

LET NO ONE BE LEFT BEHIND IN ENERGY TRANSITION

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The global energy transition is critical for addressing climate change and ensuring long-term energy security. However, significant challenges persist, particularly for Emerging Markets and Developing Economies (EMDEs), which lack the capital and investment required for a sustainable energy shift. The dominance of fossil fuels, geopolitical risks, and disparities in financing threaten progress. Investments in clean energy technologies, grid infrastructure, and innovative financing models must increase globally to meet rising energy demand. Ensuring an inclusive and equitable energy transition is vital to avoiding future inequality and ensuring global sustainability.

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Change, Security, and Sustainability in Energy

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It is difficult to overstate energy's fundamental role in the modern world. From communication and transportation to healthcare, industry, lighting, heating, and cooling—our standard of living is fundamentally built on the availability and consumption of energy.¹ Its significance has deepened in recent years as energy has moved to the forefront of strategic planning for companies and governments globally. Even sectors traditionally detached from energy concerns are now increasingly focused on it, driven by its pivotal role in addressing sustainability, climate change, and digitalization. What was once the domain of experts now permeates public discourse, media coverage, and policy debates, reflecting energy's expanded role in our society.

Energy Matters

Throughout history, energy has taken many forms, shaping the evolution of civilizations. For centuries, wood and animal dung were primary energy sources. The Industrial Revolution marked a pivotal shift with coal at its core, reshaping economies and societies. The development of the internal combustion engine and the rise of oil defined the 20th century, particularly in transportation.² The invention of electricity, and its unparalleled versatility, revolutionized technology and led to the creation of transformative devices such as the telegraph, telephone, radio, lightbulb, and a host of electrical equipment for industries and humanities daily use.³ Today, the energy demand has only intensified with the rise of advanced communication technologies, the internet, digitalization, and artificial intelligence. These innovations, particularly data centers, which are the backbone of the digital world, consume ever-greater amounts of energy, underscoring modern society's profound and growing dependence on energy. According to IEA, since 2010, the number of internet users worldwide has more than doubled, and the global internet traffic has expanded 25-fold. However, rapid improvements in energy efficiency have helped moderate growth in energy demand from data centers and data transmission networks, which account for 1-1.5 percent of global electricity use.⁴

Energy Outlook

The world's need for energy continues to grow. Since 2000, global energy consumption has increased by an average of 2 percent annually, while electricity consumption has risen by 5.4 percent annually. Non-OECD countries dominate the growth, and global

1) Travis Bradford, *The Energy System Technology, Economics, Markets, and Policy* (MIT Press, 2018).

2) Vaclav Smil, *Energy and Civilization* (MIT Press, 2017).

3) Daron Acemoglu and Simon Johnson, "Power and Progress," *Public Affairs* (2023).

4) IEA, "Data Centers and Data Transmission Networks". See <https://www.iea.org/energy-system/buildings/data-centres-and-data-transmission-networks>

energy demand will likely continue to rise as populations grow, living standards improve, and economies develop.⁵

Currently, fossil fuels constitute over 80 percent of global primary energy consumption, a figure that has remained relatively stagnant despite years of discussion and effort toward greening and diversifying the energy mix. Coal, oil, and natural gas continue to dominate, holding around 80 percent of the share, while renewables account for less than 15 percent, and nuclear energy contributes under 5 percent. According to the International Energy Agency (IEA), global fossil fuel consumption is expected to peak before 2030, driven by a sharp decline in coal demand. However, natural gas and oil are anticipated to grow in the near term, remaining essential components of the energy mix for decades to come.⁶

The pace at which electric vehicles (EVs) are adopted will likely be the most significant factor in determining when oil demand peaks. In the power sector, natural gas is expected to play a crucial balancing role in renewable energy generation until battery storage technologies can be scaled. In the building sector, electrification and biogas are poised to displace natural gas as energy-efficient designs become more prevalent gradually. Similarly, in industry (excluding chemicals), the electrification of heat and machine operations is projected to lead to a gradual decline in gas demand, mirroring the building sector trend.⁷

Renewable energy sources and emerging clean energy technologies will play a central role in meeting growing energy needs sustainably. Renewables are expected to maintain their rapid growth, driven by their cost competitiveness. In many regions, they are already the most cost-effective option for new power generation. According to IRENA, 473 gigawatts (GW) added in 2023, 81 percent or 382 GW of newly commissioned, utility-scale renewable projects had lower costs than their fossil fuel-fired alternatives.⁸ McKinsey's analysis suggests that renewable sources could account for 45-50 percent of global energy generation by 2030 and 65-85 percent by 2050. Solar power is expected to be the largest contributor, followed by wind. Nuclear energy and carbon capture, utilization, and storage (CCUS) technologies could alleviate some pressure on renewables, but their future depends heavily on political landscapes and cost developments. Meanwhile, power generation from hydrogen gas plants, which enhance grid stability, is also likely to increase.⁹

Energy consumption and investment trends are complex and vary significantly by geography. For example, coal accounts for over 50 percent of primary energy

5) 2024 Energy Institute Statistical Review of World Energy & Dignita Partners Analysis.

