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GREEN GROWTH STRATEGIES IN CHINA AND THE EUROPEAN UNION: TRENDS, INDICATORS, AND CHALLENGES OF RECENT YEARS

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Purpose of the article: *The article aims to provide a comparative analysis of the approaches of China and the European Union to developing a "green" economy between 2019 and 2024. The objective is to identify and contrast the strategies, trends, and challenges faced by both entities in their ecological transition.*

Methodology: *The analysis employs a comparative approach, evaluating strategic policies, performance indicators, and economic, social, and geopolitical consequences. The study examines key aspects such as the energy transition, the development of key industrial sectors (electric vehicles, batteries), investment flows, and the implications for the labor market and bilateral relations.*

Conclusions*: The research shows that while both entities have demonstrated significant progress, they have pursued fundamentally different paths. The EU relied on a normative framework, market mechanisms, and the mobilization of private capital, while China used centralized planning and massive public investments to dominate the production of clean technologies. The conclusions indicate a transformation of the relationship between the EU and China from an environmental partnership to a strategic rivalry, as evidenced by the introduction of protectionist measures such as the Carbon Border Adjustment Mechanism (CBAM).*

Originality: *The originality of this work lies in its comparative approach, which reveals the fundamental differences between the economic systems and strategic priorities of the two blocs. The article highlights a key paradox: while the EU sets the normative standards, China dominates production, and this dynamic of competition and cooperation will shape the global landscape in the coming years.*

Keywords: *green economy, energy transition, European Green Deal, trade barriers, electric vehicles, renewable energy, Carbon Border Adjustment Mechanism (CBAM).*

JEL Classifications: O44, F64, Q56

INTRODUCTION

The period from 2019 to 2024 marked a decisive phase for the worldwide "green" transition, when climate ambitions began to be translated into concrete economic strategies. Ensuring sustainable growth became a central priority for the world's largest economies against a backdrop of rising environmental risks and geopolitical uncertainty. In 2019, the European Union launched the European Green Deal, a comprehensive roadmap intended to achieve climate neutrality by the year 2050 (European Commission, 2019). In parallel, China, as the largest producer and consumer of energy in the world, strengthened its "dual carbon" goals—peaking carbon dioxide emissions before 2030 and reaching carbon neutrality before 2060—which became a core element of its economic policy (Luo & Zhang, 2022).

Between 2019 and 2024, trends in the development of the "green" economy became clearer, and key indicators made it possible to assess the effectiveness of the chosen strategies. While the European Union focused its efforts on building an internal market and setting standards for sustainable development (Капица,

2022), China recorded impressive results in expanding production and lowering the costs of clean technologies, which positioned it as a global leader in this field (Garside & He, 2024).

The European Union positions itself as a global leader in regulation, setting new standards in sustainable finance, the circular economy, and carbon emission pricing. Its approach rests on creating a market environment that is favorable to sustainability and on stimulating private investment.

China, by contrast, relies on a model based on centralized planning and state subsidies, which has allowed it to secure a dominant position in key sectors such as the production of solar panels, batteries, and electric vehicles (IEA, 2024). This strategy has not only accelerated the domestic transition but has also strengthened China's position as a global exporter of "green" technologies.

LITERATURE REVIEW

The analysis presented is based on a comparative methodology that makes it possible to evaluate strategic approaches, key indicators, and the challenges associated with "green" growth. The report covers such aspects as the energy transition, the development of key sectors, investment flows, and the social and geopolitical consequences. Particular attention is paid to the ways in which differences in approach influence competition and cooperation between the two economic giants, as well as to the ways in which these differences shape global trends in sustainable development.

Strategy of the European Union: the European Green Deal.

Launched in 2019, the European Green Deal is a comprehensive strategy of the European Union aimed at transforming the bloc into a modern, resource-efficient, and competitive economy. Its primary objective is to achieve climate neutrality by the year 2050, a target embedded in a legally binding European Climate Law. Within this strategy, the European Union adopted a series of legislative and regulatory measures, including the "Fit for 55" package designed to reduce net greenhouse-gas emissions by at least fifty-five percent by 2030 relative to 1990 levels (European Commission, 2019).

