Geoeconomics of the European Green Deal

by Pier Paolo Raimondi, Margherita Bianchi, Nicolò Sartori, Maria Lelli

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1. The energy transition in a contested geoeconomic landscape

The global race to net-zero is set to reshape global energy supply chains. The deployment of clean energy technologies changes manufacturing, trade and dependency patterns.[1] Such evolution is developing in a context of growing geoeconomics tension[2] (enhanced by the Covid-19 pandemic and the war in Ukraine). Under mounting geoeconomic confrontation countries are reconsidering their industrial strategies to seize opportunities and manage risks.[3]

Globalised supply chains, which now lie to the core of such reconsideration, have provided significant benefits for the growth of renewables around the world. Among them, the remarkable reduction of renewable costs stands out, making a market case for growing renewable shares and allowing their deployment at larger scale. At the heart of globalised supply chains, there have been the knowledge and technological transfer from Western countries to China, which became the powerhouse and the production hub at least costs, making possible a remarkable drop in renewable energy costs, notably solar photovoltaic (PV).

1 Luca Franza, Margherita Bianchi and Luca Bergamaschi, "Geopolitics and Italian Foreign Policy in the Age of Renewable Energy", in *IAI Papers*, No. 20|13 (June 2020), https://www.iai.it/en/node/11696.
2 According to Edward Luttwak's seminal article, geoeconomics describes the main arena for rivalry amongst states after the Cold War: economy rather than military.
3 International Energy Agency (IEA), *Energy Technology Perspectives 2023*, January 2023, https://www.iea.org/reports/energy-technology-perspectives-2023.

Given a combination of geopolitical confrontation, supply chains disruptions and spiralling of energy commodity prices (exacerbated by the Covid-19 pandemic and then the war in Ukraine), governments have called such global architecture into question, putting new emphasis of economic resilience and strategic autonomy and marking the reconsideration of the globalised and interconnected world as it has been for more than 40 years. In this context, debates and strategies over *reshoring* (or at least *nearshoring* and *friendshoring*) some industrial capabilities have been emerging not only in the Western countries, but also in China, in light of rising political disagreements and confrontation between the two sides. These political concerns and preferences are expected to redraw global supply chains as they will bring supply chains and production activities closer at home and or at least in more friendly countries.[4] While reshoring part of manufacturing capacities could entail some benefits politically (non-dependence) and socially (job creation), such build-up of alternative supply chains might take time and mean higher costs for stakeholders (governments, companies and households). Therefore, it is pivotal to reduce vulnerability (through reshoring) while minimising potential negative impacts on costs.

Countries will need to find the right balance between the need to accelerate decarbonisation and enhance domestic technological and industrial competitiveness, in a way that reduces strategic vulnerabilities while fostering socioeconomic growth. Governments will have to live up to such serious trade-off and avoid weakening of international cooperation on climate policies, technology development and trade, which remain critical ingredients for the energy transition globally.

Given the relevance of supply chains and the great power rivalry increasingly witnessed today, clean energy supply chains are increasingly framed in security terms. Greater scrutiny is driven by a combination of growing contestation of foreign dependence and China's dominance in these supply chains. China's dominant role highlights one of the main geopolitical and geoeconomics risks

4 Atlantic Council,"Transcript: US Treasury Secretary Janet Yellen on the Next Steps for Russia Sanctions and 'Friend-Shoring' Supply Chains", in *New Atlanticist*, 13 April 2022, https://www.atlanticcouncil.org/?p=512112; Clea Caulcutt, "France's Le Maire Announces Package to Boost Reshoring of Green Industries", in *PoliticoEU*, 4 January 2023, https://www.politico.eu/?p=2475960.

of the transition that governments need to address: the level of geographical concentration in global supply chains. This yields obvious security concerns about overdependence and disruptions. Nonetheless, supply disruptions in clean energy technologies will not undermine the functioning of existing energy systems – unlike fossil fuels. They will affect essentially the roll-out and availability of new capacity additions. The main threats from these supply chain disruptions are therefore delayed and more expensive energy transitions,[5] which is something that we cannot afford in any way. Furthermore, while fossil fuels are given and cannot be developed elsewhere, potentially all countries can develop clean technologies thanks to targeted industrial policies, investments in technological innovation, and quality education. According to the International Energy Agency (IEA), solar PV's installed power capacity is poised to surpass that of coal by 2027, becoming the largest power generation technology in the world by installed capacity.[6] The result of the shift in global solar PV manufacturing capacity from Europe, Japan and the US to China highlights the geopolitical dimension of the energy transition. Today, Beijing dominates in all the manufacturing stages of solar panels[7] (with a share that exceeds 80 per cent) alongside with hosting the world's 10 top suppliers of solar PV manufacturing equipment.[8] China has been able to gain such dominant role thanks to its industrial policies, strong state aid and growing domestic demand which have enabled economies of scale and continuous cost reduction (drive also by low utility and labour costs). Indeed, China has substantially contributed to the remarkable cost decline (more than 80 per cent) of solar PV over the past decade as well. China dominates also the battery supply chain, producing three-quarters of all lithium-ion batteries and being home to 70 per cent of production capacity for cathodes and 85 per cent for anodes.[9] The country holds also a favourable position in the processing and refining capacity of raw materials needed for li-ion batteries (being responsible for over half of these segments for lithium, cobalt and graphite). Conversely, Western economies

5 IEA, *Securing Clean Energy Technology Supply Chains*, July 2022, https://www.iea.org/reports/securing-clean-energy-technology-supply-chains.

6 IEA, *Renewables 2022. Analysis and Forecast to 2027*, December 2022 (revised version January 2023), https://www.iea.org/reports/renewables-2022.

7 Such as polysilicon, ingots, wafers, cells and modules.

8 IEA, *Global Solar PV Supply Chains*, July 2022 (revised version August 2022), https://www.iea.org/reports/solar-pv-global-supply-chains.

9 IEA, *Global Supply Chains of EV Batteries*, July 2022, https://www.iea.org/reports/global-supply-chains-of-ev-batteries.

play a more limited role. Over one-quarter of global electric vehicles (EV) assembly comes from Europe, while the US is responsible for only 10 per cent of EV production and holds 7 per cent of battery production capacity. Other Asian economies (Japan and Korea) play a greater role in the downstream sections of raw material value chains – especially in the production of cathode and anode material. However, it is noteworthy that the EU ranks second in the world for refining cobalt and nickel. Concerning to other clean technologies, the EU is still the leading player in the wind industry, such as turbines manufacturing.