6) IEA, "World Energy Outlook 2023," International Energy Agency.

7) McKinsey, "Global Energy Perspective 2023".

8) McKinsey Global Institute, "The Hard Stuff Navigating the Physical Realities of the Energy Transition".

9) McKinsey, "Global Energy Perspective 2023".

consumption in China and India, while Singapore uses no coal. Kazakhstan relies on coal for more than 45 percent of its primary energy mix, while Turkmenistan consumes no coal. Even within Europe, energy mixes differ widely: France has 35 percent of Nuclear in its primary energy mix, while Italy has no nuclear generation. These variations are driven by resource, financing technological availability, consumer choices and national policies.¹⁰

Energy-related emissions, the production and consumption of energy accounts for more than 85 percent of global carbon dioxide (CO₂) emissions,¹¹ have increased by an average of 1.8 percent annually since 2000. According to McKinsey, the adoption of renewables could reduce emissions from power generation by 17-71 percent by 2050 compared to today, even as energy demand doubles or triples.¹²

Investment Challenge

Ensuring a reliable and affordable energy supply is crucial to maintaining the sustainability of modern society. However, achieving this requires proactive investment before demand arises. As the energy system consists of the production, conversion, delivery, and consumption of energy resources across sectors as both fuels and feedstocks, investment is required in each link of the chain.

Historically, fossil fuels have dominated energy investments, with capital-intensive projects centered on exploration, production, and the associated supply chains. The energy sector was one of the first industries to attract large-scale foreign direct investment (FDI) globally, particularly in developing countries rich in resources but in need of capital and expertise. Group of multinational oil and gas investors sought to expand their global exploration and production (E&P) portfolios and revenues.

Following the liberalization of energy markets and the privatization of state-owned incumbents in the 1990s, multinational oil and gas companies continued their investments in newly opened markets. National governments generally welcomed FDI, as it was seen as a catalyst for market liberalization and a means to enhance energy security.

By the 2010s, the rapid pace of digitalization led to substantial investments in digital technologies in energy industry—spanning generation, transportation, and consumption.

The ongoing energy transition is further reshaping the investment landscape, with clean energy technologies like solar photovoltaics (PV) and electric vehicles (EVs) at the forefront. Since 2020, clean energy investments have surged by 40 percent, and

10) 2024 Energy Institute Statistical Review of World Energy & Dignita Partners Analysis.

11) McKinsey Global Institute, “The Hard Stuff Navigating the Physical Realities of the Energy Transition”.

12) McKinsey, “Global Energy Perspective 2023”.

global investments in clean energy are nearly double those in fossil fuels.¹³

While the urgent need to combat climate change is a key driver of this shift, other factors—such as the economic viability of mature clean energy technologies and the imperative for energy security—also play critical roles. As noted by Daniel Yergin, energy security and energy transition are deeply interconnected: without the former, the latter cannot succeed.¹⁴

Historically, energy security focused on ensuring the availability of primary energy supplies. Today, sustainability has become a core dimension of energy security.¹⁵ Disruptions in global supply chains due to the COVID-19 pandemic, the ongoing Russia-Ukraine conflict, and subsequent energy shortages and price spikes have elevated energy security concerns to the forefront. Renewable energy has emerged as a potential solution to these challenges.

The International Energy Agency (IEA) estimates that by 2050, the combined market for wind turbines, solar panels, lithium-ion batteries, electrolyzers, and fuel cells could rival the size of today's oil market. However, significant challenges lie ahead. The energy transition path is fraught with uncertainties—ranging from technology trends and geopolitical risks to consumer behavior—making it difficult to craft resilient investment strategies that can adapt to multiple scenarios.

Currently, the majority of clean energy investments are concentrated in advanced economies, which offer a more stable and less risky investment environment. Emerging Markets and Developing Economies (EMDEs), excluding China, account for only about 15 percent of global clean energy spending, despite representing two-thirds of the world's population, a significant share of industrial output, and a large portion of global emissions.¹⁶

In the period 2012-21, the top investors of greenfield investment into renewable power came from France, Germany, Italy and Spain (41 percent of total greenfield investment in renewables). The top recipients of renewable energy FDI were Australia, Chile, the United States and the United Kingdom (accounting for 46 percent of all announced greenfield investment projects in renewable energies in 2012-21). In terms of total cross-border M&A activity into renewable energy the top destinations targeted by foreign investors in clean energy were Portugal, Spain, the United Kingdom and the United States, accounting for half of total deal values.¹⁷

13) IEA, "World Energy Investment 2024," International Energy Agency (June 2024).

14) GZERO Media, "Pulitzer Prize-winning author Daniel Yergin on Energy Security in a Changing World," 5 September 2024.

15) Maria Rosaria Mauro, "Energy Security, Energy Transition, and Foreign Investments: An Evolving Complex Relationship," Law and Institutions Department, Universitas Mercatorum, 00186 Rome, Italy. MDPI Published: 19 July 2024.

