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From Climate Goals to Geopolitical Games: The battle for Green Technology Supremacy

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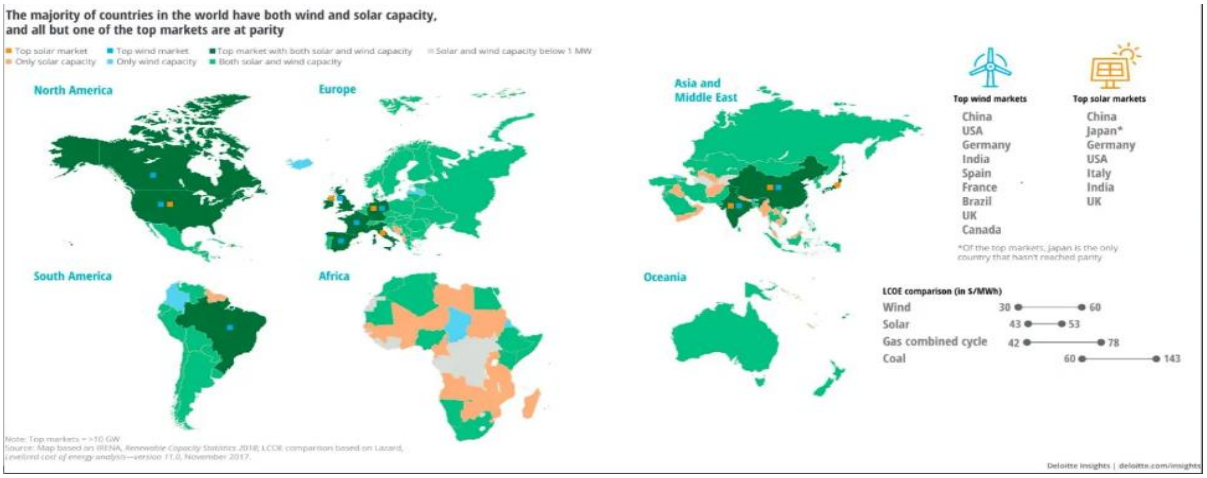
Introduction

Green technology, also known as clean technology, refers to the use of science and innovation to create environmentally friendly products and processes that reduce human impacts on the natural environment. We are living in an era of innovation and technology. Green technology strategies are gaining significance in response to the escalating concerns over climate change and the environmental impact of human activities. It not only reduces carbon emissions but also promotes sustainable practices within industries. With a growing global population, the demand for energy and resources continues to rise, contributing to higher emissions and ecological degradation.



Source: Earth.org

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Renewables like solar and wind have become central to the global energy landscape, driven by technological advancements and declining costs. As a result, they are expanding more rapidly than any other energy source. Many renewable technologies are now economically competitive with fossil fuels in the power sector, even without considering their benefits in combating air pollution and climate change.

Source: One Earth

The impact of climate change is no longer a distant threat, it is a crisis unfolding before our eyes. Rising global temperatures, extreme weather events, and environmental degradation are already affecting millions of people worldwide. Energy shortages global warming, pollution, rising urban population, soil degradation, deforestation and other environmental issues are encouraging individuals, companies and governments to look into how adapting to greener technologies can help change the world. According to Statista, an estimated 3.1 trillion U.S. dollars were invested

in the global energy sector in 2024.[2] Investment in clean energy technologies were almost twice as much as investment in fossil fuels that year, with a share of 64 percent of total spending. The share of total spending going toward clean technologies has increased by almost 20% since 2015.[3] According to International Energy Agency (IEA), Renewable energy consumption in the power, heat and transport sectors increases near 60% over 2024-2030.[4] As we can see, green technology has become a significant part of climate action throughout the world.

Strategic Importance of Green Technology

The world is now currently undergoing through a major energy transition, from oil & gas to various green energy sources. And there has been a significant development in the renewable energy technology. This shift is not a mere exaggeration of climate activists but a reality driven by multiple factors. Advances in renewable energy technology, transformations in global energy markets, the rise of cleaner hydrocarbons like natural gas, and—most importantly—growing awareness among businesses and the public about climate change and the benefits of sustainable energy are all accelerating this transformation. Thus, green technology has become a key component among national strategies of different nations. The strategic importance of green technology is multifaceted; encompassing various economic, environmental, and geopolitical dimensions.

