Strategic autonomy in the cleantech rush:
Europe, United States and China

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1. Abstract

Recent global geopolitical shifts are reshaping the landscape of the clean technology market during a pivotal phase of its expansion. As competition in clean technology production intensifies, the dynamics of sourcing the components needed for manufacturing are molding strategic relationships among major economic powers and are becoming decisive in determining the success of the ecological transition. Recent policies aimed at promoting the cleantech market underscore facets of **strategic autonomy**. This report delves into the concept of strategic autonomy, examining the reasons behind its emergence in the public debate and its impact on geopolitical balances. Specifically, it considers the policies adopted by the **European Union**, the **United States**, and **China**, along with the factors highlighting these powers' pursuit of autonomy in developing resilient supply chains. The report presents two key insights. Firstly, it emphasizes that **hostilities and economic competition between major powers, such as China and the United States, risk having a negative impact on climate mitigation policies**. If environmental policies draw their effectiveness from state cooperation, the need to decouple national markets to avoid over-dependency could prove detrimental to the development of these supply chains, ultimately increasing the final cost of clean technologies. Secondly, given the disparities in production capacity for major technologies among different regions, especially in comparison to China, the dominant player today, **it is unrealistic for many countries to effectively compete in every segment of production chains**. Consequently, import openness from third-party countries remains crucial for various regions to foster the cleantech industry. In this regard, **the report concludes that a European de-risking strategy, reducing the risk of dependence on third-party countries, is more desirable for cleantech supply chain resilience compared to autonomy strategies and protectionist policies**.

2. Introduction

The widescale development and global dissemination of clean technologies are playing a pivotal role in the race toward a sustainable global economy. These technologies are not only essential for decarbonizing industrial processes and everyday life but also for achieving global emissions reduction targets and mitigating climate change. Moreover, clean technologies offer significant economic opportunities. On the one hand, they are instrumental in decoupling GDP growth from CO2 emissions. On the other hand, they contribute to the growth of sustainable sectors and markets, with the potential to replace those dependent on fossil fuels, ultimately driving sustainable progress.[1] Achieving this transformation involves the development of new industrial supply chains and the subsequent reemployment of surplus workers from fossil fuel-related sectors.[2] Research conducted by the International Labour Organization underscores that investments in clean technologies hold the potential to generate employment opportunities and stimulate economic activity, leading to positive impacts on GDP.[3] The world's major economic powers are in a heated competition to secure substantial stakes in this rapidly expanding market. Access to and control over clean technologies, as well as the critical resources underpinning them, have assumed strategic importance on par with historically significant resources like oil. In this evolving global landscape, the race for industrial leadership converges with the competition for dominance in clean technologies. Striking a balance between these dual challenges has become a top priority for world leaders as they strive to ensure a sustainable and prosperous future for their nations.

[1] International Energy Agency. (2016). Decoupling of global emissions and economic growth confirmed.

[2] Luigi Aldieri, Fabio Carlucci, Andrea Cirà, Giuseppe Ioppolo, Concetto Paolo Vinci. Is green innovation an opportunity or a threat to employment? An empirical analysis of three main industrialized areas: The USA, Japan and Europe, *Journal of Cleaner Production,Volume 214*, 2019, Pages 758-766.

[3] ILO, "Renewable energy jobs hit 12.7 million globally", *ILO*, https://www.ilo.org/global.

3. Strategic autonomy, a new paradigm?

3.1 Overstretched dependence jeopardises healthy supply chains

The upheavals that have echoed across the global geopolitical landscape since the late 2010s have led major powers investing in clean technologies to give great importance to the autonomy and robustness of their production supply chains.

On one hand, the COVID-19 pandemic exposed the vulnerabilities of international supply chains [4], leading to a global trend of shortening and securing value chains.[5] Within Europe, the Russian invasion of Ukraine and its subsequent exploitation of gas reserves as a coercive instrument exposed the vulnerability of European energy security in relation to external suppliers.[6] As the European Union aspires to create new clean energy systems, the security and availability of the technologies that power them become crucial to avoid replicating the dynamics seen in the gas market.[7]

On the other hand, the hostilities and rivalries between China and the United States, exacerbated by the trade war that began in 2018[8], spilled beyond traditional domains of contention.[9] Although cooperative efforts with China are generally sought in the context of the climate crisis, the realm of cleantech appears to be an exception.[10] The drive towards energy decoupling from Chinese industries, championed by Democrats in the United States, along with the Republicans' call to slow down the ecological transition for fear of increasing interdependence with China[11], underscores the considerable impact of geopolitical competition on climate mitigation policies.