As the world seeks to electrify the energy system, powered by clean energy sources,[10] the role of storage and batteries increases. Lithium-ion battery storage has expanded its relevance and magnitude since 1990s with the development of digital appliances. Particularly in the past decade, the rise of electric vehicles demand has brought to an entire new level the importance of batteries. At the same time, costs have fallen for a decade contributing to the expansion of EVs. The downward trend of battery prices has been reverted only in 2021/22, alike all the other commodities, when the price rose by 7 per cent. This increase has a direct impact to the final price of EVs as raw materials are a key factor in the cost structure of many clean energy technologies, including the lithium-ion batteries, especially after technology learning and economies of scale. Raw material costs account for some 50–70 per cent of total battery costs, up from 40–50 per cent five years ago.[11]

Natural resources will remain a key component in the global supply chains as countries seek shift from fuel-intensive to mineral-intensive energy systems. Critical raw materials (CRMs) are expected to become even more important politically and strategically. Security and strategic concerns erupted in 2010 regarding China's dominant role in the rare earth elements (REEs). Indeed, Beijing dominates the global market and the global supply chains, producing some 60 per cent of the worlds' REEs and processing and refining around 80 per cent. Given such centrality, other countries are over-dependent on Chinese imports. Concerns first emerged in 2010 when, for political reasons, Beijing

10 Luca Franza, Margherita Bianchi and Luca Bergamaschi, "Geopolitics and Italian Foreign Policy in the Age of Renewable Energy", in *IAI Papers*, No. 20|13 (June 2020), https://www.iai.it/en/node/11696.
11 IEA, *The Role of Critical Minerals in Clean Energy Transitions*, May 2021 (revised version March 2022), https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions.

halted exports to Japan leveraging its almost monopolist role (some 97 per cent of the REE supplies came from China). Some of REEs are important inputs for some of green technologies, such wind turbines (especially for offshore) or EVs. Security concerns have further increased as US–China rivalry emerged during Trump's Administration and China's threats to reduce or block REE exports to the US. These concerns – also exacerbated by REEs' importance for the digital and defence industry – have induced importing countries to explore new sources of production outside China, such as in Africa, South East Asia, Australia, the Arctic and especially in the US.

Following the 2010 export ban, governments have begun considering strategic vulnerabilities related not only to their dependence on Chinese REEs but also to other CRMs. Among them, lithium stands out in terms of relevance and similar challenges, albeit industry has been more pro-active. Three countries, known as the "Lithium Triangle", stand out among resource-rich countries: Argentina, Bolivia and Chile. Australia and China come below the three South American countries. However, given the remarkable growth in EV and forecasted demand growth, lithium demand outstripped supply in 2022, leading to the aforementioned increase in prices of this mineral (around +500 per cent in a year) and potentially hindering energy and industrial transition.[12] Another critical mineral for the green technologies is cobalt, whose production is highly concentrated in the Democratic Republic of Congo (DRC). Despite it does not hold major cobalt reserves, China has achieved a pivotal position in the upstream sector thanks to its state-owned companies' mining rights in many cobalt mines in the DRC. The high geographical concentration spurs not only diversification efforts but also technological developments (e.g. recycling, substitutions) in order to reduce and replace CRMs demand. In the case of cobalt, cobalt-free batteries (such as LFPs) are steadily emerging in the market.

Security issues related to CRMs are not only related to the mining activities but also to refining and processing segments. China has built extensive capacity in these segments thanks to its competitive advantages and state support, so that no countries can decouple entirely in the short term. In this sense, diversification efforts cannot be limited only to the mining sector but should be

12 Annie Lee, "The Trouble with Lithium", in *Bloomberg*, 25 May 2022, https://www.bloomberg.com/news/features/2022-05-25/lithium-the-hunt-for-the-wonder-metal-fueling-evs.

also extended to other segments of the value chains. However, diversification efforts are particularly challenging due to market barriers, capital-intensity of new greenfield investments, long lead time for new projects[13] as well as societal and environmental challenges. Nonetheless, growing (geo)political considerations may prompt required support to new investments not only motivated by market considerations. Hydrocarbons' recent price volatility is instructive with respect to all commodities, including CRMs. Governments will need to provide secure and stable frameworks for investments along the entire value chain of critical minerals (and green technologies as well) to prevent massive price volatility and supply shortages in light of growing mineral demand. At the same time, many security concerns related to CRMs are often exaggerated as policy and technological developments will affect future demand.[14]

In conclusion, China has managed to gain a pivotal position in the geoeconomics of clean energy technologies and supply chains thanks to its long-lasting industrial policies, subsidies, state-owned companies, and cheap labour. Furthermore, China is also relevant in several segments of supply chains from extraction, refining and processing of critical raw materials, the irreplaceable inputs for the clean energy technologies.

These figures help explaining why governments started addressing strategic vulnerabilities and overdependence in the clean energy area. Notably, the US has managed to reach a major legislative breakthrough in August 2022 with the approval of the US' Inflation Reduction Act (IRA). Besides several non-energy-related provisions, the IRA seeks to boost decarbonisation and to support clean energy technologies. By overcoming bipartisan deadlock, the Act is the most ambitious climate bill ever to be passed in the US. Simultaneously, the IRA seeks to revamp domestic manufacturing base and create new clean-energy jobs amid US-China competition. It envisages nearly 370 billion US dollars' worth of clean energy and climate incentives[15] in order to reconcile decarbonisation

13 In average, launching a mining project takes 10-15 years.

14 Dolf Gielen and Carlo Papa, *Materials for the Energy Transition*, Abu Dhabi and Rome, International Renewable Energy Agency and ENEL, November 2021, https://www.enelfoundation.org/all-news/news/2021/11/materials-for-the-energy-transition.

15 White House, *Building a Clean Energy Economy: A Guidebook to the Inflation Reduction Act's Investments in Clean Energy and Climate Action*, January 2023, https://www.whitehouse.gov/wp-

domestic economic/industrial interests and energy security. A key incentive is the tax credit for EV (7,500 US dollars for passenger vehicles), half of which is available if EV battery components are manufactured or assembled in North America and the rest if battery minerals are extracted, processed, or recycled in the US or from a country with a free trade agreement with the US.[16] Given these developments, the first new US cobalt mine, located in Idaho, has been opened in 2022 after decades.[17] Through massive investment and tax breaks, clean energy technologies are overcoming traditional scepticism also in the conservative states.[18] According to some analysis, red states are expected to get the highest IRA investment per capita between now and 2030.[19]

The US thus seeks to reaffirm its political and economic leadership and avoid into strategic dependences in light of the growing political rivalry with China. While the IRA represents a positive gamechanger for the decarbonisation in the US, its approval raised criticism in the European Union, as it is perceived as a protectionist mobilisation of the US industrial policy challenging not only rivals such as China, but also partners and allies, such as Europe and others.

