2024 Global Energy Outlook

Executive Summary

Schneider Electric's Sustainability Business

Life Is On Schneider Electric

Introduction

Leading the Way with Energy Resilience, Next-Gen Cleantech, and an Equitable Energy Transition

2023 marked one of the hottest years on record, as unprecedented impacts from climate change swept across various continents.[1] In June, smoke from wildfires in Canada engulfed numerous cities in North America, creating orange skies and air quality alerts. Increased rates of wildfires were seen in other regions such as Southern Europe and North Africa as well, along with catastrophic floods in India and Australia, and severe droughts in Central America and East Africa. These and other events unfolded amidst the enduring impact of the pandemic, ongoing geopolitical conflicts, and other external pressures that intensified volatility in the global energy market.

Despite these challenges, the clean energy transition accelerated in 2023 and is poised for an even faster pace in 2024. Investments in clean technologies have accelerated and are improving energy resilience at both the grid and building level. Wind and solar energy continue to have the highest rates of growth with new investments in continued development.

Emerging and resurgent technologies such as hydrogen, nuclear power, and geothermal energy are also gaining increased interest as the demand for dispatchable 24/7 baseload energy supply and fuels for transport and industrial processes escalates.

This paper summarizes the key trends and market forces expected to shape the global energy market in 2024 and beyond. Five themes have emerged, developed with guidance from global experts across Schneider Electric's energy management and Sustainability Business advisory teams. The insights provide market intelligence and spotlight emerging trends to propel new market opportunities and cultivate a resilient, sustainable, and equitable energy future.

Executive Summary

Five emerging trends are driving a new era of global growth, technological innovation, and equitable climate action in the global energy market. These identified trends were compiled from qualitative research with Schneider Electric's energy management advisory team, drawn from a cross-section of experts across all regions and energy disciplines.

1 **Energy resilience is a catalyst for change in the global energy market.**

2 **The acceleration of next-gen clean energy will open new pathways to a greener future.**

3 **Global competitiveness is expected to shape new economic development policies and decarbonization mandates.**

4 **AI is set to take energy management to the next frontier.**

5 **A "Just Transition" is essential to managing how energy will be generated and consumed.**

Click an icon above to navigate to the section

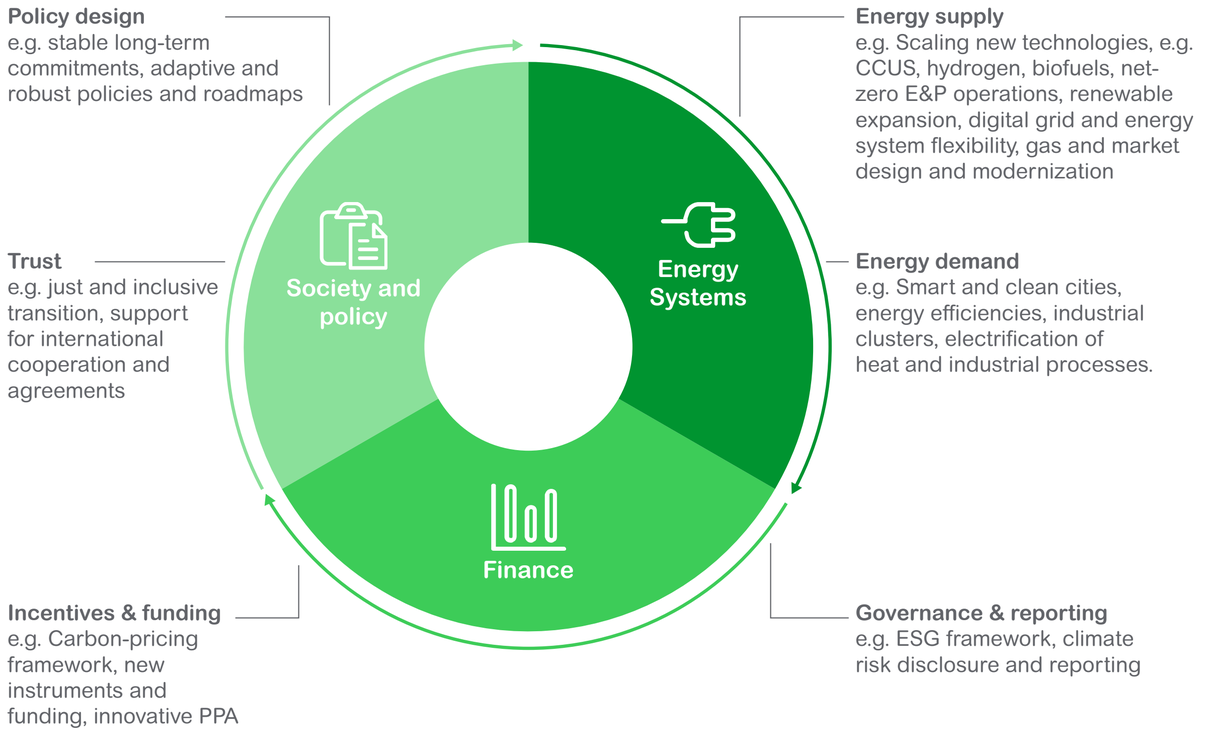
Energy resilience is a catalyst for change in the global energy market.