The key initiatives of the European Green Deal span a wide range of sectors. The Industrial Plan for the Green Deal, together with the Critical Raw Materials Act and the Net-Zero Industry Act, are intended to scale the production of clean technologies and to reduce dependency on external suppliers (Garside & He, 2024). In addition, the REPowerEU plan, launched in response to geopolitical tensions and the energy crisis, directed forty percent of its funding to the provision of affordable and secure energy, thereby supporting a reduction in reliance on fossil fuels and a diversification of supply sources (Смирнов, 2023).

The strategy of the European Union demonstrates that for the bloc the "green" transition is not only an environmental necessity but also a fundamental instrument for strengthening its "strategic autonomy" and economic security (Федоров, 2021). In the context of rising geopolitical risks and vulnerable supply chains, the European Green Deal has functioned as a response intended to minimise dependence on imports, including fossil fuels and key components for clean technologies. Thus, the European Green Deal serves climate, economic, and strategic objectives at the same time.

China's approach: centralized planning.

China's approach: centralized planning. China's approach to the "green" economy is grounded in centralized state planning, which reflects the nature of its economic system. The Fourteenth Five-Year Plan plays a foundational role in this process, embedding the "dual carbon" objectives of reaching a peak in emissions before the year 2030 and achieving carbon neutrality before the year 2060 (Luo & Zhang, 2022). The government directs very large volumes of investment and resources into strategically important sectors, which leads to rapid scaling of production and to global dominance in such industries as solar energy, battery manufacturing, and electric vehicles.

The evolution of Chinese policy is also evident. In the year 2024, authorities published an updated "Industry Guidance Catalogue for the Green and Low-Carbon Transition" (Garside & He, 2024). In contrast

to the version issued in the year 2019, the new catalogue places emphasis on a "low-carbon" transition that includes traditional, carbon-intensive industries in need of transformation, for example by adding sectors that work on carbon capture, utilization, and storage technologies and on the low-carbon transformation of coal-fired power plants (Garside & He, 2024). China is also actively developing a system of "green" finance, including experimental pilot zones and new standards for transition financing (Luo & Zhang, 2022).

The effectiveness of the Chinese model lies in its capacity to channel resources into strategically important sectors, thereby ensuring rapid scaling and dominance in global markets. This approach, unlike the European one, is oriented less toward market mechanisms and more toward the attainment of ambitious goals through active state industrial planning. Growth in the "new trio" of industries—solar panels, batteries, and electric vehicles—became a key factor that enabled China to meet its target for growth in gross domestic product in the year 2024 (Котляров, 2023).

Comparative analysis of the approaches.

The difference in approaches between the European Union and China reflects a fundamental divergence in their economic systems and strategic priorities (Wouters & Houtven, 2023). The European Union relies on directive regulation, the creation of incentives, and market formation in order to attract private investment. Its strategy rests on three pillars: the pricing of carbon emissions through the European Union Emissions Trading System, regulatory measures such as obligations for renewable energy and energy efficiency, and financial incentives.

China, by contrast, employs a state-oriented model that includes direct public investment, subsidies, and centralized industrial planning. This model enables a rapid but less market-driven transition (Федоров, 2021). Whereas the European Union seeks to democratize the green transition by mobilizing capital through a complex regulatory framework, China uses its state structure to position the green economy as a new driver of growth (Garside & He, 2024).

During the period from 2019 to 2024, both sides achieved significant progress in the shift to renewable energy sources. In the European Union, the share of renewables in electricity generation rose from thirty-four percent to forty-seven percent. Over the same period, the share of fossil fuels in the European Union's energy balance fell from thirty-nine percent to a historic low of twenty-nine percent. In the year 2024, solar generation exceeded coal-fired generation for the first time, and the share of solar energy in the European Union's electricity mix reached eleven percent (Global Carbon Project, 2024).

China, over the same period, accounted for forty percent of the global increase in renewable energy capacity. In the year 2023, the country commissioned as much solar capacity as the entire world installed in the year 2022, while the increase in wind capacity amounted to sixty-six percent compared with the previous year. By the year 2021, China had overtaken the European Union to become the world leader in installed capacity of distributed solar power plants (International Energy Agency, 2024).

MATERIALS AND METHODS

However, while the European Union is successfully pushing fossil fuels out of its energy balance, China exhibits a dual approach: it is the global leader in the installation of renewable energy but at the same time continues to bring new coal-fired power plants online (Иванов & Петров, 2024). This strategy reflects the pursuit of energy security and the maintenance of economic growth. This also explains why, despite impressive advances in renewables, China's per capita emissions have already exceeded those of the European Union (Global Carbon Project, 2024).