These attempts to redraw the map of manufacturing hubs give rise to significant trade tensions, which is particularly concerning for the EU. While the US and China have clearly enhanced their competition, a question is whether and how the EU and the US can cooperate on the industrial and strategic dimension of the green transition and how the EU could still cooperate with China on technologies and green investments. Concerns about these dynamics are also appearing in China, as it fears to be increasingly isolated and to potentially suffer from disruptions in products and technologies due to export bans. Thus, China is looking into opportunities to prevent these threats and enhance its security as well. By contrast, the European reliance on China's technologies could result

content/uploads/2022/12/Inflation-Reduction-Act-Guidebook.pdf; Jane Nakano, "IRA and the EV Tax Credits—Can We Kill Multiple Birds with One Stone?", in *CSIS Commentaries*, 15 September 2022, https://www.csis.org/node/66902.

16 Ibid.

17 Claire Bushey and Aime Williams, "US Opens New Cobalt Mine as EV Battery Needs Grow", in *Financial Times*, 7 October 2022, https://www.ft.com/content/561232f9-adf2-4ec3-a28e-e449dfb6dcce.

18 Brian Eckhouse, "Green Factories Are Changing Minds in More Conservative US States", in *Bloomberg*, 28 November 2022, https://www.bloomberg.com/news/articles/2022-11-28/how-clean-energy-jobs-could-be-political-game-changer.

19 Ashna Aggarwal, Jacob Corvidae and Wendy Jaglom-Kurtz, "The Economic Tides Just Turned for States", in *RMI Blog*, 6 February 2023, https://rmi.org/economic-tides-just-turned-for-states.

in exposing the Union to a spiral geoeconomics competition between the US and China, undermining European ability to respond to potential tensions with China as well as growing competition in mineral-rich countries to secure mineral supplies.

2. Rising EU climate ambitions in the evolving geoeconomics of supply chains

Within such evolving geopolitical landscape, the EU may find itself more vulnerable to clean energy supply chains as its climate ambitions ramp up. Since 2019, the EU has strived to upgrade its climate framework in response to the latest crises (health and economic). Indeed, in July 2021, the Commission proposed the "Fit for 55" package which envisages a series of legislative proposals to implement an upgrade of the 2030 greenhouse gas emissions reduction target from 40 to 55 per cent compared to 1990.[20] Such commitment has then been bolstered by the energy crisis and Russia's war in Ukraine, when the Commission has launched its REPowerEU plan, which seeks to achieve a double goal: reducing overdependence on Russia's energy imports through geographical diversification in the short term and boosting decarbonisation by 2030. This approach heightens the attempt to reconcile energy security with climate objectives. Renewables (and energy efficiency) are crucial drivers for energy security. The EU institutions agreed the Renewable Energy Directive to increase the 2030 target for RES share of gross final consumption from 40 per cent – envisaged in the "Fit for 55" package – to 42,5 per cent with an additional 2.5 per cent indicative top up that would allow to reach 45 per cent. A great emphasis is given to the solar energy also with the launch of its Solar Energy Strategy, which aims to bring online over 320 GW of solar PV by 2025 (more than doubling compared to 2020) and reach almost 600 GW by 2030.[21] In 2022, the EU has accelerated the installation of wind and solar capacity (around 58 GW, of which 42 GW of photovoltaic and 16 GW of wind), which avoided the need for around 11 bcm of natural gas in the power sector.[22] REPowerEU called for

20 The previous target for 2030 (set in 2014) was 40 per cent.

21 European Commission, *EU Solar Energy Strategy* (COM/2022/221), 18 May 2022, https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex:52022DC0221.

22 Peter Zeniewski, Gergely Molnar and Paul Hugues, "Europe's Energy Crisis: What Factors Drove the

higher energy efficiency (the low hanging fruit for energy transition), with an agreement at EU institutions to increase the EU 2030 binding energy efficiency target from initial 9 per cent under the "Fit for 55" package to 11,7 per cent. The IEA estimated that efficiency, including heat pumps, have contributed to reduce by around 3.5 bcm in the EU in 2022.

Heat pumps has indeed gained a newfound strategic relevance in a bid to eliminate Russian gas and accelerate the energy transition. Throughout 2022, around 2.8 million heat pumps were installed contributing to saving around 1.4 bcm of gas.[23] The EU policies aim to double the rate of deployment of heat pumps reaching 10 million heat pumps in the next five years and lead to 60 million new heat pumps by 2030, to be added to the 17 million installed in 2021.[24] The EU holds comparative advantages in this sector, yet the growing demand is deteriorating the trade balance and EU producers face rising energy and input costs.[25] According to the IEA, heat pumps are generally traded much less than solar PV modules. Nonetheless, in 2021 Europe and North America were net importers of mainly heating heat pumps, while China, Japan and Korea were net exporters.[26] There are some constraints regarding procurement of raw[27] and processed materials, component manufacturing[28] and assembly[29] as well as human capital.[30]

Record Fall in Natural Gas Demand in 2022?", in *IEA Commentaries*, 14 March 2023, https://www.iea.org/commentaries/europe-s-energy-crisis-what-factors-drove-the-record-fall-in-natural-gas-demand-in-2022.

23 Ibid.

24 European Heat Pump Association (EHPA) website: *REPowerEU and the EU Heat Pump Accelerator*, https://www.ehpa.org/accelerator.

25 European Commission, *Proposal for a Regulation on Establishing a Framework of Measures for Strengthening Europe's Net-Zero Technology Products Manufacturing Ecosystem (Net Zero Industry Act)* (COM/2023/161), 16 March 2023, https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex:52023PC0161.

26 IEA, *Energy Technology Perspectives 2023*, cit.

27 Steel and copper. Risks are more related to copper given its relevance for other low-carbon technologies and solutions.

28 Inverters and electrical components may fall victim to the semiconductor bottleneck.

29 Barriers for new players to entry the market, such as complex systems and licensing requirements.

30 Labour shortages and skill development may delay the increase of manufacturing. See Stathia Bampinioti et al., "Building Resilient Supply Chains for the European Energy Transition", in *McKinsey's Insights on Electric Power & Natural Gas*, 17 October 2022, https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/building-resilient-supply-chains-for-the-european-energy-transition.