Global energy systems have faced substantial strain in recent years due to disruptions and shocks, including the effects of climate change, geopolitical events, and supply chain demands on the back of the COVID-19 pandemic. These multifaceted challenges have created increased pressure and incentives for companies and governments alike to accelerate investments in energy resilience.

Achieving energy resilience requires robust physical infrastructure that enables real-time monitoring and demand flexibility, as well as diversified energy supply and dynamic grid interconnectivity. Energy consumers need solutions that enable them to anticipate, withstand, and quickly recover from both infrastructure disruptions and market shocks.

The World Economic Forum identifies six critical factors to support energy-resilient infrastructure, stabilizing energy systems and maintaining grid reliability: (see figure 1)

Figure 1: Six Factors for Energy Resilience



Source: World Economic Forum
https://www.weforum.org/publications/fostering-effective-energy-transition-2021/in-full/5-building-resilience-to-overcome-new-risks/

Energy resilience

(Continued)

The symbiosis of the factors, shown in Figure 1 – which includes solutions such as smart grids, microgrids, energy storage, and diversified energy sources – is essential to protecting the resilience of energy systems. In North America, for example, Jersey City partnered with Schneider Electric to improve its energy resilience in the wake of climate change-related impact on coastal communities. The plan involved fully transitioning Jersey City's sanitation truck fleet to electric vehicles, modernizing city facilities, and creating a microgrid, ensuring the city can operate for up to 14 days following a power grid failure.

In other regions like Australia, Schneider Electric's 2023 Sustainability Index report found that mitigating climate-related risk was among the top three drivers of decarbonization efforts for Australian companies, followed closely by brand perception and the opportunity for savings. As the policy landscape, weather events, and consumer behaviors continue their dramatic shift, energy resilience will be an increasingly valuable investment for cost control, risk management, and to protect brand reputation.

The acceleration of **next-gen clean energy** will open new pathways to a greener future.

At the 2023 United Nations' Climate Change Conference (COP28), representatives from nearly 200 countries agreed to begin the transition away from fossil fuels to avert the worst of climate change. Parties also committed to triple renewable energy production, leading UN Climate Change Executive Secretary Simon Stiell to declare that this COP marks the "beginning of the end" of the fossil fuel era.[2]

The International Renewable Energy Agency (IRENA) has found that more than two-thirds of carbon dioxide emission reductions can be achieved through an increased supply of renewable energy, the electrification of energy services currently supplied with fossil fuels, and the improvement of energy efficiency.[3] Increased public and private investments in cleaner energy production and electrification will create multiple pathways to achieve decarbonization ambitions, a challenge that we must seize if we are to limit the worst of climate changes' impacts.