[4] Miroudot, S. (2020). Reshaping the policy debate on the implications of COVID-19 for global supply chains. *Journal of International Business Policy*, *3*, 430-442.

[5] Jennifer Lee, "Beauty and the beast: Implications of the US-China tech war on climate and energy", *EnergySource*, https://www.atlanticcouncil.org

[6] Goldthau, A. (2008). Rhetoric versus reality: Russian threats to European energy supply. *Energy Policy*, *36*(2), 686-692.

[7] European Union: European Commission, *Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on establishing a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem (Net Zero Industry Act)*, 16 march 2023, COM(2023) 161 final

[8] Zeng, K., Wells, R., Gu, J., & Wilkins, A. (2022). Bilateral Tensions, the Trade War, and US–China Trade Relations. *Business and Politics, 24*(4), 399-429. doi:10.1017/bap.2022.8

[9] Jisi, W., & Ran, H. (2019). From cooperative partnership to strategic competition: a review of China–US relations 2009–2019. *China International Strategy Review*, *1*, 1-10.

[10] Jennifer Lee, "Beauty and the beast: Implications of the US-China tech war on climate and energy", *EnergySource*, https://www.atlanticcouncil.org

[11] Maxine Joselow, "This Republican wants to outcompete China on climate change", *The Washington Post*, https://www.washingtonpost.com/politics/2022/10/17/this-republican-wants-outcompete-china-climate-change/

With an anticipated tripling of the global market for zero-impact technology production by 2030, amounting to a staggering €600 billion annually, the competition among nations to seize dominance in this arena is expected to increase in the near future.[12] In this context, there are five major players: China, the United States, the European Union, followed by Japan and India. The manufacturing operations of clean technologies are, indeed, geographically concentrated. For the five pivotal clean technologies - batteries, photovoltaics, wind power, electrolyzers, and heat pumps - it is estimated that these countries collectively account for 80-90% of global manufacturing capacity. A significant gap exists with China, which holds a global capacity ranging from no less than 40% to as much as 80% across the spectrum of these five technologies.[13].

Over the past two years, significant policies have been enacted to bolster the development of the clean technology manufacturing sector, aiming to enhance competitiveness and accelerate the decarbonization process. China has integrated cleantech policies into its **2021-2025 Five-Year Plan**, while the United States enacted the **Inflation Reduction Act (IRA)** during the summer of 2022. The European Commission, for its part, published the **Green Deal Industrial Plan**, comprising the **Net Zero Industry Act (NZIA)** and the Critical Raw Materials Act (CRMA), in early 2023. The impact of these policies will inevitably reshape the partly established equilibrium of competitive advantage among nations, the varying degrees of specialization in distinct technologies, and the resulting trade dynamics.

3.2 Seeking a strategic autonomy

In a geopolitical landscape characterized by intense competition for clean technologies, ensuring supply chains that are as independent as possible from hazardous partners is considered a priority. Among the policies adopted by China, the United States, and the European Union to cultivate these supply chains, a common thread can be identified: strategic autonomy. Within the realm of clean technologies, this concept relates to a nation's ability to act with maximal self-sufficiency, developing production chains that rely on its own resources in strategic domains and collaborating with external partners only when needed.[14,15]