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[2] "Energy Sector Investment Share by Type 2015-2024 | Statista." 2015. Statista. Statista. 2015. https://www.statista.com/statistics/1480582/energy-sector-investment-shares-by-source/.

[3] greenmachines. 2021. "FUTURE of GREEN TECHNOLOGY." Green Machines. February 22, 2021. https://greenmachines.com/future-of-green-technology/.

[4] IEA. 2024. "Global Overview – Renewables 2024 – Analysis - IEA." IEA. 2024. https://www.iea.org/reports/renewables-2024/global-overview.

Transitioning to green energy reduces reliance on fossil fuels. Environmentally friendly mechanisms are imperative for sustainable and inclusive development. Hence, countries are focusing on green economic growth. According to the study conducted by Khan, Syed Abdul Rehman, Zhang Yu, and Muhammad Umar[5], green economic growth is an expansion of the economic growth model that promotes economic progress while also prioritizing environmental protection and social sustainability. As the impacts of climate change become increasingly severe, nations feel a moral and political obligation to lead in mitigating its effects. This involves transitioning to sustainable energy systems and reducing greenhouse gas emissions.

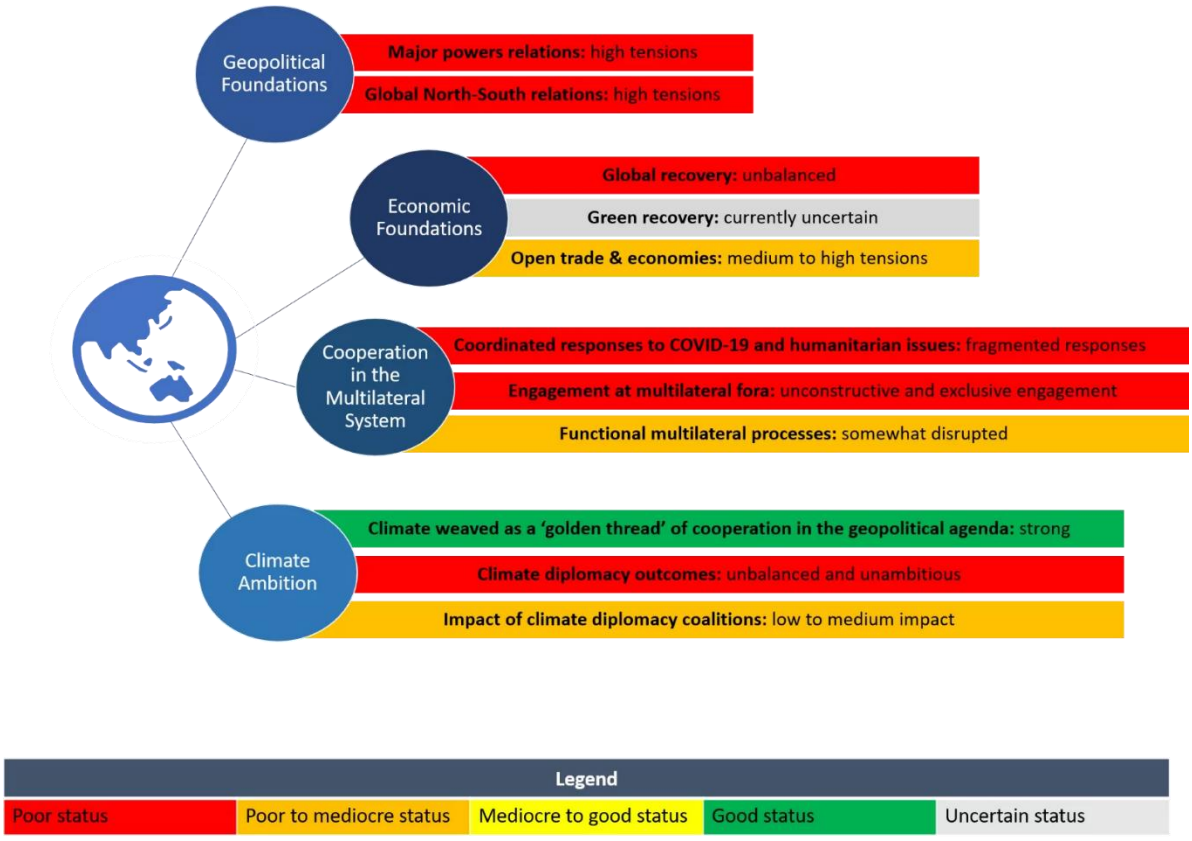
One of the most revolutionary aspects of green technology is its ability to shift energy production from centralized power plants to a distributed network of local energy sources. This transition includes small-scale solutions like rooftop solar panels and community wind farms, making energy generation more accessible and sustainable. According to International Energy Agency (IEA), electric car sales will increase by an average of 23% per year from 2024 to 2030.[6]