In light of its climate and energy targets, the EU is exposed to some fragilities in key technologies and materials, which can anyways turn up in opportunities and benefits. If not properly addressed, a condition of international dependence is expected to remain a pressing issue in several aspects of the clean energy transition; for example, regarding to the critical raw material supplies and technological dependence.[31] The EU has small domestic production of these CRMs and almost entirely relies on imports to meet domestic demand. This is the case for the REEs (98 per cent), magnesium (93 per cent) from China, borate (98 per cent) form Turkey, platinum (71 per cent) from South Africa, and niobium (85 per cent) from Brazil.[32] Furthermore, the geopolitical confrontation with Russia given its invasion of Ukraine may cause further disruptions on other mineral supplies as Moscow is a key producer of several minerals such as nickel (11 per cent of global production and 15 per cent of world exports) and palladium (43 per cent of world's production and 21 per cent of world exports).[33]

Furthermore, the risk is to shift from an overdependence (i.e. on Russian gas) to another (i.e. Chinese clean energy technologies and products) – albeit differences security risks as aforementioned. Following Russia's invasion of Ukraine, the EU imports of solar PV panels (mainly from China) has soared. This condition has alerted experts and EU officials about the risk of new dependencies, as the EU only produced 1.7 GW of wafers, 1.37 GW of cells and 9.22 GW of modules compared to 41.4 GW of new installed solar PV capacity in 2022.[34] The highest risk is in selected technologies, such as solar PV and batteries, especially in light of the EU's accelerated timetable for the decarbonisation of the transport sector. Within the "Fit for 55" package, the EU envisages a revision of CO2 standards for light vehicles, which should ban sales for new traditional cars by 2035. China accounts for nearly 80 per cent of global battery cell manufacturing capacity. Additionally, Chinese EV makers

31 For an overview of where the EU stands in clean tech manufacturing please see: Giovanni Sgaravatti, Simone Tagliapietra and Cecilia Trasi, "Cleantech Manufacturing: Where Does Europe Really Stand?", in *Bruegel Analysis*, 17 May 2023, https://www.bruegel.org/node/9063.

32 Kjeld van Wieringen with Marcos Fernández Álvarez, "Securing the EU's Supply of Critical Raw Materials", in *EPRS At a Glance*, July 2022, https://www.europarl.europa.eu/thinktank/en/document/EPRS_ATA(2022)733586.

33 OECD, "The Supply of Critical Raw Materials Endangered by Russia's War on Ukraine", in *OECD Policy Responses on the Impacts of the War in Ukraine*, 4 August 2022, https://doi.org/10.1787/e01ac7be-en.

34 Giovanni Sgaravatti, Simone Tagliapietra and Cecilia Trasi, "Cleantech Manufacturing", cit.

are gaining growing market shares both in China (the world largest EV market) and abroad.[35] The dependence is also in the downstream as China accounts for more than 60 per cent of lithium and cobalt refining and for more than 60 per cent of the global production of cathodes, anodes, separators and electrolytes, which are all key components of battery cells.

Fragilities and risks in key technologies and materials supply chains do not lay only on availability of resources or industrial capabilities but also on more social and normative issues, such as sustainability and transparency issues of the suppliers, human rights and social responsibility, which demand to be addressed by the EU. For example, around 40 per cent of global supply of polysilicon, which is a key component of solar panels, comes from China's Xinjiang Uyghur Autonomous Region,[36] where forced labour and violation of human rights have been reported.[37] Given the lion's share of Xinjiang in global polysilicon supply, it is crucial to find a solution to human rights abuse in the supply chains albeit there is no easy solution in short-term. A positive example however comes from the US government, which in June 2021 banned the import of polysilicon from that region due to human rights concerns and called for greater verification of the origin of imported materials. Undoubtedly, China's lack of attention to sustainability and human rights issues is a further reason for the EU to develop its own local photovoltaic industry. Moreover, between 15 and 30 per cent of cobalt used in lithium-ion batteries comes from artisanal mines in Democratic Republic of Congo, where forced and child labour is common.[38]

35 Edward White and Peter Campbell, "China's Carmakers Outstrip Foreign Brands in Its Electric Vehicle Boom", in *Financial Times*, 17 January 2023, https://www.ft.com/content/dd149923-1c5d-4e5e-8be6-d979aa48aa33.

36 James Cockayne, Edgar Rodríguez Huerta and Oana Burcu, *'The Energy of Freedom'? Solar Energy, Modern Slavery and the Just Transition*, University of Nottingham, March 2022, https://www.nottingham.ac.uk/research/beacons-of-excellence/rights-lab/resources/reports-and-briefings/2022/march/the-energy-of-freedom-full-report.pdf.

37 Ana Swanson and Chris Buckley, "Chinese Solar Companies Tied to Use of Forced Labor", in *The New York Times*, 8 January 2021, https://www.nytimes.com/2021/01/08/business/economy/china-solar-companies-forced-labor-xinjiang.html.

38 James Cockayne, Edgar Rodríguez Huerta and Oana Burcu, *'The Energy of Freedom'?*, cit.

3. The role of the Green Deal

As outlined in the previous sections, supply chains bottlenecks create risks around volume availability (e.g. shortages), price volatility, (geo)political risks (e.g. dependency), long lead times and other issues, such as quality and social concerns.[39] Therefore, the ability to address such bottlenecks will be a defining feature of Europe's role in the global energy transition. The EU is starting reconsidering its strategic vulnerabilities in the context of a mounting debate on Europe's industrial policy. The EU has set several targets, launched initiatives and strategies to overcome bottlenecks, reduce vulnerabilities, while supporting its climate ambition with industrial and technological capabilities. These European initiatives are both a response to and a factor shaping the current evolving geoeconomic developments.

An industrial strategy and thinking

Any climate objective, not coupled with a serious industrial strategy, would fall short. Governments need to pursue industrial policies in order to reconcile socioeconomic growth and sustainability. However, for many years the EU has lacked a unified and coherent vision as many member states have pursued and used different policy tools. This fragmented landscape generates some risks of undermining the level playing field within the Union, although the EU developed also some tools to preserves the "level playing field" such as state aid discipline. In March 2020, the Commission presented its New Industrial Strategy in order to shape the industrial transformation required by the Green Deal.[40] It aims at securing supply of clean energy and raw materials, creating lead markets in clean technologies with regulatory policies, public procurement and competition policy. Furthermore, through this strategy, the Commission seeks to increase investment in green research, innovation, deployment and up-to-date infrastructure. However, the Commission document seemed more as a collection of energy, climate, innovation and social policy initiatives

39 Stathia Bampinioti et al., "Building Resilient Supply Chains for the European Energy Transition", cit.
40 European Commission, *A New Industrial Strategy for Europe* (COM/2020/102), 10 March 2020, https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex:52020DC0102.

rather than a truly coherent industrial policy framework.[41] Furthermore, the strategy did not provide a clear governance necessary to unleash industrial opportunities in the context of the Green Deal.[42] Following the Covid-19 crisis, the industrial strategy was updated in May 2021 in order to take account of the changing circumstances.

In 2022, industrial policy and strategy have made a strong comeback in the European and international political debate. The EU has found itself in a very challenging context and its growing industrial thinking has been rooted on the concept of strategic autonomy. High energy prices could undermine competitiveness of European industry. Furthermore, proactive industrial policy has been emerging from systemic actors, such as China and the US. In short, the EU has found itself between a rock (USA) and a hard place (China) regarding industrial policy and strategic thinking.