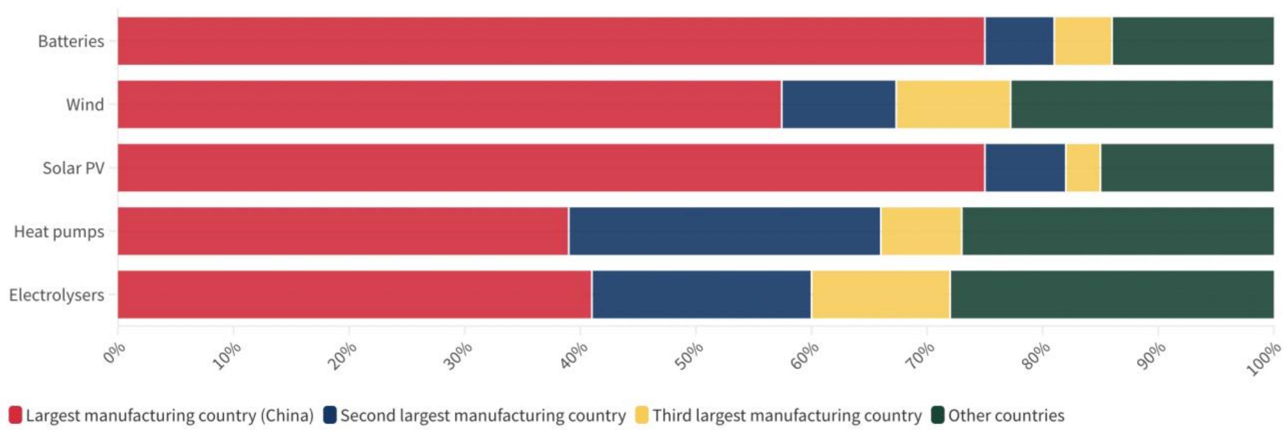
The ongoing debate surrounding strategic autonomy in Europe rests upon a fundamental assumption: when companies base their investment decisions and supply chains solely on their economic interests, they risk creating trade models that excessively depend on unreliable partners.[16] Pursuing strategic autonomy thus implies reconsidering the trade-off between economic efficiency and geopolitical resilience. For instance, within the sphere of clean technologies and their components, China detains a considerable competitive advantage—a consequence of over two decades of policies that prioritized the development of a highly integrated internal production chain. Rational economics would urge European

[12] Energy Technology Perspectives (2023), International Energy Agency.
[13] Ibid., 4
[14] Van den Abeele, E. (2021). Towards a new paradigm in open strategic autonomy?. *ETUI Research Paper-Working Paper*.
[15] Mario, D. (2022). EU strategic autonomy 2013-2023: From concept to capacity.
[16] Simone Tagliapietra, "Economic efficiency versus geopolitical resilience: strategic autonomy's difficult balancing act", *Bruegel*, https://www.bruegel.org/first-glance

companies to continue importing from China at lower prices.[17] However, this would entail cultivating a dangerous dependence on a few actors who may not align politically, thereby granting them coercive power and eroding the geopolitical resilience of the European supply chain. The path toward strategic autonomy for both the EU and the United States thus consists of diversifying suppliers through policies of reshoring or "friend-shoring," reinforcing trade relations with countries that are considered aligned with Western values.[18]

Within the realm of clean technology manufacturing, the rationale for pursuing strategic autonomy in Europe is particularly compelling due to the high market concentration and the significant disparity in terms of competitive advantage between China and other actors. As illustrated in Figure 1, considering the concentration of manufacturing across the five identified technologies, China assumed a leading position in production across all domains. A similar dominance of China is mirrored in the upstream segments of the supply chain, such as the refinement of critical minerals and the production of bulk materials employed in manufacturing processes.[19]

Figure 1 - Geographic concentration of cleantech manufacturing
2021, percentage



Source: IEA, Geographic concentration by supply chain segment, 2021, IEA, Paris

[17] International Energy Agency, *Global EV Outlook 2023* (Parigi: IEA Publications, 2023).
[18] Ivi.
[19] IEA, Geographic concentration by supply chain segment, 2021, IEA, Paris, https://www.iea.org

4. Policies adopted in the international context

4.1 The EU Green Deal Industrial Plan

In fostering a resilient green technology industry and upholding its role as a trendsetter in facing the climate crisis, the European Union grapples with the strategic interests of global major powers, geopolitical equilibrium, and commercial dynamics. Consequently, strategic supply considerations have added up to the economic opportunities presented by the development of the cleantech sector within a broader context of industrial competitiveness, laying the groundwork for the Green Deal Industrial Plan (GDIP). This Plan includes a series of initiatives spanning the entire industrial value chain: the Critical Raw Materials Act, the Net Zero Industry Act, and the Electricity Market Design.[20] In support of these dossiers, the Commission has recently proposed the Strategic Technologies for Europe Platform (STEP) to redirect investments into key programs across various areas of investment.[21] The GDIP is based on four pillars: (i) streamlining authorization processes, (ii) accelerating access to financing, (iii) developing the necessary skills for the transition, and (iv) reinforcing trade ties with like-minded partners to establish more resilient supply chains.

