Issue Brief

June 2026
No: 518

From Oil to Minerals: Reconfiguring Energy Geopolitics in the Age of Renewables

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Abstract

The transition from fossil fuel based energy systems to renewable energy systems represent a fundamental transformation in the structure of international politics and economic power. Throughout the twentieth century, geopolitical influence was deeply rooted in the control of hydrocarbon resources such as oil and natural gas. These resources were geographically concentrated, enabling states to derive power through territorial control, military presence and strategic alliances. The geopolitics of oil was therefore characterised by direct competition over resource rich regions, control over supply routes and the use of energy as an instrument of statecraft.

However, the increasing shift towards renewable energy technologies, driven by climate imperatives, technological innovation and evolving policy frameworks, is essentially changing the material foundation of energy systems. Unlike fossil fuels, renewable technologies depend on a diverse set of critical minerals such as lithium, cobalt, nickel, copper and rare earth elements. These minerals are not only geographically dispersed but also embedded within complex global supply chains that span extraction, processing, refining, manufacturing and technological integration.

As a result, geopolitical power is increasingly determined not by ownership of raw materials alone but by control over the systems that enable their transformation and use. This article highlights that energy transition is not reducing geopolitical competition, rather it is reconfiguring it into a more complex and network driven form. The emerging order is characterised by new patterns of interdependence, asymmetry and strategic rivalry. By combining theoretical insights with empirical analysis, the article shows that energy geopolitics is evolving into a system defined by supply chain control, technological dominance and geo-economic competition.

Keywords: Energy Geopolitics, Critical Minerals, Renewable Energy Transition, Supply Chain Resilience, Strategic Autonomy

Introduction

Energy has long been central to the functioning of global economies and the conduct of international politics. In the twentieth century, oil emerged as the most strategically significant resource, shaping the trajectory of international relations. Control over oil reserves

enabled states to secure economic growth, influence global markets and flex geopolitical power. The Middle East, with its vast hydrocarbon resources, became a focal point of global strategic competition.

The geopolitics of fossil fuels was characterised by three defining features viz. territorial concentration, direct control and relatively linear supply chains. States competed for access to oil through military alliances, diplomatic engagement and economic agreements. Energy security was framed in terms of securing access to resources and protecting supply routes.

In the twenty first century, this framework is undergoing a profound transformation. Climate change concerns, technological advancements and policy initiatives are accelerating the transition towards renewable energy systems. This transition is not merely a substitution of energy sources but a structural shift that reshapes the entire energy ecosystem.

Renewable energy systems differ significantly from fossil fuel systems in their material composition and technological requirements. They rely on a wide variety of critical minerals that are essential for energy generation, storage and transmission. These minerals are embedded within complex global supply chains, thus creating new forms of dependency and vulnerability.

As a result, the nature of geopolitical competition is changing. States are no longer competing solely for access to resources but for control over supply chains, technological capabilities and industrial ecosystems. The ability to manage and influence these interconnected systems has become a key determinant of power in the emerging energy order.

From Territorial Control to Network Power

The transition from fossil fuels to renewable energy represents a shift from territorial control to network based power. In the traditional system, power was derived from control over geographically concentrated resources. States with access to oil reserves could exert influence through direct control and strategic positioning.

In contrast, renewable energy systems are characterised by dispersed resources and complex supply chains. Critical minerals are found in various parts of the world, including Africa, Latin America and Australia. However, extraction is only the first step in a multi- stage process that includes refining, processing, manufacturing and distribution.

This creates a networked system in which power is sourced from control over key nodes rather than physical territory. For example, a country that dominates mineral processing or battery manufacturing can exert significant influence over global markets, even if it lacks substantial raw material reserves.

Network power operates through the ability to control flows of materials, capital and technology. Unlike traditional forms of power, which are visible and geographically bounded, network power is diffused and embedded within global systems. This makes it more complex and difficult to challenge.

Theoretical Perspectives

The transformation of energy geopolitics requires a re-evaluation of theoretical frameworks in international relations. Realism continues to provide useful lens for understanding state behaviour as states remain concerned with power and security in an anarchic system. The competition for critical minerals can be seen as a continuation of traditional resource race in a new form.

While realism provides a useful starting point for understanding competition over critical minerals, it does not fully capture the complexity of the emerging energy landscape. Liberal theories of international relations offer additional insights by emphasising the role of cooperation, institutions and interdependence. In a globalised economy, supply chains connect multiple countries, creating mutual dependencies that can both stabilise and destabilise relationships.

Interdependence in the renewable energy era is qualitatively different from that of the fossil fuel era. In the oil-based system, interdependence largely existed between producers and consumers. In contrast, renewable energy supply chains involve multiple stages such as mining, refining, manufacturing and technology integration; each of which may be dominated by different countries. This creates a web of interconnections that is far more complex.