Table 1 presents key indicators of the energy transition in the European Union and China, illustrating different approaches: the European Union focuses on substitution, whereas China focuses on expanding capacity in both green and fossil energy sources.

During the period from 2019 to 2024, China strengthened its position as a global manufacturing power, including in the sector of "green" technologies. In the year 2024, every fourth electric vehicle sold in the European Union was produced in China, rising sharply from an almost negligible level in the year 2019; these vehicles, sold at an average price of thirty-two thousand euro, offered an attractive alternative for European consumers. China also dominates the manufacture of batteries for electric vehicles: Chinese battery producers held roughly sixty percent of the global market in the year 2023 (Федоров, 2021; Garside & He, 2024). Alongside exports of finished products, Chinese companies became the second-largest investors in the European supply chain for batteries and electric vehicles, behind only intra-European flows. Against this backdrop of rapid growth, the European Union in the year 2024 proposed provisional duties on electric vehicles imported from China (Wouters & Houtven, 2023).

Table 1. Dynamics of the energy transition (2019-2024)

Indicator	European Union	China
The share of renewable energy sources in electricity generation	Increased from 34% in 2019 to 47% in 2024.	The share of renewable energy in total generation increased to 24.2% in 2022.
The share of fossil fuels	Decreased from 39% in 2019 to 29% in 2024.	Coal still accounts for 61% of the total energy supply in 2023.
Solar energy	The share in electricity generation increased to 11% in 2024, overtaking coal for the first time.	It has overtaken the EU in terms of distributed solar power plants by 2021, and installed more solar capacity in 2023 than the entire world in 2022.
Total capacity increase	Reduction of gas demand in the electric sector by 20%.	Provided 40% of the global renewable energy growth for the period 2019-2024.

Source: *Data from Ember (2025) and the International Energy Agency (2024).*

The expansion of China's electric-vehicle and battery sector is a direct consequence of large-scale state support and industrial subsidies within China's policy framework. For the European Union, this success poses a dual challenge: not only an economic one, by exerting pressure on Europe's automotive industry, but also a strategic one, by deepening the Union's dependence on Chinese technologies in a sector that is essential for meeting its own climate objectives (Капица, 2022). European policymakers therefore face a difficult choice between sustaining the "green" transition with affordable Chinese technologies or protecting domestic industry and employment at the risk of slowing climate efforts (Wouters & Houtven, 2023).

Union and China actively developed instruments of "green" finance, but with different emphases. The European Union focused on building a reliable and transparent financial architecture. In 2020, an investment plan was launched with the aim of mobilising at least one trillion euro in sustainable investment by the year 2030, and a comprehensive regulatory framework was advanced, including the Sustainable Finance Disclosure Regulation, which helps to direct private capital toward sustainable projects. China, for its part, recorded impressive investment volumes which in the year 2023 exceeded those of any other country by more than a factor of two; China's investment in clean energy accounted for roughly one third of the global total and became an important driver of the country's growth in gross domestic product. China is also actively developing transition finance designed to assist traditional, carbon-intensive industries such as steel and electric power in their transformation (Garside & He, 2024).

Bilateral investment flows between the European Union and China during 2019–2024 reflected an intensifying competitive dynamic. The volume of Chinese foreign direct investment in the European Union reached approximately nine point four billion euro in the year 2024, alongside a notable shift in composition: Chinese capital flows into Europe were no longer dominated by mergers and acquisitions but, in most cases,

took the form of "greenfield" projects, that is, investment in new production facilities. The move toward greenfield projects in the European Union—illustrated by the battery plant of Contemporary Amperex Technology in Hungary—represents a strategic response to the European Union's protectionist measures. Rather than exporting finished goods that may be subject to trade duties, Chinese firms establish production assets directly on European Union territory. These "sticky" assets secure a long-term market presence and allow firms to navigate trade barriers. The step also carries a geopolitical dimension by embedding Chinese influence within the European production ecosystem, a development that has raised concerns among European authorities. Table 2 presents key data on bilateral investment and trade, illustrating China's growing economic weight and the strategy it pursues (Wouters & Houtven, 2023; Garside & He, 2024).