Europe currently stands as a net importer of net-zero technologies, with a quarter of batteries imported from non-member countries, primarily China.[22] Dependency varies depending on the technology, with certain markets such as solar PV, where silicon wafer imports exceed 90%.[23] In this context, the Net Zero Industry Act (NZIA), proposed by the Commission on March 16, establishes objectives and a regulatory framework to develop the clean technology industry within the European Union. It aims to influence the factors that determine investments in cleantech sectors, for instance by reducing the bureaucratic burden required for project approvals and supporting innovation and research in the sector through regulatory sandboxes for experimenting new projects.[24]

For what concerns the specific technologies, the EU aims to[25]:

- **For solar energy**, attain a minimum operational capacity of 30 GW for photovoltaic module production by 2030, across the entire photovoltaic value chain.

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[20] European Union: European Commission, *COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A Green Deal Industrial Plan for the Net-Zero Age*, 1.2.2023, COM(2023) 62 final

[21] European Commission, Press release, *EU budget: Commission proposes Strategic Technologies for Europe Platform (STEP) to support European leadership on critical technologies,* Brussels, 20 June 2023

[22] European Union: European Commission, *Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on establishing a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem (Net Zero Industry Act)*, 16 march 2023, COM(2023) 161 final

[23] Energy Technology Perspectives (2023), International Energy Agency.

[24] European Union: European Commission, *Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on establishing a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem (Net Zero Industry Act)*, 16 march 2023, COM(2023) 161 final

[25] Ibid.

- **For wind technology and heat pumps**, expand their current market shares over the course of this decade (with a projection of 85% and 60% production share, respectively, for wind technologies and heat pumps by 2030).

- **For battery production**, meet the objectives of the European Battery Alliance, aiming to satisfy nearly 90% of the EU's annual battery demand through EU battery manufacturers.

- **For European electrolyzer manufacturers**, produce 10 million tons of renewable hydrogen (RFNBO), with a 100% production share in covering the EU's electrolysis needs, as envisioned in the REPowerEU plan.

The Net Zero Industry Act (NZIA) has been perceived by some observers as a defective policy leaning towards protectionism, formulated as a crude response to the US Inflation Reduction Act.[26] It has indeed been observed that the European market protectionist approach runs the risk of impeding the decarbonization process in the EU.[27] Regarding the financing required to achieve the established NZIA targets, the Commission has estimated the need for approximately €17 billion in public investments by 2030.[28] When combining the already active and relevant funding for NZIA sectors (up to €8 billion) with those introduced by the Strategic Technologies for Europe Platform (approximately €10 billion), there does not appear to be a significant investment gap. However, these figures are subject to high uncertainty, for at least two reasons. Firstly, STEP funds are also available to support the digital transition and biotech-related sectors, potentially diverting resources away from cleantech. Secondly, these investments do not exist in isolation and should serve as catalysts for much larger private investments. Their success largely depends on the extent to which this dynamic materializes.

4.2 US Inflation Reduction Act

The Inflation Reduction Act, passed by the United States Congress in August 2022, encompasses a set of policies aimed at increasing tax revenues and directing new public spending toward emissions reduction and healthcare cost reduction.[29] Despite the introduction of federal funding equivalent to approximately $500 billion, the legislation aims to achieve a budget surplus of around $240 billion, thanks to new revenues, including an increased corporate minimum tax.[30]

Approximately 80% of the expenditures introduced by the IRA are directed towards the energy and climate sectors, with a particular focus on renewable energy generation, transportation, electric grids, and building energy efficiency.[31] These supports will primarily be disbursed in the form of tax incentives (approximately $250 billion projected), grants

[26] Grégory Claeys, The Net-Zero Industry Act puts EU credibility at risk, *Bruegel*, https://www.bruegel.org/first-glance/net-zero-industry-act-puts-eu-credibility-risk
[27] Niclas Poitiers et al., The EU Net Zero Industry Act and the risk of reviving past failures, *Bruegel*, https://www.bruegel.org/first-glance/eu-net-zero-industry-act-and-risk-reviving-past-failures
[28] EC SWD, "Investment needs assessment and funding availabilities to strengthen EU's Net-Zero technology manufacturing capacity" https://single-market-economy.ec.europa.eu
[29] H.R. 5376 - Inflation Reduction Act of 2022, Congress.gov.
[30] Estimated budgetary effects of Public Law 117–169, to provide for reconciliation pursuant to Title II of S. Con. Res. 14," Congressional Budget Office, September 7, 2022.7
[31] Inflation Reduction Act of 2022

