Calvin Butler**, CEO of Exelon, one of the largest electric utilities in the United States, serving more than ten million customers and investing tens of billions of dollars to strengthen the grid.

According to Butler, the power sector is entering a phase of unprecedented transformation. "The energy industry will go through more change and transformation in the next 10 years than it has in the last 100," he says. Long regarded as a stable and relatively predictable industry, energy is now at the center of major economic and technological shifts. "We say that the energy industry is 5 percent of GDP (Gross Domestic Product), but we power the next 95."

The surge in data centers is one of the main drivers of change. Butler cautions, however, against oversimplification, noting that demand growth is also fueled by industrial reshoring, the rise of electric vehicles, and new digital applications. At the same time, he acknowledges that artificial intelligence is playing an increasingly decisive role: "The increased demand for electricity is not just data center growth. (...) But is the biggest part of that the boom of data center growth? Yes."

For the American executive, the response does not lie solely in expanding generation capacity, but above all in strengthening grid infrastructure. Even if some forecasts for data center growth prove to be overly optimistic, the investments will remain necessary. "We're making the system more reliable and more resilient by adding additional capacity to it," he explains, emphasizing how new substations, transmission lines, and connections enhance the overall resilience of the power system.

Looking ahead, Butler expects demand growth to be below the most extreme projections, yet still significant. Rather than a tenfold increase, as suggested in some analyses, he foresees growth in the range of three to five times current levels. And this is a challenge that will require new infrastructure, substantial investments, and increasingly sophisticated energy planning to balance reliability, sustainability, and economic competitiveness.

News & Events

Upcoming Energy Events

APPEC 2026: Asia's Premier Oil Conference

September 7–10, 2026

Singapore

www.spglobal.com

APPEC is Asia's leading conference dedicated to oil and energy markets. Organized by S&P Global, the event brings together more than 1,200 industry leaders from 55 countries to discuss the outlook for the sector amid price volatility, shifting trade flows, and evolving geopolitical dynamics. It serves as a key platform for producers, refiners, traders, logistics operators, investors, and technology companies across the entire energy value chain.

Nuclear Inter Jura Congress 2026

October 18–22, 2026

Wales, United Kingdom

www.oecd-nea.org

Now in its 26th edition, the Nuclear Inter Jura Congress is the leading international event dedicated to nuclear law. Organized by the International Nuclear Law Association (INLA), it brings together institutional representatives, regulatory authorities, legal professionals, industry operators, academics, and financial experts to discuss the legal and regulatory frameworks governing the peaceful use of nuclear energy and the development of nuclear programs worldwide.

Wetex & Dubai Solar Show 2026

October 20–22, 2026

Dubai, United Arab Emirates

www.wetex.ae

Organized by the Dubai Electricity and Water Authority (DEWA), WETEX is one of the leading international events focusing on energy, water, and sustainability. The exhibition serves as a global platform for showcasing innovations and technologies in renewable energy, sustainable mobility, smart cities, artificial intelligence for utilities, and efficient water resource management, supporting the United Arab Emirates' sustainable development goals.

Enlit Europe 2026

November 10–12, 2026

Vienna, Austria

www.enlit.world

RE+ is North America's largest clean energy event. Building on the legacy of Solar Power International, it brings together key players from the solar, energy storage, hydrogen, microgrid, electric mobility, and wind energy sectors. Through conferences, business networking opportunities, and educational sessions, the event provides a comprehensive overview of the technologies and market developments driving the evolution of the U.S. and global energy landscape.

Shaping a Better Energy Future

CESI is a multinational Italian group headquartered in Milan. Founded in 1956, it is now one of the world's leading technical consulting and engineering firms specializing in innovation, digitalization, and testing for the electrical sector, as well as in civil and environmental engineering. Through its KEMA Labs business unit, CESI is the world's leading independent provider of Testing, Inspection, and Certification services for the electrical industry. Additionally, through its CESI Space business unit, the Group also develops and manufactures solar cells for space applications.

With nearly 70 years of expertise, CESI operates in more than 70 countries worldwide. CESI collaborates with key global players in the energy sector, including utilities, transmission system operators, distribution system operators, power generation companies, system integrators, financial investors, and manufacturers of electromechanical and electronic components. The company also works with governments and regulatory authorities, maintaining close cooperation with major international financial institutions.

CESI is a fully independent joint-stock company headquartered in Milan, Italy, with operational facilities in Arnhem (Netherlands), Berlin and Mannheim (Germany), Prague (Czech Republic), Dubai (UAE), Knoxville and Chalfont (USA), Rio de Janeiro (Brazil), and Santiago de Chile (Chile).

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