Table 2. Summary of bilateral investment and trade (EU-China, 2019-2024)

Indicator	Meaning
EU trade deficit with China (2024)	€305.8 billion
Electric vehicle exports from China to the EU (2019-2024)	The share of electric vehicles manufactured in China in the EU market has grown from "almost zero" in 2019 to 25% in 2024.
Chinese FDI in the EU (2024)	€9.4 billion; Growth of more than 50% compared to 2022 in the electric vehicle sector

Source: *Data from Wouters and Houtven (2023), Garside and He (2024), and the International Energy Agency (2024).*

The most prominent example of strengthened protectionism on the part of the European Union is the Carbon Border Adjustment Mechanism, introduced in a transitional mode in October 2023 and expected to become fully operational in 2026 . Its purpose is to prevent so-called "carbon leakage," that is, the relocation of carbon-intensive production to regions with less stringent climate standards. The mechanism imposes a charge on imports of certain carbon-intensive goods—such as steel, aluminium, cement, and fertilisers—in order to equalise carbon costs between European and non-European producers (European Commission, 2023). Beyond environmental policy, the mechanism functions in practice as a quasi-tariff that directly affects the competitiveness of Chinese exporters in highly carbon-intensive sectors; empirical studies find that it lowers export prices and volumes of affected Chinese goods and worsens China's terms of trade, signalling a fundamental shift in European Union–China relations from cooperation to strategic rivalry.

Social aspects and labour-market effects

The "green" transition has a substantial impact on labour markets in both China and the European Union. According to a 2024 review, China in 2023 accounted for approximately seven point three nine million "green" jobs, or about forty-six percent of the global total; the majority of these positions—roughly four point six million—were in the solar sector, with additional employment in wind and hydropower. In the European Union during the same period, about one point eight one million "green" jobs were recorded; moreover, from 2010 to 2022 the growth of "green" employment in the European Union significantly outpaced the growth of total employment.

Table 3. Comparison of green jobs and their structure

Indicator	European Union (2023)	China (2023)
Total number of "green" jobs	1.81 million	7.39 million (46% of global volume)
Share of total employment	3.1% (in 2022)	Data not provided, but about 46% of global volume
Main employment sectors	Renewable energy, energy efficiency, waste management.	Production of solar panels (4.6 million jobs), wind and hydropower.

Sources: *data from IRENA (2024), the European Union (2022), and Garside and He (2024).*

The employment structure of the "green" economy differs markedly between the two regions: in China most "green" jobs are created in equipment manufacturing such as solar panels and batteries, whereas in the European Union employment expands in implementation, services, and energy-efficiency activities.

This means that China exports not only finished products but also the labour embodied in "green" manufacturing, creating direct competitive pressure on segments of the European labour market. As a result, the rise of Chinese imports has weighed on labour demand in European industries such as automotive and chemicals, contributing to a decline in vacancies in affected segments. Table 3 presents a comparison of the number and structure of "green" jobs, which illustrates the differences in development models (IRENA, 2024).

In both the European Union and China, the move toward a "green" economy raises serious social questions that require comprehensive measures. The European Union recognises this challenge through the Just Transition Fund, with a budget of almost twenty billion euro, aimed at supporting vulnerable regions and retraining workers. At the same time, policies under the European Green Deal can affect vulnerable groups unevenly. Older women and persons with disabilities, for example, may face specific difficulties when energy prices rise, which calls for targeted protection and accessible support services (Капица, 2022). In China, despite stated goals to ensure a fair transition, significant job losses are expected in traditional, carbon-intensive sectors such as coal mining. This will require large-scale programmes for retraining and worker support, as well as regional development tools to absorb displaced labour (Garside & He,2024). Unlike the European Union, where the main issue is protecting ageing industrial regions, China's challenge lies in reallocating very large numbers of workers from legacy industries into new, "green" sectors. In both cases, the problem of a "just transition" is more complex than the mere allocation of funds and demands integrated social policies that can soften the effects of structural change (IRENA, 2024).