Renewable sources are scaling at tremendous speed to meet the demands of the energy transition. According to the International Energy Agency (IEA), renewables will make up over one-third of the global generation mix by 2025,[4] with solar and wind capacity predominantly driving growth in renewable energy supply.[5] Solar power expansion continues to dominate global markets as manufacturing innovations, supply chain growth, and regional legislation and incentive schemes – like the US Inflation Reduction Act (IRA) and EU Green Taxonomy – further drive costs down.

While the momentum in clean energy expansion has been driven by the falling costs of solar and wind, these technologies alone are not sufficient to deliver net zero emissions. Increased investment in next-generation clean energy sources, such as green hydrogen, nuclear power, geothermal energy, electrification of heat and transport, clean fuels, batteries, and other innovations is required in 2024 and beyond to reach net zero.

Policies will also need to address regulatory barriers to scale-up clean energy technologies, particularly when it comes to enhancing the grid and increasing its capacity to sustain the integration of new technologies. BloombergNEF estimates that at least $21.4 trillion USD needs to be invested in grids across the world by 2050 to support a net-zero emissions trajectory.[6]

Next-gen clean energy
(Continued)

Our experts have also observed a significant spike in the use of liquefied natural gas (LNG) over the past decade, despite the need to rapidly decarbonize energy supply. LNG is sometimes viewed as a cleaner, cheaper, and more abundant alternative to coal to serve as the bridge to a renewable energy future. However, while demand for LNG is expected to continue to grow, it has drawn increased scrutiny due to its associated increase in methane emissions and price shocks as a result of geopolitical conflicts and market manipulations.

Experts also predict energy price disruptions will continue to be felt more acutely in nations with high energy imports relative to those with high energy exports, which may prompt import-dependent nations to accelerate investments in renewables. In contrast, geopolitics may also have a negative ripple effect on the renewable energy sector, leading to a redoubling of efforts in energy efficiency and diversified supply in regions with energy disruptions. This has already been seen throughout Europe as a result of the Russian-Ukraine war, as an example. In Germany, coal-powered plants have been put on stand-by in the event of natural gas shortages during the 2024 winter.[9]

Snapshot: Green Hydrogen

Among the next-gen sources, green hydrogen is estimated to meet a significant share of clean energy demand. IRENA estimates that hydrogen and its derivatives will satisfy a sizeable fraction (14%) by 2050.[7]

Investment in green hydrogen is already gaining traction in many regions. In fact, more than 40 countries have adopted national strategies for low-carbon hydrogen:[8]

- The EU has adopted two delegated acts defining renewable hydrogen and implementing funding mechanisms
- The US included low-carbon hydrogen incentives in the IRA and recently announced a historic $7B federal investment in the sector
- India adopted its National Green Hydrogen Mission in 2023
- Japan has a strategy to locally produce and import low-carbon hydrogen

Despite increased investment in green hydrogen, experts fear hydrogen production will increase faster than emission-free electricity, which could worsen emissions generation in the short term. This is a reasonable concern, given that green hydrogen is produced by electrolyzers – electric equipment used to split water and hydrogen – that must be powered by renewable energy to remain “green.”

Global competitiveness is expected to shape new economic development policies and decarbonization mandates.

Competition to be a major player in clean energy manufacturing has become a predominant theme in global economic development policy. The US IRA, for instance, has increased expectations of domestic clean energy manufacturing to advance the country's market position. Consequently, the EU is feeling the pressure to implement comparable policy measures to maintain its share of renewable energy producers and attract new investment. In February 2023, the European Commission presented the Green Deal Industrial Plan, intended to create a more conducive environment for the expansion of the EU's manufacturing capacity for net-zero technologies and products essential for meeting climate goals.[10] Additional measures include the EU announcing it would propose a European Sovereignty Fund to finance joint projects within the 27-nation bloc.[11]

Some argue that such a divide is unwarranted. The IRA could provide an opportunity for the US and EU to grow their clean industries together, increasing mutual green economic development benefit and decarbonization progress, while improving their ability to compete with China, which continues to dominate clean energy manufacturing exports and development.