(approximately $80 billion projected), and loan guarantees (approximately $40 billion projected).[32] When considering these figures, it is important to keep two aspects in mind. First, disbursements are conditioned on the achievement of specific criteria. For the sake of strategic autonomy, these criteria include minimum levels of U.S. manufacturing production and/or a minimum percentage of critical minerals extracted or processed within the Federation or in states with free trade agreements. This implies that the actual average benefits will be lower than the maximum announced, given the likely non-satisfaction of all clauses. For example, if the maximum hydrogen production subsidies amount to $3/kg produced, they decrease to $0.006/kg as the minimum threshold for eligible production.[33]

Second, nearly all incentives, grants, and loan guarantees are virtually unlimited, meaning they are disbursed without total spending caps or production volumes. This feature, while sending a positive investment signal, complicates the estimation of the macroeconomic impact of such a policy. Some forecast total costs three times higher than official estimates, anticipating a significant increase in cleantech manufacturing activity due to the reduction in net production costs compared to global competition levels.[34]

This possibility seriously jeopardises the fiscal neutrality of the measure, potentially exerting inflationary pressures, in paradox with the objective that gives the Act its name. The generous incentives introduced have rapidly spurred increased investments. In the battery sector, the International Energy Agency has tracked over $50 billion in announced projects between August 2022 and March 2023 and an 85% increase in installed capacity in 2022 compared to 2021.[35]

At an aggregate level, it is projected that the IRA could lead to a reduction in U.S. emissions of up to 40% by 2030 compared to 2005.[36] While the Act, when compared to a scenario without incentives, improves the decarbonization trajectory by approximately 10%, it would not be sufficient to achieve the -50% by 2030 (vs. 2005) target stated in the U.S. Nationally Determined Contribution (NDC) for reaching climate neutrality by 2050.[37] Furthermore, in a global context of central bank balance sheet expansion, and in the absence of a carbon price at levels that ensure the polluter pays principle (a concept explored in a previous report) in the United States, the IRA brings with it various criticalities that should not be underestimated.[38]

4.3 China's Five Years Plan

Unlike its European and American counterparts, the 2021-2025 Chinese Five-Year Plan (5YP) has directed industrial policies towards the cleantech sectors that have been in existence and

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[32] *Ibid*.
[33] Kleimann, D., *et al*. (2023) 'How Europe should answer the US Inflation Reduction Act', Policy Contribution 04/2023, Bruegel.
[34] Credit Suisse (2023) "US Inflation Reduction Act – A tipping point in climate action".
[35] IEA, State of Clean Technology Manufacturing (2023).
[36] John Bistline et al. ,Emissions and energy impacts of the Inflation Reduction Act.Science380,1324-1327(2023).
[37] Bistline, John, Neil Mehrotra, and Catherine Wolfram. *Economic Implications of the Climate Provisions of the Inflation Reduction Act*. No. w31267. National Bureau of Economic Research, 2023.
[38] Bistline, John, Neil Mehrotra, and Catherine Wolfram. *Economic Implications of the Climate Provisions of the Inflation Reduction Act*. No. w31267. National Bureau of Economic Research, 2023.

successfully applied for nearly two decades.[39] The technologies in which the country boasts significant competitive advantages, stemming from first-mover dynamics, include crystalline silicon solar, onshore wind, and lithium-ion batteries. The public policies that have fueled the growth of the manufacturing of these technologies include targets, standards, financial incentives, access to financing, contracts, and investments in research and development.[40]

Within the distinctive context of "Chinese socialism with Chinese characteristics," these methods have contributed to the creation of a strategic innovation ecosystem, benefitting both the country's trade balance and its domestic decarbonization objectives. The Plan has indeed substantiated the official declarations of the NDCs announced at the end of 2021. In the updated NDC goals, China aims to[41]:

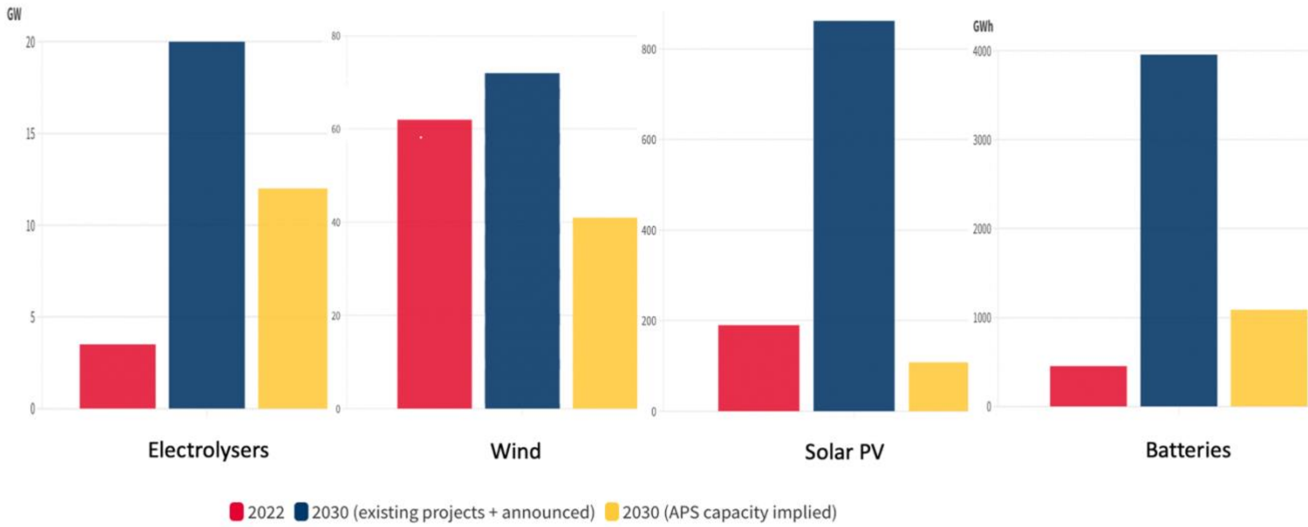
- Reach peak CO2 emissions before 2030.
- Achieve carbon neutrality before 2060.
- Reduce CO2 emissions per unit of GDP by over 65% compared to 2005 levels.
- Increase the share of non-fossil fuels in the primary energy mix to about 25%.
- Increase the volume of forest stock by 6 billion cubic meters from 2005 levels.
- Bring the total installed capacity of wind and solar to over 1.2 terawatts by 2030.

The role of manufacturing and the adoption of cleantech technologies is therefore evident in decarbonization plans, as explicitly stated in the last goal. Particularly for the last two mentioned technologies, the Global Energy Monitor reports that if the announced projects are successfully realized, the country will double its installed capacity of photovoltaic solar and wind by 2025, exceeding 1.5 terawatts - 25% more than the NDC target, five years ahead.[42]

As shown in Figure 2, China is poised for a significant surplus in production capacity compared to the volumes needed to meet the "Announced Pledges" (APS) scenario formulated by the IEA. This holds true for all strategic green technologies, except for heat pumps, which are not shown in the figure. As evidenced by the figure, more than two-thirds of production (on average) for these technologies exceeds domestic installation needs in the APS scenario.[43] This data, coupled with the aforementioned projections of installations surpassing targets, might suggest that the country has introduced a strategy aimed at increasing domestic ambition - and thus investing its own cleantech surplus in the domestic market - instead of relying on exports. However, these two options are not mutually exclusive, as a gap can be identified between projected installed capacity and production. Closing off Chinese cleantech manufacturing to exports would thus make little economic sense, especially in light of the already allocated and challenging-to-recover investments.

[39] Gallagher, Kelly Sims. The globalization of clean energy technology: Lessons from China. MIT press, 2014.
[40] Finamore, Barbara A. "Clean tech innovation in China and its impact on the geopolitics of the energy transition." OIES Forum. Vol. 126. 2021.
[41] https://cop23.unfccc.int/documents/497392
[42] Global Energy Monitor, "China poised to double wind and solar capacity five years ahead of 2030 target", *Global Energy Monitor*, https://globalenergymonitor.org/press-release
[43] IEA, State of Clean Technology Manufacturing (2023).