While China has managed to gain a centrality within the global supply chains of numerous green technologies or minerals that are indispensable for the energy transition because of its long-lasting industrial policies, the US has recently approved a package of green subsidies – the IRA – that could attract European and international companies and investments. Given such risks, the European countries and institutions have criticised the IRA,[43] which exacerbated an already mounting trade tension across the Atlantic[44] – albeit the renewed reinforcement of Transatlantic political ties under President Biden and following Russia's invasion of Ukraine. In this context, European officials and governments have called for a revision of European industrial policy. France and Germany stressed the need for a renewed impetus in European industrial policy,[45] while the President of the Commission Ursula von der Leyen initially stated that the EU must "simplify and adapt" its rules on state

41 Simone Tagliapietra and Reinhilde Veugelers, "Fostering the Industrial Component of the European Green Deal: Key Principles and Policy Options", in *Intereconomics*, Vol. 56, No. 6 (2021), p. 305-310, https://doi.org/10.1007/s10272-021-1006-5.

42 Ibid.

43 Andy Bounds, "Belgium Accuses US of 'Aggressive' Push to Lure European Business", in *Financial Times*, 10 January 2023, https://www.ft.com/content/16816444-1694-4530-84bb-ac289d6776dd.

44 Prior to the US IRA, the EU and the US faced growing tensions with Trump's tariffs and the discussion over the Transatlantic Trade and Investment Partnership.

45 Bruno Le Maire and Robert Habeck, *Joint statement: "We Call for a Renewed Impetus in European Industrial Policy"*, 22 November 2022, https://presse.economie.gouv.fr/?p=103071.

aid in light of the US IRA.[46] The executive vice-president of the Commission, Margrethe Vestager, proposed a Temporary Crisis and Transition Framework for state aid, which would allow member states to more easily subsidies renewable energy technologies and to implement tax breaks for companies in strategic sectors that are at risk of diverting investments to third countries outside Europe.[47] Precisely, this framework allows member states to set up schemes for investments in clean energies, storage and renewable heat and envisages also simplified tender procedures to fast-track the permitting process that has been one of the main barriers to clean energy technologies.

However, choosing this road could be risky for the internal market, as a loose state aid framework would provide uneven opportunities among member states with different fiscal capacity. Furthermore, state aid may prove to be useless as industry thrives nonetheless where energy resources are relatively cheap.[48] The evolution of the solar PV production represents a clear reminder of this risk. In early 2023, the Commission presented its Green Deal Industrial Plan which aims to support the fast transition to climate neutrality in the EU while enhancing European net-zero industry's competitiveness. The Plan is based on four pillars: a predictable and simplified regulatory environment, speeding up access to finance, enhancing skills and open trade for resilient supply chains.[49] Concerning the first pillar, the Commission presented the Net-Zero Industry Act (NZIA) and the Critical Raw Materials Act. The NZIA aims at simplifying regulations to accelerate strategic projects with the objective to approach or reach at least 40 per cent of the annual deployment needs for strategic net-zero technologies manufactures in the EU by 2030.[50]

The risk in the making of an industrial strategy for the energy transition is to replicate others' policies. While it is clear that the evolving geopolitical landscape,

46 Henry Foy and Sam Fleming, "Ursula von der Leyen Promises EU Help for Companies Lured by US Green Subsidies", in *Financial Times*, 4 December 2022, https://www.ft.com/content/19a28687-0172-445a-829d-a8fd08592197.

47 János Allenbach-Ammann, "EU Commission's Vestager Proposes Change to State Aid Rules", in *Euractiv*, 13 January 2023, https://www.euractiv.com/?p=1864891.

48 Pier Paolo Raimondi, "Walking Out of the Woods: EU Industrial Policy between the Energy Crisis and Decarbonisation", in *IAI Commentaries*, No. 22|64 (December 2022), https://www.iai.it/it/node/16355.

49 European Commission, *The Green Deal Industrial Plan: Putting Europe's Net-Zero Industry in the Lead*, 1 February 2023, https://ec.europa.eu/commission/presscorner/detail/en/ip_23_510.

50 European Commission, *Questions and Answers: The Net-Zero Industry Act and the European Hydrogen Bank*, 16 March 2023, https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_1666.

characterised by greater industrial competition also among partners, requires industrial and strategic thinking from the EU, Europeans should develop their approach based on their own characteristics,[51] streamlining and harmonising the existing economic and political tools aimed at transforming and developing industries in line with its net-zero targets. In this way, the EU could create better coordination, preventing lengthy discussions along traditional cleavages (i.e. frugal and non-frugal member states).

As interests and concerns related to the industrial policy and green technologies, the EU has set several schemes to foster industrial transformation and development within its borders. In this sense, the Commission has favoured the creation of industrial alliances between stakeholders in key technologies. The alliance scheme was initially launched regarding batteries in 2017 and circular plastics in 2018. Following the launch of the European Green Deal, the Commission decided to replicate the scheme by launching the European Clean Hydrogen Alliance and the European Raw Materials Alliance in 2020.

Solar Alliance

In December 2022, the European Solar PV Industry Alliance was also launched, with the aim to facilitate innovation-led expansion of a resilient industrial solar value chain in the EU, in particular in the PV manufacturing sector. The Alliance stems from the EU's Solar Strategy, which acknowledges the challenges in the supply chains of raw materials and the need of strengthening European manufacturing capabilities in order to preserve European competitiveness. Indeed, while the EU is one of the largest markets for PV, it relies heavily on imports from Asian countries. Yet, it is a strong innovator especially in emerging PV technologies and applications, such as agri-PV, building-integrated PV and floating PV.[52] The Alliance could contribute a growing role of European players in the supply chain. A positive example is the launch in 2022 of the 3Sun Factory in Sicily, which is set to become the biggest factory in Europe by 2024 reaching a production capacity of 3 GW. The factory will produce new generation panels

51 Pier Paolo Raimondi, "Walking Out of the Woods", cit.
52 European Commission, *Progress on Competitiveness of Clean Energy Technologies* (COM/2022/643), 15 November 2022, https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex:52022DC0643.

highlighting the relevance of research and development activities in the quest of combining energy transition and industrial capabilities.[53]

The Battery Alliance

In 2017, the EU launched its Battery Alliance, which aims to achieve strategic autonomy in the battery field through rising domestic production.[54] Given the relevance of its automotive industry, the EU needs to secure the supply chains and adequate industrial capabilities to support its transformation towards EV. The sector is dominated by China as highlighted in the previous sections. To cut its dependence on China for EV batteries, the EU should invest heavily in production capacities and research and development activities in order to reduce, recycle and replace mineral inputs. This could also reduce security risks related to several minerals, like cobalt, as well. For example, LFPs, which tripled its market share, can be a valid avenue to replace critical minerals and improve technological and industrial capacity. As of today, China holds a comparative advantage also in this sector. Yet, some non-Chinese companies, Volkswagen and Ford, announced their intention to entry the sector in order to reduce vulnerabilities related to selected minerals.[55] Another emerging alternative to Li-ion is sodium-ion (Na-ion) batteries, which guarantee a dual advantage: relying on lower cost materials than Li-ion leading to cheaper batteries and completely avoiding the need for critical minerals. The EU could support the development of related supply chains to reduce its exposure to critical dependencies and develop cross-cutting technologies. As of today, almost all the 30 Na-ion battery manufacturing plants,[56] with a combined capacity of over 100 GWh, is located in China. Yet, this is still representing a niche compared to

53 Enel website: *3Sun Gigafactory*, https://www.enelgreenpower.com/who-we-are/innovation/3SUN-factory; Laura Serafini, "A Catania arriva il pannello solare del futuro: occupa la stessa superficie ma produce il 10% di energia in più", in *Il Sole 24 Ore*, 6 February 2023, https://www.ilsole24ore.com/art/a-catania-arriva-pannello-solare-futuro-occupa-stessa-superficie-ma-produce-10percento-energia-piu-AEiWoWiC.