As global competition among developed markets continues, several emerging markets are closing in with innovative approaches that could refresh economic development policies and introduce new decarbonization mandates, spurring increased renewable energy adoption. (see examples on next page)

Global competitiveness

(Continued)

Snapshot: India

India is positioning itself to decarbonize its economy and is expected to increase its renewable capacity in 2024 due to faster onshore wind, hydropower, and distributed solar investment.[12]

Snapshot: Japan

Japan has been investing heavily in offshore wind farms. The country has set an ambitious goal of producing 38% of its electricity using renewables by the end of the decade – more than double its current clean supply – and has pledged carbon neutrality by 2050.[1] This progress aligns with a broader regional trend also observed in Singapore, Vietnam, and Taiwan. In 2022, for example, a deal was struck to construct a 4,000 MW offshore wind power plant in Bing Thuan, Vietnam for $13 Billion.[13]

Our experts also noted that market disruptions from unstable energy systems, geopolitics and changes in governments could have the potential to impact capital flow and investor behavior, constraining investment in infrastructure development projects, tax incentives, and creating a patchwork of policies.

AI is set to take energy management to the next frontier.

2023 was the breakout year for generative Artificial Intelligence (AI), with a wave of new AI tools coming to market equipped to address a range of business challenges. AI technology is set to take energy management to the next frontier by using algorithms, machine learning, and data from sources such as smart meters and IoT devices to analyze and optimize energy use. AI is also used to optimize energy infrastructure, such as microgrids, contributing to local energy resiliency requirements.

When combined with digital solutions, AI helps identify consumption patterns and areas for efficiency improvements, manages energy use in real-time, and addresses a host of energy management requirements. Furthermore, AI is also used to help businesses create decarbonization strategies, identify renewable opportunities and drive improvements across their supply chain. Schneider Electric uses AI to advance productivity and insights for clients by integrating large language models into its EcoStruxure™ Resource Advisor software via a Copilot tool. This platform is designed to provide energy and sustainability teams with enhanced data analysis, visualization, decision support, and performance optimization to steer energy management and decarbonization efforts.

Artificial Intelligence

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Snapshot: A powerful tool needs more power – or does it?

The growth of AI applications in all sectors has increased power requirements, increasing data center loads. As shown in Figure 2, AI workloads are projected to exponentially grow power consumption in upcoming years.[14] Efforts are underway to reduce the energy consumption of AI systems, such as developing more energy-efficient algorithms, optimizing hardware for AI workloads, and implementing energy-saving techniques in data centers.

+ Learn more: Schneider Electric announced an industry-first blueprint for optimizing data centers to harness the power of AI, including the use of energy-efficient hardware and renewable power sources.

Figure 2: AI workloads in data centers

Schneider Electric estimate	2023	2028
Total data center power consumption	57 GW	93 GW
AI power consumption	4.5 GW	14.0 - 18.7 GW
AI power consumption (% of total)	8%	15-20%
AI workload (Training vs Inference)	20% Training, 80% Inference	15% Training, 85% Inference
AI workload (Central vs Edge)	95% Central, 5% Edge	50% Central, 50% Edge

This table is from Schneider Electric's 2023 report titled, "The AI Disruption: Challenges and Guidance for Data Center Design." The report reveals that interference loads will increase over time as the newly trained AI models are transitioned into production.