16) IEA, "World Energy Investment 2024," International Energy Agency (June 2024).

17) Polina Knutsson and Perla Ibarlucea Flores, "Trends, Investor Types and Drivers of Renewable Energy FDI,"

The energy transition demands comprehensive investments in both upstream (generation) and downstream (transmission, distribution, storage, and end-use) projects. These investments are highly capital-intensive, making the cost of capital a critical factor. The cost of capital, which represents the expected financial return for a clean energy project, is closely tied to the perceived risks associated with future project cash flows.

EMDE holds just one-tenth of the world's financial wealth and cannot fund their energy transitions without substantial international investment. Finishing clean energy projects is typically much higher in EMDE than in developed ones, making it crucial to reduce the cost of capital. In 2024, the cost of capital will increase across most of the world, with emerging markets and developing economies outside China facing much higher financing costs. According to the IEA's 2023 Cost of Capital Observatory Dashboard, stakeholders identified the top risks that need to be addressed to lower capital costs: political, currency, regulatory, off-taker, and transmission risks. Political and currency risks are country-wide, while the others are specific to the energy sector. For instance, currency risk is the top concern in Brazil, regulatory risk dominates in India, Indonesia, and Mexico, transmission network risk is most critical in Senegal, and political risk tops the list in South Africa and Vietnam.

Most investments in the energy sector are made by corporations, with firms accounting for the largest share of investments in both the fossil fuel and clean energy sectors. However, there are significant country-by-country variations: half of all energy investments in emerging markets and developing economies are made by governments or state-owned enterprises, compared with just 15 percent in advanced economies. Three-quarters of global energy investments today are funded from private and commercial sources, and around 25 percent from public finance, and just 1 percent from national and international development finance institutions (DFIs). Debt sustainability has become a growing concern across developing economies – three-quarters of all developing economies have debt-to-GDP ratios of at least 75 percent – so mobilizing a greater share of private finance in these markets is essential.¹⁸ EMDE should focus on creating attractive business models for private and commercial sources.

Grids are generally financed on a corporate basis, whereas solar photovoltaic (PV) and wind projects increasingly rely on project finance structures. This distinction is particularly significant in emerging markets and developing economies (EMDEs), where corporate-based lending to utilities is challenging without addressing the underlying financial health of these entities.¹⁹

OECD Working Papers on International Investment 2022/02.

18) IEA, "World Energy Investment 2024," International Energy Agency (June 2024).

19) IEA, "World Energy Investment 2024," International Energy Agency (June 2024).

Equity financing plays a pivotal role in supporting clean energy technologies involving substantial upfront risks—such as geothermal and hydropower—or technologies still in the early stages of development, including battery storage, carbon capture, and low-carbon hydrogen. As these technologies mature, the associated risks are expected to decrease, making them more suitable for debt financing. However, technologies with long construction timelines, such as grid infrastructure and nuclear power, present additional challenges due to heightened technological risks.²⁰

Several countries have already introduced mechanisms such as feed-in tariffs, and auctions to attract renewable energy investments. China has taken steps to support large state-owned enterprises and state-owned banks to increase clean energy finance, including through the development of sustainable finance regulations and incentives, so state ownership is expected to remain prominent even as clean energy becomes a larger part of the energy mix.

To further mitigate investment risks and enhance attractiveness, tools such as guarantees, revenue-sharing mechanisms, currency hedging instruments, subsidies, and tax incentives can be considered in emerging markets.

As the global energy transition accelerates, household investments have risen significantly. According to IEA, the share of household-driven energy spending has increased from 9 percent in 2015 to 18 percent in 2023, driven largely by the adoption of rooftop solar installations, energy-efficient building technologies, and electric vehicle purchases. However, as households take on a larger portion of energy investments, concerns about affordability and rising living costs may pose challenges to sustaining this trend. Addressing these issues will require innovative consumer finance policies and tailored financial instruments. In particular, investments in emerging markets and developing economies (EMDEs) remain constrained and demand bespoke strategies that account for their unique economic and social contexts.

The IEA's 2024 Investment Report highlights some progress. New policy initiatives, well-managed public tenders, and improved grid infrastructure in countries like India, Brazil, parts of Southeast Asia, and Africa have driven clean energy investments upward. In 2024, Africa's clean energy investments are projected to exceed USD 40 billion, nearly double the amount invested in 2020.

In 2023, multilateral development banks, including the European Bank for Reconstruction and Development (EBRD), allocated \$74.7 billion in financing to low- and middle-income countries. Of this, 67 percent was directed toward combating climate change, while the remaining 33 percent supported climate adaptation efforts. Private sector investment mobilized in low- and middle-income countries totaled

20) IEA, "World Energy Investment 2024," International Energy Agency (June 2024).

\$28.5 billion.²¹

To ensure that the clean energy transition brings a better future for all, emerging markets and developing economies must gain equal access to the investment required to finance this transition.

21) EBRD, European Bank for Reconstruction and Development, 20 September 2024.