However, interdependence is not inherently benign. Asymmetrical interdependence can create power imbalances, allowing dominant actors to exert influence over others. For example, a country that controls mineral processing capabilities can restrict access to refined materials, thereby affecting downstream industries in other countries. This highlights the dual nature of interdependence as both a ‘source of cooperation’ and ‘a potential tool of coercion’.

Geo-economics provides a framework for understanding how states navigate this environment. It emphasizes the use of economic instruments such as trade policy, industrial policy and investment strategies to achieve geopolitical objectives. In the renewable energy era, geoeconomic competition is becoming increasingly prominent, as states seek to secure their positions within global supply chains.

The concept of systemic control is particularly important in this context. Rather than focusing solely on resource ownership, states aim to control the entire value chain. This includes not only physical infrastructure but also technological capabilities, regulatory frameworks and financial systems. States that can integrate these elements are much better placed to shape the global energy order.

Material Foundations: Critical Minerals and New Dependencies

The transition to renewable energy systems has brought critical minerals to the forefront of geopolitical analysis. These materials are essential for technologies such as electric vehicles, wind turbines, solar panels and energy storage devices. Lithium, cobalt, nickel and rare earth elements play particularly important roles in these technologies.

Unlike fossil fuels, which are relatively uniform commodities, critical minerals differ widely in their properties and uses. This diversity increases the complexity of supply chains and makes replacement more difficult. For example, while lithium is essential for battery production, there are limited alternatives that can provide the same level of performance.

The geographic distribution of these minerals introduces new patterns of dependency. Many critical minerals are concentrated in developing countries, often with limited governance capacity. For instance, the Democratic Republic of Congo accounts for a large share of global cobalt production, while lithium is heavily concentrated in Australia and South America.

However, extraction is only one part of the equation. The processing and refinement of these minerals are often concentrated in few countries which will create bottlenecks in the supply chain. This concentration of processing capacity is a key source of geopolitical leverage.

These new dependencies differ from those of the fossil fuel era. While oil dependencies were largely bilateral (producer-consumer), mineral dependencies are multilayered and involves multiple actors across different stages of the supply chain. This creates a more complex and dynamic geopolitical landscape.

Supply Chains as Strategic Infrastructure

Supply chains in the renewable energy era functions as strategic infrastructure, similar to pipelines and shipping routes in the fossil fuel era. However, they are more complex and involves greater number of actors and processes.

Each stage of the supply chain viz. mining, processing, manufacturing and distribution represents a potential point of control. Countries that dominates key stages can influence the entire system. For example, control over refining capacity allows a country to determine the availability of processed materials, regardless of where the raw materials are extracted.

This creates opportunities for strategic leverage. States can use supply chain control to influence market outcomes, shape technological standards and achieve geopolitical objectives. Tools such as export restrictions, tariffs and subsidies can be used to manipulate supply chains in favour of state interests.

At the same time, supply chains are vulnerable to disruptions. Natural disasters, political instability and global crisis, such as pandemics, can disrupt production and transportation. The Covid-19 pandemic, for example, exposed the fragility of global supply chains and highlighted the risks of overdependence on specific regions.

As a result, supply chain resilience has become a key priority for many states. This includes efforts to diversify supply sources, invest in domestic capabilities and build strategic reserves of critical materials.

Case Study: China's Systemic Advantage

China has emerged as a dominant actor in critical mineral supply chains, illustrating the concept of systemic control. Over the past two decades, China has implemented a comprehensive strategy that spans mining, processing and manufacturing.

China's dominance is particularly evident in the processing of rare earth elements and the production of lithium-ion batteries. By investing in refining capacity and manufacturing infrastructure, China has positioned itself at the centre of the global supply chain.

This dominance provides China with significant strategic advantages. It can influence global prices, control supply availability and shape technological standards. Moreover, China's integration across the value chain allows it to capture a large share of economic value.

China's approach reflects a long-term strategic vision that combines industrial policy, state support and global investment. It highlights the importance of systemic control in the renewable energy era.

Case Study: The United States and Strategic Response

The United States has recognised the strategic implications of China's dominance and is taking steps to strengthen its position. Policies such as the Inflation Reduction Act aim to promote domestic production and reduce dependence on foreign supply chains.

The US strategy places emphasis on diversification, innovation and partnerships. By collaborating with allies such as Australia, Canada and Japan, the United States seeks to build a more resilient and secure supply chain network.

However, the US faces challenges in building domestic capacity, including high costs and regulatory barriers. Balancing economic efficiency with strategic security remains a key challenge.