54 Website of the European Commission DG Internal Market: *European Battery Alliance*, https://single-market-economy.ec.europa.eu/node/548_en.

55 Henrique Ribeiro, "Volkswagen's Plan on LFP Use Shifts Hydroxide Dominance Narrative in EV Sector", in *S&P Global Commodity Insights*, 17 March 2021, https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/metals/031721-volkswagens-plan-on-lfp-use-shifts-hydroxide-dominance-narrative-in-ev-sector.

56 Currently operating, planned or under construction.

current manufacturing capacity of Li-ion batteries (around 1,500 GWh),[57] but it is a sector of potential growing relevance for rising EU capacity.

Moreover, the EU should increase its support for recycling activities. Two milestones have been reached over the past months. First, in December 2022, the European Parliament and Council reached a provisional agreement to overhaul EU rules on batteries and take into account technological developments and future challenges[58] and then, in July 2023, it was adopted Regulation 2023/1542 which envisages minimal levels of recycled components in batteries.[59] The new rules will cover the entire battery life cycle, from design to end-of-life and apply to all types of batteries sold in the EU (from portable to EVs). The deal requires a carbon footprint declaration and label for EV batteries and it introduces due diligence policy to address the social and environmental risks linked to sourcing, processing and trading raw materials and secondary raw materials. Additionally, the new rules will enhance the recycling components in order to build Europe's recycling industry.

Critical Raw Materials Strategy

As clean energy technologies require critical raw materials, the EU needs to take into account also the supply of CRMs. The EU is working on expanding and diversifying its CRM supply. The first pillar of this strategy is to develop primary production of CRMs within the European borders. In this sense, the Commission presented the Critical Raw Materials Act, which set clear benchmarks for domestic capacities along the strategic raw materials supply chain and to diversify EU supply.[60] Within the EU, countries hold some CRMs deposits; for example, Sweden announced the discovery of a major REE deposit in January

57 IEA, *Global EV Outlook 2023*, April 2023, https://www.iea.org/reports/global-ev-outlook-2023.

58 European Parliament, *Batteries: Deal on New EU Rules for Design, Production and Waste Treatment*, 9 December 2022, https://www.europarl.europa.eu/news/en/press-room/20221205IPR60614.

59 European Parliament and Council of the European Union, *Regulation (EU) 2023/1542 of 12 July 2023 Concerning Batteries and Waste Batteries*, http://data.europa.eu/eli/reg/2023/1542/oj.

60 At least 10 per cent of the EU's annual consumption for extraction, at least 40 per cent of the EU's consumption or processing, at least 15 per cent of the EU's annual consumption for recycling and not more than 65 per cent of the EU's annual consumption of each strategic raw material at any relevant stage of processing from a single third country. See European Commission, *Critical Raw Materials: Ensuring Secure and Sustainable Supply Chains for EU's Green and Digital Future*, 16 March 2023, https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1661.

2023.[61] Nonetheless, environmental concerns, societal acceptance (as occurred in Portugal and Serbia) and high costs are key obstacles to massive production within the EU limiting solutions in the short- and medium-term. Therefore, the EU is building strategic partnerships with key producing and mineral-rich countries, such as Canada, Ukraine, Kazakhstan and Namibia during the COP27 in 2022.[62] The CRM Act envisages the creation of strategic partnerships and trade agreements, such as with Chile and Australia. Additionally, the Act considers the formation of a CRM "club" with interested countries and partners in order to enhance global supply chains. Moreover, given the lengthy process to launch new mining and processing operations, a key strategy would be focusing on recycling and research into substitution (through advanced materials or alternative technologies). Recycling depends on the availability of sufficient end-of-life volumes, which for some technologies may not happen before 2030.[63] Moreover, substitution and innovation could ensure both strategic autonomy and leadership for the EU while preserving cooperative relations with key producing countries.

Hydrogen Strategy

In July 2020, the Commission launched its Hydrogen Strategy aiming at promoting a fast development of production capacities for green hydrogen to regain technological dominance in clean energy technologies. With this strategy, the EU aspired to become the technological leader in such field after the incapacity of keeping a global leading position in the solar PV industry in the past years. Associated with clean electrification, green hydrogen could play a pivotal role in the decarbonisation of hard-to-abate sectors as well as for storage. The strategy envisaged three phases with different production targets.[64] In the wake of Russia's war in Ukraine, the Commission has enhanced

61 "Swedish Mining Company Discovers Europe's Largest Deposit of Rare Earth Elements", in *Euronews*, 13 January 2023, https://www.euronews.com/green/2023/01/13/swedish-mining-company-discovers-europes-largest-deposit-of-rare-earth-elements.

62 European Commission, *COP27: European Union Concludes a Strategic Partnership with Namibia on Sustainable Raw Materials and Renewable Hydrogen*, 8 November 2022, https://ec.europa.eu/commission/presscorner/detail/en/ip_22_6683.

63 Samuel Carrara et al., "Supply Chain Analysis and Material Demand Forecast in Strategic Technologies and Sectors in the EU. A Foresight Study", in *JRC Science for Policy Reports*, 2023, https://doi.org/10.2760/386650.

64 From 2020 to 2024, installation of at least 6 GW of green hydrogen electrolysers and the production

its hydrogen production and import targets setting for both a 10 million tons target by 2030 outlined in the REPowerEU.

The clean hydrogen supply chains are yet to start, but fierce competition for mastering clean hydrogen technologies is already emerging. China has expressed great interests in developing hydrogen technology, considered as a strategic "frontier technology" and its strategy was officially launched in March 2023.[65] China plans to first develop a hydrogen value chain, and then greening it.[66] As of today, China is the largest hydrogen producer in the world, accounting for around one third of global output. Yet, it relies on coal for two-thirds, natural gas for under 20 per cent while renewable energy-based electrolysis for approximately 1 per cent. Nonetheless, China is a major producer of alkaline electrolysers, which can benefit from low costs. Alkaline electrolysers in China are having an economic competitive advantage vis-à-vis Europe. Estimated costs for Chinese alkaline electrolysers are as little as 200 US dollars/kW, well below 1,200 US dollars/kW of European.[67] As China ramps up its renewable capacity, the country could increase renewable hydrogen production.