RESULTS AND DISCUSSIONS

Despite growing economic frictions, the European Union and China continue to present themselves as "two engines" of global climate governance. Their advantages are complementary: China is a world leader in renewable energy technologies, electric vehicles, and batteries, while the European Union has deep experience with green finance and market-based instruments. Within this framework, the parties have held a series of high-level dialogues on climate and environmental issues, which has helped to deepen cooperation and to advance multilateral climate governance. Yet behind the cooperative façade there is a fragile balance between mutual benefit and strategic rivalry. European documents and public statements increasingly frame China not only as a partner but also as a "systemic rival," which complicates bilateral engagement (Wouters & Houtven, 2023).

In response to China's growing economic and technological dominance, the European Union has shifted from a partnership narrative toward "de-risking." This policy aims to reduce critical dependence in supply chains and to diversify where necessary. "De-risking," together with trade barriers such as duties on Chinese electric vehicles and the Carbon Border Adjustment Mechanism, is a direct response to China's dominance in key green sectors. The approach reflects a strategic choice: to accept the risk of a slower domestic green transition—because Chinese technologies are often cheaper—in exchange for strengthening European industry and ensuring strategic security. This choice places European policymakers before a central tension: whether to pursue ambitious climate objectives at any cost, or to protect internal economic interests and employment

CONCLUSIONS

The analysis indicates that during the period from 2019 to 2024 China and the European Union adopted fundamentally different, yet equally ambitious, approaches to building a "green" economy. The

European Union bet on comprehensive regulation and market mechanisms in order to shape a new, sustainable economic paradigm. China, by contrast, leveraged its state-oriented system to secure industrial advantage and dominance in the manufacture of key "green" technologies.

Future relations between the two sides are likely to resemble a complex balance between unavoidable cooperation on climate and intensifying competition in strategic industries. The rise of protectionist instruments on the European side, such as the Carbon Border Adjustment Mechanism and duties on electric vehicles, together with China's response through strategically placed "greenfield" investments in Europe, will shape both the economic and the geopolitical landscape.

REFERENCES

1. European Commission. (2019). The European Green Deal (Communication COM/2019/640). Brussels: European Union.
2. IEA (International Energy Agency). (2024). Global EV Outlook 2024: Trends and developments in electric vehicle markets. Paris: IEA.
3. European Commission. (2023). Regulation (EU) 2023/956 establishing a Carbon Border Adjustment Mechanism (CBAM). Official Journal of the European Union.
4. Luo, C., & Zhang, Y. (2022). China's Green Industrial Policy and Global Competition: A State-Led Approach to Climate Change. Energy Policy, Vol. 162. (
5. Wouters, J., & Van Houtven, D. (2023). From Partnership to Rivalry? The Evolving EU-China Relationship in the Context of the Green Transition. Journal of European Integration, Vol. 45, Issue 5.
6. Garside, B., & He, J. (2024). China's role in the global renewable energy transition: Production power and geopolitical implications. Chatham House Research Paper.
7. Van der Ven, C. (2021). The Green Deal and the Global South: Assessing the Impact of CBAM on Developing Economies and Trade Flows. Journal of World Trade, Vol. 55, Issue 6.
8. Котляров, И. Д. (2023). Энергетический переход и новая экономическая география: роль Китая и США. Мировая экономика и международные отношения (МЭиМО), Т. 67, № 4.
9. Иванов, И. С., & Петров, А. В. (2024). Механизм трансграничного углеродного регулирования (CBAM): Вызовы для торговых партнеров ЕС. Вестник МГИМО-Университета, № 2.
10. Капица, Л. М. (2022). «Зеленая» экономика ЕС: Нормативное регулирование и потенциал конкурентного преимущества. Российский внешнеэкономический вестник, № 11.
11. Смирнов, О. А. (2023). Сравнительный анализ моделей зеленого роста: Рыночный подход ЕС против государственного планирования Китая. Проблемы теории и практики управления, № 5.
12. Федоров, В. Г. (2021). Технологическое лидерство Китая в производстве литий-ионных аккумуляторов: Угроза или возможность для мировой экономики? Экономический журнал Высшей школы экономики, Т. 25, № 3.
13. Ember. (2025). *European Electricity Review 2025*. London: Ember.
14. International Energy Agency. (2024). *China – Countries and Regions (2019–2024 update)*. Paris: International Energy Agency.
15. Global Carbon Project. (2024). *Global Carbon Budget 2024*. Exeter: Global Carbon Project.
16. IRENA. (2024). Renewable Energy and Jobs – Annual Review 2024. Abu Dhabi: International Renewable Energy Agency.