Figure 2 - Cleantech capacity projected vs APS scenario, China



Source: IEA (2023), State of Clean Manufacturing

5. The benefits of an international strategy

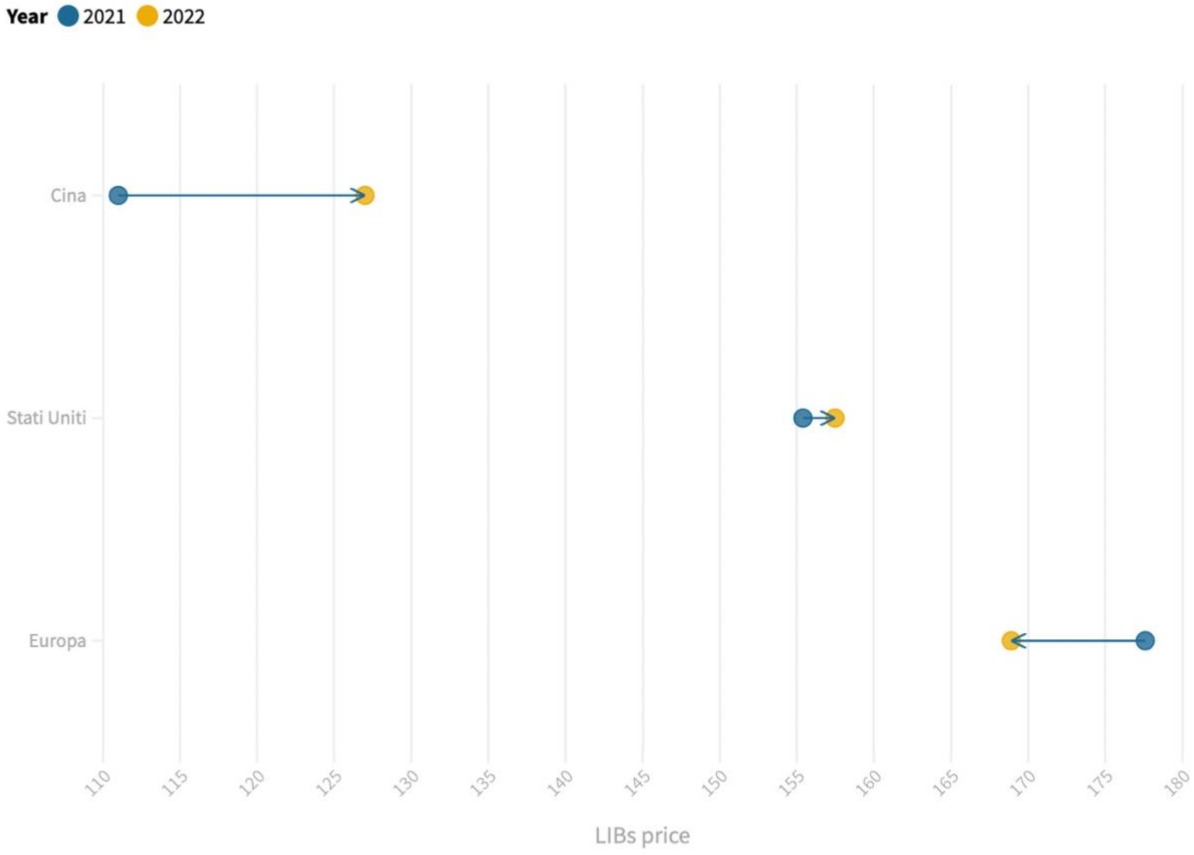
Given the current market concentration and the efficiency advantages that China has developed in recent years, achieving strategic autonomy in Europe is not immediate and comes with costs. As observed, China's competitive advantage results in significantly higher production costs when sourcing raw materials elsewhere or manufacturing in Europe.

The market for batteries offers a clear example of this issue. As shown in Figure 3, even with an average 7% increase in battery costs between 2021 and 2022, of which China was particularly affected, in 2022 battery prices were 24% higher in the United States and 33% higher in Europe compared to their Chinese counterparts.[44][45]
Higher prices in Europe and the United States reflect the relative immaturity of these markets and the more challenging access to cost-effective raw materials, resulting in higher production costs.

[44] BloombergNEF, "Lithium-ion Battery Pack Prices Rise for First Time to an Average of $151/kWh", *BloombergNEF*, https://about.bnef.com/blog/lithium-ion-battery-pack-prices-rise-for-first-time-to-an-average-of-151-kwh/

[45] BloombergNEF, "Battery Pack Prices Fall to an Average of $132/kWh, But Rising Commodity Prices Start to Bite", *BloombergNEF*, https://about.bnef.com/blog/battery-pack-prices-fall-to-an-average-of-132-kwh-but-rising-commodity-prices-start-to-bite/

Figure 3 - Lithium-ion battery price by geography
2021-2022, $/kWh



Source: BNEF, Annual Battery Price Survey 2021-2022

It is plausible the substantial subsidies for U.S. manufacturing introduced by the IRA will force a reconfiguration of global supply chains in the coming years, redirecting resources toward the American market. In the short term, this poses a risk of slowing down the expansion of clean technology manufacturing outside the United States, as the large investments are expected to significantly reduce production costs for American companies, potentially harming Europe's competitiveness.[46] However, in the long term, it is anticipated that the cost reductions in clean technologies driven by the IRA will foster the ecological transition globally, offsetting the competitiveness losses abroad. While the exact impact of these two effects is yet to be determined, this perspective adds complexity to European policies aimed at ensuring both the competitiveness and resilience of the clean technology market.