Also, the US' IRA allocated significant tax credits (up to 3 US dollars/kg) for producing clean hydrogen, alongside other 8 billion US dollars of federal funding for clean hydrogen hubs in the separate Bipartisan Infrastructure Law.[68] This could make the US the most attractive market in the world for producing green hydrogen and electrolysers. The EU has expressed strongly its opposition to the entire IRA framework as it fears to lose technological leadership in the hydrogen value chain. The EU has developed important capabilities in the production of electrolysers but it needs to continue investing into it and develop research and development projects. Notably,

of up to 1 Mt of green hydrogen. From 2025 to 2030, at least 40 GW of electrolysers and the production of up to 10 Mt of green hydrogen. From 2030 to 2050, hydrogen technologies deployed at large scale across all hard-to-decarbonise sectors.

65 European Commission, *REPowerEU Plan* (COM/2022/230), 18 May 2022, https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex:52022DC0230.

66 "China Maps 2021-2035 Plan on Hydrogen Energy Development", in *Xinhua*, 24 March 2023, https://english.news.cn/20220324/26f6fa95f8f44ee0b0c74cb0be1d2453/c.html.

67 Alexander Brown and Nis Grünberg, "China's Nascent Green Hydrogen Sector: How Policy, Research and Business Are Forging a New Industry", in *MERICS China Monitor*, No. 77 (28 June 2022), https://merics.org/en/node/1580.

68 Xiaohan Gong, Rainer Quitzow and Anatole Boute, "China's Emerging Hydrogen Economy", in *RIFS Studies*, January 2023, https://doi.org/10.48481/rifs.2023.001.

imported volumes of hydrogen will be essential in the decarbonisation of the EU, while other regions, such as the US and China, may be able to produce enough hydrogen volume domestically to meet their demand.[69] In September 2022, President von der Leyen announced the formation of a Hydrogen Bank, which will be able to invest 3 billion euro to help building the future market for hydrogen.[70] The Hydrogen Bank was presented by the Commission in March 2023 to support European manufacturing capacity.[71] The first pilot auctions for renewable hydrogen production is expected to be held in late 2023, with an initial budget of 800 million euro.[72] The EU will need to increase substantially its financial support in order to develop a hydrogen economy and reach its hydrogen targets.

Heat pumps

Heat pumps have been included in the list of strategic clean technologies in the NZIA. This technology can contribute to reduce the role of gas in the heating sector. Moreover, the EU can benefit from existing strengths in the sector as it is a recognised market leader. In particular, the EU is a technology leader in use of natural refrigerants, in noise reduction and energy efficiency and in sorption heat pumps.[73] Nonetheless, the EU has increased its imports from Asia, and China, in order to meet rising demand. The EU seeks to foster manufacturing capabilities in the EU, which demands a clear strategy to facilitate the ramp-up of manufacturing capacity as well as overcome constraints and bottlenecks.[74]

69 White House, *Building a Clean Energy Economy*, cit.; *Bipartisan Infrastructure Law Tribal Playbook*, May 2022, https://www.whitehouse.gov/build/resources/bipartisan-infrastructure-law-tribal-playbook.
70 Laima Eicke and Nicola De Blasio, "Green Hydrogen Value Chains in the Industrial Sector—Geopolitical and Market Implications", in Energy Research & Social Science, Vol. 93 (November 2022), Art. 102847, https://doi.org/10.1016/j.erss.2022.102847.
71 European Commission, *2022 State of the Union Address by President von der Leyen*, 14 September 2022, https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_22_5493.
72 European Commission DG Energy, *Commission Outlines European Hydrogen Bank to Boost Renewable Hydrogen*, 16 March 2023, https://energy.ec.europa.eu/node/5182_en.
73 Wester van Gaal, "EU Launches 'Hydrogen Bank' — But What Is It?", in *EUobserver*, 17 March 2023, https://euobserver.com/green-economy/156845.
74 Lorcan Lyons et al., "Clean Energy Technology Observatory: Heat Pumps in the European Union – 2022 Status Report on Technology Development, Trends, Value Chains and Markets", in *JRC Technical Reports*, 2022, https://doi.org/10.2760/372872.

CBAM, finance and trade considerations

While the EU is increasingly looking into opportunities and challenges on the industrial sector, it is also reinventing tools that are expected to shape other sectors, such as trade and finance. A major policy tool that will shape energy geoeconomics is the European Carbon Border Adjustment Mechanism (CBAM), which intends to impose a carbon tax on the carbon content of imported products to induce other countries to set higher climate policies and protect its own industries from the risk of relocation of industrial activities due to different national climate ambitions and carbon related regulation or reduced competitiveness as they undergo a decarbonisation process. In December 2022, the Council and the European Parliament reached an agreement of a provisional and conditional nature on the CBAM. CBAM will begin to operate from October 2023 with the specific aim to collect data and it is expected to enter into force in 2026. It would be phased in gradually alongside the phasing out of the free allowances in the EU emissions trading system (ETS).[75] The CBAM has been met with some international outrage from BRICS countries to the US.[76] The EU needs to build both incisive and just mechanism to implement climate policies both within the Union and abroad. The role of the EU within the global trade is not trivial. A hanging issue is certainly how the EU would be able to reduce the regressive effects of such mechanism for developing countries, which are expected to be the most affected, and preserving trade openness. The EU is the world's largest trading bloc as it is the top trading partner for 80 countries. By comparison, the US is the top trading partner for a little over 20 countries.[77]

75 Nikolaus J. Kurmayer, "Brussels Prepares 'Strategy' to Boost Deployment of Heat Pumps", in *Euractiv*, 10 March 2023, https://www.euractiv.com/?p=1891970.

76 See website of the European Commission DG Taxation and Customs Union: *Carbon Border Adjustment Mechanism*, https://taxation-customs.ec.europa.eu/node/1454_en.

77 Noah Kaufman et al., "As US-EU Trade Tensions Rise, Conflicting Carbon Tariffs Could Undermine Climate Efforts", in *The Conversation*, 23 January 2023, https://theconversation.com/as-us-eu-trade-tensions-rise-conflicting-carbon-tariffs-could-undermine-climate-efforts-198072.

4. Open questions and policy recommendations

Governments are in the middle of the transition, which entails major opportunities but it also comes with risks and challenges.[78] The new international context has led to a renewed debate aiming at finding the right balance between an effective transition, the need to offset negative and excessive dependencies, the urgency to exploit economic opportunities while ensuring a just transition capable of managing the social dimension in terms of jobs and costs. Moreover, after four decades of globalisation and interconnectivity, resilience is gaining of newfound political relevance as countries are facing rising competition. Nonetheless, cooperation is essential in addressing climate change and in the creation of global sustainable supply chains. No country can actually pursue self-sufficiency. It is neither feasible nor desirable. Without cooperation and economies of scale, clean energy technologies and their supply chains would face higher costs directly affecting the speed of the transition and the consumers.