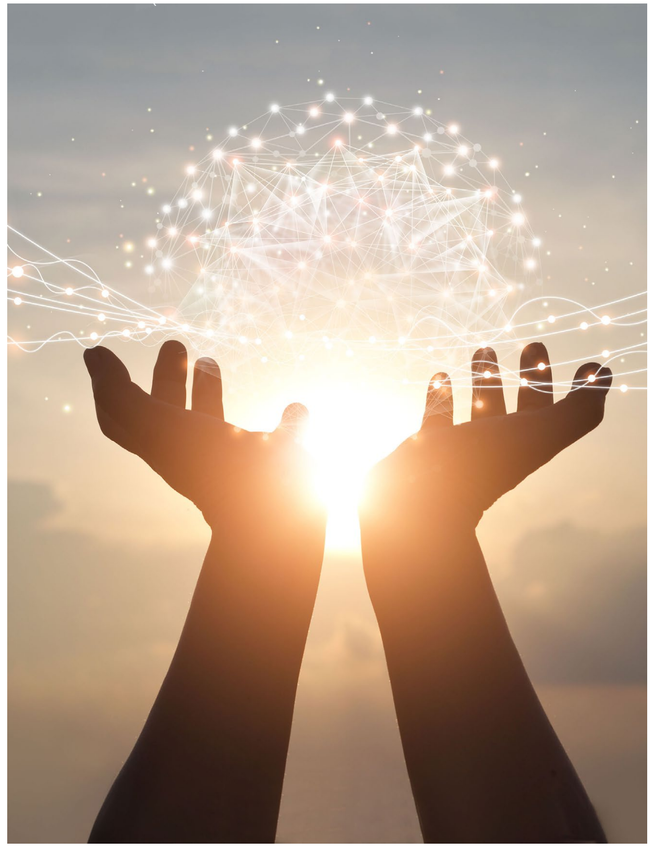
A **“Just Transition”** is essential to managing how energy will be generated and consumed.

A “Just Transition” refers to the social implications of the energy and digital transitions and calls for an equitable shift towards a low-carbon future that benefits everyone, requiring significant and decisive measures to govern the generation and consumption of energy.

Two key factors are central to the Just Transition: accessibility and resiliency. Notably, the first high-level ministerial roundtable on the “Just Transition” was held at COP28 in December 2023, where 90 representatives affirmed that sustainable and just solutions to the climate crisis must be founded on meaningful and effective social dialogue and participation of all stakeholders.[15]

Accessibility of energy focuses on equity, ensuring all people have access to clean and affordable energy regardless of socioeconomic status or geography. While equitable access will look different around the world, depending on communities’ needs, achieving this goal will likely include developing microgrids in rural areas that provide energy to communities off the main power grid, inclusive policy frameworks that prioritize development in underserved areas, energy subsidies for low-income families, and more.

Energy resilience focuses on maintaining essential services, supporting economic development, and improving the overall quality of life for all societies. Increasing the use of clean energy is crucial in achieving resilience. However, a resilient and equitable transition also includes efforts to protect scarce resources, like metal and minerals, by promoting conservation and circulation in the production and consumption of raw materials. Human rights must also be protected through labor safeguards and environmental and safety protection for workers and communities procuring these critical resources.



Conclusion

The global energy transition requires a cleaner, more resilient and equitable future that introduces a new era of global growth, economic reform, technological innovation, and climate action. In summary, these five trends are among the top market forces expected to steer the global energy market in 2024 and beyond:

1. The increasing importance of **energy resilience** and critical requirements to ensure the stability, scalability and security of energy systems.
2. The acceleration of **next-gen clean energy** and its impact on the global energy market and its role in creating new pathways to a greener future.
3. **Global competition** is driving innovative approaches to economic development policies and decarbonization mandates.
4. **AI** is set to take energy management to the next frontier, with a need to balance gains against new load demands.
5. A **Just Transition** is essential to contributing to an equitable and sustainable energy transition for all.

Gain Perspective with *Perspectives Virtual*

Gain access to this related webinar recording to hear experts from Schneider Electric's Sustainability Business share in-depth insights on these key trends, set to create new market opportunities, while cultivating a resilient, sustainable and equitable energy future.

Schneider Electric is committed to supporting your business' energy transition by offering end-to-end sustainability consultancy services and solutions. Contact us today to learn how our global experts can help shape your path to net-zero future.

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