Case Study: India and the Pursuit of Strategic Autonomy

India represents a distinctive case in the evolving landscape of energy geopolitics. As one of the fastest growing major economies and a country with ambitious renewable energy targets, India faces a dual challenge such as rapidly expanding its clean energy capacity while ensuring secure and reliable access to critical minerals. Unlike China, India does not possess significant reserves of many key minerals such as lithium and cobalt, making it structurally dependent on external sources.

Recognising these vulnerabilities, India has begun to adopt a more proactive and strategic approach. One of the most significant initiatives in this direction is the establishment of Khanij Bidesh India Limited (KABIL)— a joint venture aimed at acquiring overseas mineral assets. Through KABIL, India is exploring opportunities in resource rich regions such as Australia, Latin America and Africa. These efforts reflect a shift from 'passive import dependent strategy' to a more 'active engagement with global resource markets.

In addition to overseas investments, India is also focusing on strengthening its domestic capabilities. Government policies aimed at promoting electric vehicles, renewable energy and battery manufacturing are driving demand for critical minerals while simultaneously encouraging the development of local industries. Initiatives such as the Production Linked

Incentive (PLI) schemes are designed to boost domestic manufacturing capacity in sectors such as advanced chemistry cells and electronics.

India is also pursuing strategic partnerships with like minded countries to enhance supply chain resilience. Collaborations with countries such as Japan and Australia are aimed at securing access to critical minerals and developing alternative supply chains that reduce dependence on dominant players. These partnerships are not only economic but also geopolitical, reflecting shared concerns about supply chain vulnerabilities.

The concept of strategic autonomy is central to India's approach. Rather than seeking complete self-sufficiency which is neither feasible nor efficient, India aims to balance domestic capacity building with international cooperation. This approach acknowledges the interconnected nature of global supply chains while striving to minimise vulnerabilities.

Technological Chokepoints: Batteries, Semiconductors and Innovation Ecosystems

While access to raw materials is important, control over technology represents an even more critical dimension of power in the renewable energy era. Technologies such as advanced batteries, semiconductors and energy management systems serve as chokepoints that can determine the direction and pace of the energy transition.

Battery technology, in particular, lies at the heart of the renewable energy ecosystem. The performance, cost and scalability of batteries influence the adoption of electric vehicles and the integration of renewable energy into power grids. Countries that dominate battery manufacturing and innovation can shape global markets and standards.

China's leadership in battery production, driven by companies such as CATL and BYD, illustrates the importance of technological dominance. However, other countries are investing heavily to catch up. The United States and European Union are promoting domestic battery industries through subsidies, research funding and regulatory support.

Semiconductors represent another critical chokepoint. Modern energy systems rely on digital technologies for grid management, energy efficiency and smart infrastructure. The global semiconductor shortage during the Covid-19 pandemic highlighted the vulnerability of supply chains and the strategic importance of this sector.

Innovation ecosystems play a crucial role in maintaining technological leadership. These ecosystems include research institutions, skilled labour, intellectual property

frameworks and venture capital networks. Countries that invest in these areas are better positioned to sustain long term competitiveness.

The interplay between technology and geopolitics is becoming increasingly evident. Export controls on advanced technologies, restrictions on foreign investments and competition over intellectual property rights are shaping the contours of the emerging energy order.

Environmental Geopolitics of Mining

The shift towards critical minerals introduces new environmental challenges that have significant geopolitical implications. Unlike fossil fuels, that are primarily associated with carbon emissions, the extraction and processing of critical minerals involve a wide range of environmental impacts, including land degradation, water consumption and pollution.

Mining activities can have severe ecological consequences, particularly in regions with weak regulatory frameworks. For example, lithium extraction in arid regions can strain water resources, while cobalt mining has been associated with environmental and human rights concerns. These issues can lead to social unrest, regulatory changes and disruptions in supply chains.

Environmental considerations are increasingly influencing geopolitical dynamics. Countries with strict environmental regulations may face higher production costs, thus potentially reducing their competitiveness. Conversely, countries with weaker regulations may attract investment but at the cost of sustainability and long-term environmental damage.

The growing emphasis on sustainability is also reshaping supply chains. Consumers, investors and governments are demanding greater transparency and ethical sourcing of materials. This has led to the development of certification systems and standards aimed at promoting responsible mining practices.

Environmental geopolitics adds a new layer of complexity to the energy transition. States must balance the need for resource security with environmental protection and social responsibility. Failure to address these issues can undermine both domestic stability and international credibility.

The Role of Corporations in Energy Geopolitics

In the renewable energy era, multinational corporations are playing an increasingly important role in shaping geopolitical outcomes. Companies involved in mining,

manufacturing and technology development are key actors in global supply chains and innovation systems.