The Geopolitics of Climate Actions

Before going into the discussion of the battle for Green Technology supremacy, we need to understand how international political dynamics, power structures and national interests influence the decisions countries make regarding climate change mitigation and adaption. Although climate is something that has no boundary, the impact of climate change affects every living being of the earth one way or another. Geopolitics and Climate change mutually impact one another. Climate

[5] Khan, Syed Abdul Rehman, Zhang Yu, and Muhammad Umar. "A road map for environmental sustainability and green economic development: an empirical study." *Environmental Science and Pollution Research* (2022): 1-9.
[6] IEA. 2023. “Electric Vehicles.” IEA. July 11, 2023. https://www.iea.org/energy-system/transport/electric-vehicles.

change is conventionally understood as a classic international collective action problem. Climate action is shaped by various geographical, economic and political factors among nations. The transition to clean energy is not just an environmental imperative but also a significant geopolitical issue.



Source: E3G

According to World Meteorological Organization (WMO)'s State of The Climate Update, 2024 is set to be the hottest year on record, temporarily hitting the 1.5°C above the pre-industrial era.[7] A fundamental feature of international climate politics is that the world's two largest economies, the

[7] World Meteorological Organization. 2025. "WMO Confirms 2024 as Warmest Year on Record at about 1.55°c above Pre-Industrial Level." World Meteorological Organization. January 10, 2025. https://wmo.int/news/media-centre/wmo-confirms-2024-warmest-year-record-about-155degc-above-pre-industrial-level.

United States and China, are also world's two largest national emitters, which makes climate cooperation between them a matter of geopolitics as well as energy and economics.

Throughout history, resource control has driven local, regional, and global power struggles. Oil and gas have long shaped geopolitics and the climate, while critical minerals like copper, cobalt, and lithium are set to influence the future. As the green transition accelerates, geopolitical influence will shift to resource-rich countries like China, Chile, Australia, and the Democratic Republic of Congo, which supply essential materials for sustainable technologies.[8] The rapid expansion of renewable energy is driving a global energy shift with far-reaching geopolitical implications. Just as fossil fuels have shaped the geopolitical landscape for the past two centuries, this shift to green technology will redefine the global balance of power, international relations, conflict dynamics, and the social, economic, and environmental factors influencing geopolitical stability.

China's Dominance in Green Technology

In 2020, the President of China, Xi Jinping told the United Nations General Assembly that China would be carbon neutral by 2060. To keep his promise, the Chinese state is acting accordingly. Local government has increased subsidies for major clean-energy projects. An analysis by CarbonBrief[9] shows that, A massive 40% of China's GDP growth came from clean-energy sectors. Solar power, along with manufacturing capacity for solar panels, EVs and batteries, were the main

[8] Thompson, Helen. 2022. "The Geopolitics of Fossil Fuels and Renewables Reshape the World." *Nature* 603 (7901): 364–64. https://doi.org/10.1038/d41586-022-00713-3.