For these reasons, a reevaluation of the concept of strategic autonomy in a more moderate form is gaining ground in the European debate on cleantech industrial policy. While considering the need to diversify suppliers for components required in the clean technology industry, taking advantage of international trade remains vital for the rapid and cost-effective

[46] Kleimann, D., Poitiers, N., Sapir, A., Tagliapietra, S., Véron, N., Veugelers, R., & Zettelmeyer, J. (2023). *How Europe should answer the US Inflation Reduction Act*. Bruegel.

dissemination of clean energy.[47] For many countries, effectively competing in every segment of production chains is not realistic, and therefore maintaining openness to imports from third countries is crucial to enable industry development.[48] In the quest to secure supply chains, the benefits of specialization in technologies where a comparative advantage is held over other players must not be overlooked. Such specializations often stem from intrinsic geographical advantages, such as low-cost access to renewable energy or critical minerals essential for clean technologies, leading to lower production costs. However, today, they also result from past investment policies that allowed for the asymmetric development and geographical concentration of value chains.

The adoption of an international strategy in the clean tech manufacturing sector thus offers several cost-related benefits. Value chain optimization through the division of labor among countries based on comparative advantages contributes to greater efficiency and overall cost reduction. Furthermore, international collaboration allows for resource sharing and a reduction in research and development costs.[49]

Signals pointing towards a more moderate pursuit of strategic autonomy are also found in the recent debate on de-risking strategies, as opposed to decoupling strategies. While the latter would entail a disruption of trade flows between the European Union and unlike-minded countries like China, a risk reduction approach builds on measures aimed at reducing exposure to risks arising from trade relations with China, without abandoning completely those ties.[50]. The de-risking strategy, initially proposed by European Commission President von der Leyen, involves the adoption of measures to diversify sources of supply and reduce dependence on individual Chinese suppliers to avoid potential supply chain disruptions and security risks. Following the G7 summit held in Hiroshima, the United States, the European Union, and Japan have emphasized de-risking policies rather than complete decoupling of trade with Beijing[51]. However, this strategy is complex due to the fact that the countries involved are both collaborators and rivals in the economic arena. Therefore, G7 countries will need to strike a balance between the need to mitigate risks without compromising the advantages derived from economic relations with China.

If de-risking involves diversifying suppliers to minimize risks associated with trade flows with strategically risky political actors, one possible strategy involves creating trade agreements and global alliances with like-minded partners in terms of political structure and strategic interests. Recently, the European Union, the United States, and Japan have expressed their common interest in finding friendly countries with which to collaborate in safeguarding critical sectors, such as clean technologies and their components.[52] Regarding critical minerals required for technologies, for example, the European Union's intention is to create a kind of

[47] IEA (2023), Energy Technology Perspectives 2023, IEA, Paris https://www.iea.org/reports/energy-technology-perspectives-2023, License: CC BY 4.0

[48] Ivi.

[49] Mathews, J. A. (2017). Global trade and promotion of cleantech industry: a post-Paris agenda. *Climate policy*, *17*(1), 102-110.

[50] The Economist, "What does "de-risking" trade with China mean?", *The Economist*, https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_856515/lang--en/index.htm

[51] Ivi.

[52] Takeo Kumagai, Meghan Gordon, "Japan, US in pact for critical minerals supply chain; Tokyo expects EV tax benefits", *S&P Global*, https://www.spglobal.com/commodityinsights

global alliance, a critical minerals club among like-minded countries, to strengthen supply chains while respecting trade rules.[53]

[53] Cecilia Malmstrõm, "Will the scramble for rare earths produce a transatlantic trade accord?", *Peterson Institute for International Economics*, https://www.piie.com/blogs/realtime-economics/will-scramble-rare-earths-produce-transatlantic-trade-accord

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