Corporations such as Tesla, CATL and major mining firms influence investment patterns, technological development and market dynamics. For example, Tesla's expansion has driven demand for lithium and battery materials, influencing global supply chains and prompting investments in mining and processing.

Chinese companies, particularly in the battery sector, have become dominant players in global markets. Their integration into global supply chains and close alignment with state policies have given them a strategic advantage. At the same time, Western companies are seeking to diversify supply chains and reduce dependence on specific regions.

The growing influence of corporation reflects a broader shift in the nature of power. Non- state actors are increasingly shaping global economic and technological landscapes, often in ways that intersect with state interests. This creates a more complex and multi-layered geopolitical environment.

The relationship between states and corporations is also evolving. Governments are increasingly supporting domestic industries through subsidies, regulatory frameworks and strategic investments. This blurring of boundaries between public and private actors is a defining feature of modern geo-economics.

Supply Chain Shocks and Global Crisis

Recent global events have underscored the vulnerability of supply chains and their importance in energy geopolitics. The Covid-19 pandemic disrupted production and transportation networks, revealing the fragility of global supply systems. Similarly, geopolitical tensions such as the Russia-Ukraine conflict have highlighted the risks associated with dependence on specific regions.

These crises have accelerated efforts to enhance supply chain resilience. Countries are seeking to diversify sources of supply, invest in domestic production and build strategic reserves of critical materials. The concept of "friend-shoring" has gained prominence, with countries prioritising partnerships with trusted allies.

Supply chain shocks also highlight the interconnected nature of the global economy. Disruptions in one sector can have cascading effects across multiple industries, hence emphasising the need for coordinated responses and international cooperation.

Implications for Global Power and Strategic Competition

The transition to a mineral based energy system is reshaping global power dynamics by creating new forms of dependency and asymmetry. Countries that control key segments of the supply chain, particularly processing and technology, can exert influence over others.

These asymmetries can be leveraged for strategic advantage, affecting economic and political outcomes. At the same time, they create vulnerabilities that can be exploited during times of crisis. Managing these dynamics is a central challenge for policymakers.

Strategic competition is likely to intensify as countries seek to secure their positions in the emerging energy order. This competition will be driven not only by resource availability but also by technological capabilities, industrial policy and diplomatic strategies.

Future Trajectories of Energy Geopolitics

Looking ahead, the geopolitics of energy is likely to become even more complex as technological innovation, policy evolution and shifting economic priorities reshape global systems. One key trajectory is the increasing importance of circular economy practices, particularly the recycling of critical minerals. As demand for lithium, cobalt and rare earth elements grow, recycling technologies could reduce dependence on primary extraction and mitigate supply risks. Countries that invest early in recycling infrastructure may gain a strategic advantage by creating secondary supply chains that are less vulnerable to geopolitical disruptions.

Another emerging dimension is the role of digitalization in energy systems. Smart grids, artificial intelligence and data driven energy management are transforming how energy is produced, distributed and consumed. Control over digital infrastructure and data flows may become as important as control over physical resources, thus adding a new layer to energy geopolitics.

Finally, the transition to renewable energy may lead to a partial decentralisation of energy systems. Unlike fossil fuels, renewable resources such as solar and wind are more widely distributed, allowing countries to reduce dependence on imports. However, this

decentralisation is counterbalanced by continued reliance on global supply chains for technology and materials, ensuring that interdependence remains a defining feature of the system.

Conclusion

The global transition from fossil fuels to renewable energy represents a fundamental transformation in the nature of energy geopolitics. While traditional systems were based on territorial control over hydrocarbon resources, the emerging paradigm is defined by control over critical minerals, supply chains and technological systems.

This transformation does not eliminate geopolitical competition but reconfigures it into a more complex and interconnected form. Power is increasingly exercised through networks of production, processing and innovation rather than physical territory alone.

The future of energy geopolitics will depend on the ability of states to integrate resources, technology, and strategy. Those that can effectively manage supply chains, invest in innovation and navigate environmental and social challenges will be best positioned to succeed.

Ultimately, the shift from oil to minerals marks not the end of energy geopolitics but its evolution into a dynamic, network-driven system characterised by new opportunities and risks.

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Lieutenant Colonel Rohit Kumar is an alumnus of the National Defence Academy and Jawaharlal Nehru University. The author was commissioned into the Regiment of Artillery before transferring to the Army Education Corps. A battle casualty sustained during counter-insurgency operations in Jammu & Kashmir, he has served in operational, staff and instructional appointments, including at the Indian Military Academy, where he taught International Relations and Theory of Warfare. He was awarded the GOC-in-C Commendation Card in 2009. He holds a Master's degree in Political Science from IGNOU and a certification in Cyber Law from NLSIU, with distinguished performance in professional military courses, including instructor grading in Information Warfare.