[9] Myllyvirta, Lauri. 2024. "Analysis: Clean Energy Was Top Driver of China's Economic Growth in 2023." Carbon Brief. January 25, 2024. https://www.carbonbrief.org/analysis-clean-energy-was-top-driver-of-chinas-economic-growth-in-2023/.

focus of China's clean-energy investments in 2023. The major role that clean energy played in boosting growth in 2023 means the industry is now a key part of China's wider economic and industrial development. The government took initiatives to make renewable energy more popular in the country. China introduced its first law on renewable energy, requiring the grid to purchase clean energy at preferable prices. China's four-trillion-yuan investment in renewables made clean-energy manufacturing a serious economic player in China. It emerged the prospect of an energy source which could both significantly reduce the country's chronic air pollution and simultaneously cut its dependence on importing oil and gas.

Renewable energy production in China has boomed in recent years

Source: The Associated Press

China is dominant not just as a developer of zero-carbon tech and producer of zero-carbon products, but also as a processor of the critical raw materials which are needed to make these

technologies work. China dominates the production of and supply chains for nearly all clean technologies. In 2019, the International Renewable Energy Agency (IRENA), an intergovernmental organization that promotes the adoption and sustainable use of renewable energy, concluded that, “No country has put itself in a better position to become the world’s renewable energy superpower than China. In aggregate, it is now the world’s largest producer, exporter and installer of solar panels, wind turbines, batteries and electric vehicles, placing it at the forefront of the global energy transition”. China is strengthening its competitive advantage in advanced technologies to tackle global warming, emerging as a global leader in patents for capturing and sequestering industrial carbon dioxide emissions.

China's dominance in green technology supply chains stems from decades of strategic government support, innovation driven by economies of scale, and highly integrated supply networks aimed at shaping future industries. Since the 1990s, the government has focused on renewable energy to reduce reliance on fossil fuel imports. In the 2000s, policies like “Made in China 2025” and the “Strategic Emerging Industries initiative” prioritized new energy industries and vehicles. As a result, China no longer just copies foreign technology but is now at the forefront of research, development, and new patents.

The West’s Response: Competing with China’s Green Growth

The West, particularly the U.S. and EU, is actively responding to China's dominance in green technology through a mix of competition, collaboration, and policy measures. In today's geopolitical landscape, where tensions between Western nations and China continue to rise, finding common ground for cooperation can be difficult. However, the fight against climate change is one

area that presents a clear opportunity for mutual benefit and trust-building. Collaboration on climate change appears to be a win-win. China is committed to significantly reducing its carbon footprint, and working with international partners is crucial to achieving this goal. However, the reality is far more complex. Geopolitical tensions and concerns over transparency—heightened in the wake of the COVID-19 pandemic—have made many businesses wary of deepening ties with China. The pandemic also strained key business relationships, prompting an exodus of foreign experts from China and weakening connections between Chinese and international companies. Meanwhile, Western governments, particularly the United States, are reversing long-standing policies and taking steps to distance themselves from China both politically and economically.

Source: Asia Times

To counter China's rising dominance in clean technology, the United States, European Union, and other Western nations have adopted strategies to strengthen their own green tech industries and lessen dependence on Chinese imports. The U.S. has introduced substantial subsidies and incentives to promote domestic clean energy production. According to The United States

Environmental Protection Agency (EPA), the Inflation Reduction Act allocates $369 billion to support renewable energy projects, electric vehicles (EVs), and other green technologies[10]. This significant investment aims to stimulate local manufacturing and innovation in the clean tech sector.

In response to China's growing dominance in clean technology, Western policymakers, including European Commission President Ursula von der Leyen[11], are advocating for "de-risking" ties with China. This has led to policies aimed at strengthening domestic production. The U.S. passed the "Inflation Reduction Act" in 2022 to boost green industries through tax incentives and subsidies, while the EU introduced the "Net Zero Industry Act" in 2023 to expand green tech manufacturing. Both are also working to secure critical mineral supply chains through initiatives like the U.S.-led "Minerals Security Partnership" and the EU Critical Raw Material Act.

Both the European Union and the United States are taking measures to restrict imports from Chinese suppliers. Although their approaches and tools are somewhat different, their objectives remain the same. The U.S. has imposed new tariffs on green goods, making Chinese electric vehicles (EVs) and other clean technologies significantly more expensive. Additionally, the Uyghur Forced Labor Prevention Act has resulted in widespread bans on Chinese solar

[10]United States Environmental Protection Agency. 2022. "Summary of Inflation Reduction Act Provisions Related to Renewable Energy." Www.epa.gov. November 21, 2022. https://www.epa.gov/green-power-markets/summary-inflation-reduction-act-provisions-related-renewable-energy.

[11] Leyen, Ursula von der. 2023. "Press Corner." European Commission - European Commission. March 30, 2023. https://ec.europa.eu/commission/presscorner/detail/en/speech_23_2063.

components. Meanwhile, the European Union has approved its own forced labor ban[12] and is conducting anti-subsidy investigations into Chinese EVs, solar panels, and wind turbines.

Source: CNBC

However, if such measures are not part of a broader strategy that emphasizes strong global partnerships and ongoing engagement, they risk making green goods more expensive in the West, ultimately slowing down the energy transition. A study by Wood Mackenzie[13] found that, swiftly eliminating Chinese-made clean tech products from global markets could lead to a 20 percent rise in capital expenditures from 2023 to 2050, adding $6 trillion in additional global costs. Solar panels in the U.S. cost twice as much as in Europe because of import limits on Chinese panels. Trying to move away from China too quickly could cause supply problems and slow down the global energy

[12] European Parliament. 2024. "Products Made with Forced Labour to Be Banned from EU Single Market | News | European Parliament." Www.europarl.europa.eu. April 23, 2024. https://www.europarl.europa.eu/news/en/press-room/20240419IPR20551/products-made-with-forced-labour-to-be-banned-from-eu-single-market.

[13] Rory McCarthy, "Not Made in China: The US$6 Trillion Cost of Shifting the World's Clean-tech Manufacturing Hub | Wood Mackenzie," Wood Mackenzie, February 12, 2024, https://www.woodmac.com/news/opinion/not-made-in-china-the-us$6-trillion-cost-of-shifting-the-worlds-clean-tech-manufacturing-hub/.

transition. For example, China responded to U.S. restrictions on advanced chips by limiting exports of minerals needed for chip production, showing how such actions could lead to unexpected problems.

Climate Cooperation vs. Competition: Can the World Balance Both?

China spent more than twice as much on its green transition in 2023 than any other country, and this investment has made it a global powerhouse in clean energy production. There is no way around China's dominance in the green technology sector is short term. The U.S. and the EU should focus on innovation and comparative advantages rather than protectionism. Green technologies face challenges like mineral demand, complex production, and energy storage limits, requiring continued innovation for a sustainable transition. The growing competition from China should be a wake-up call for the United States, Europe, and other allies to strengthen their financial efforts and accelerate innovation and resource recycling in green technology supply chains. As more countries work to build their own clean energy industries, there is a chance to create a more diverse global supply chain. The U.S. should collaborate with partners to curb China's dominance while expanding clean energy access. To ease trade tensions, both the U.S. and China must reassess priorities and find common ground.

Conclusion

According to a report of IEA, despite the ongoing implementation of industrial strategies in other countries, the value of China's clean technology exports is set to exceed USD 340 billion in 2035, based on today's policy settings.[14] As the energy sector evolves and trade increasingly focuses on

[14] Energy Technology Perspectives 2024 – Analysis - IEA. 2024. "Energy Technology Perspectives 2024 – Analysis - IEA." IEA. October 30, 2024. https://www.iea.org/reports/energy-technology-perspectives-2024.

green technologies, there will be long-term implications. The complex landscape of business environment and geopolitical tensions between the East and the West poses significant challenges. But climate doesn't care about politics. Countries coming forward with a spirit of engagement and mutual benefit, will be key to combat climate change with clean technology.