Protectionism vs interconnectivity

EU should focus on strengthening its competitiveness leveraging on single market integration, while avoiding to embrace excessive and ineffective protectionist policies, such as local-component requirements.

Member states seek to preserve Europe's competitiveness in light of growing industrial competition and recent energy price spikes. This has led to a reconsideration by the EU and its member states whether the free market and interdependence can still provide massive benefits for stakeholders (governments, companies and consumers) and accelerate the energy transition. In light of multiple and complex challenges, governments have restored market interventions and protectionism. Indeed, the new international context has contributed to the comeback of economic security as a top priority. While

78 See website of the European Commission DG Trade: *EU Position in World Trade*, https://policy.trade.ec.europa.eu/node/1108_en.

economic security is crucial for each country, the EU and its member states need to find the right equilibrium over resilience and efficiency. In this sense, the EU is struggling to find the best policy response to both the traditional Chinese market dominance and the new implications of the US IRA, which will likely harm Europe's competitiveness through its subsidies conditional on local-component requirements. Despite negative effects and uncertainty, the IRA could represent a breakthrough for energy transition in the US, the EU and most of the rest of the world by reducing the cost of clean energy technologies. On the one hand, the EU needs to focus on strengthening its competitiveness through its own characteristics (competition and single market integration) and avoiding to embrace excessive and ineffective protectionist policies, such as local-component requirements. On the other, the EU and its member states should consider the overall strategic and socio-economic benefits of developing a local supply chain, which would have relevant returns in terms of GDP occupation and technological/industrial autonomy.

External dimensions

EU should engage with external players to ensure a just transition. The European industry could leverage on i) its strong track record on high environmental and sustainability standards and ii) active engagement with local communities. Higher environmental, social and governance (ESG) standards and non-price criteria can be essential elements vis-à-vis third countries.

Avoiding protectionism and explicit local content policies would allow the EU to establish more cooperative external policies and limit counterproductive trade retorsions from global players. However, to secure the deployment of high-quality products in terms of environmental and social impact in the European market, the EU should promote higher ESG standards and non-price criteria, that can be relevant also to incentivise the innovation required for achieving the EU targets. In this context, he European industry could leverage on its strengths as a competitive advantage upon competitors, such as strong track record on high environmental and sustainability standards and engaging actively with local communities.[79]

79 IEA, *Energy Technology Perspectives 2023*, cit.

In any case, it is crucial for the EU to not renegade its trade-oriented approach. While building up its local manufacturing capacity, the EU should engage with external players to ensure a just transition, designing its tools and instruments (e.g. Global Gateway, CBAM) adequately to support external partners as well.

Industrial policies in key sectors

EU needs to have a systemic approach, supported by a strategic vision. It is crucial to identify appropriate mechanisms and tools who can provide guidance for the implementation at EU-wide level.

Such general context contributes to the renewed debate about industrial policy, fostering the proposal of the Net-Zero Industry Act. Governments seek to enhance domestic industrial manufacturing capabilities, dominating clean energy technologies, creating jobs and reduce external dependences. However, in drawing its response to evolving geoeconomics of supply chains, the EU should carefully assess in which sectors it can increase its industrial capacity to enhance strategic autonomy and reduce dependencies. Indeed, the EU could aim at enhancing its manufacturing capacities in selected sectors (e.g. wind turbines), while accepting some interdependence on others (e.g. existing solar panels). This approach will result in avoiding waste of money and market distortions. Redrawing global supply chains and building alternative manufacturing capabilities demand massive amount of money. It is crucial therefore to focus on those sectors where it is achievable both in terms of capitals and time. To do so, the EU needs to have a systemic approach, coordinated and supported by a strategic vision for the supply chains integrations. In this challenging, but crucial, task, an opportunity is to identify appropriate mechanisms and tools who can provide guidance for the implementation of the strategic vision on value chains. Competition and single markets are valuable assets that needed to be enhanced, but at the same time, the EU needs to have a clear strategic thinking and vision on which sectors it needs and can enhance its role in.

Technological sectors and regulatory aspects

EU should broaden the industrial and strategic thinking to the entire supply chains, without limiting the effort and commitment to end products, while scaling up all different segments of the supply chains.

It is crucial to broaden the industrial and strategic thinking to the entire supply chains without limiting the effort and commitment to end products, such as batteries or solar panels. In this sense, the EU should consider the scaling up of the manufacturing capacity also for the different segments of the supply chains, which could contribute to build and enhance healthy and competitive supply chains. Furthermore, the EU could also focus on high value-added components and technologies, through research and development (R&D) and research and innovation (R&I), to gain technological relevance and economic growth. To foster industrial innovation and development, it is of paramount importance to design and apply streamlined and predictable permitting procedures at all levels of the value chain, giving priority status at national level to ensure rapid administrative treatment and strengthening the offices in charge of authorisation procedures.

Critical raw materials

EU needs to work on a secure and affordable supply chain of CRMs and the recycling sector should be expanded. High value-added components and technologies should be prioritised.

The EU needs to work on building a secure and affordable supply chain of CRMs as energy systems are switching from being fossil fuel-intensive to mineral-intensive. The EU should cooperate with other main economies to ensure investments in the CRM industry. Also in this field, it is crucial to have a strategic and coherent approach by incentivising investments especially in those materials that represent a strategic vulnerability and bottleneck. The EU and US can cooperate with third countries in favouring the build-up of a stable and secure industry for the upcoming increased demand. Furthermore, cooperation should not be limited to the production and refining activities but also to gather political commitment for higher transparency and standards in

the CRM markets. Thus, countries should evaluate the creation of an agency or department, also within existing international fora, that oversees this matter. Finally, one area where the EU could expand its relevance is the recycling of the CRM. This could essentially contribute to lower dependence on mineral imports - possibly in cooperation with key external partners as the US, reduce the environmental impact of clean energy technologies, as well as develop new local industry and jobs.

Scientific and technological cooperation

EU should build new cooperation frameworks for scientific and technological development, R&D and R&I funds and programmes as well as fostering new job skills.

Last but not least, the EU should build new cooperation frameworks for scientific and technological development, R&D and R&I funds and programmes as well as fostering new job skills. Also in this area, the EU can enhance scientific cooperation with friendly countries, such as the US, but also with emerging economies, like India and African countries, to find new solutions to energy, climate and industrial challenges as well as promote a more just and equitable transition. Furthermore, the EU should not neglect cooperative framework with China given its ambition and role in the energy transition.

Geoeconomics of the European Green Deal

The energy transition is reshaping global energy supply chains. This evolution is developing in a context of growing geoeconomic tensions as countries are reconsidering their industrial strategies to seize opportunities and manage risks. The paper will discuss how decarbonisation policies, and the Green Deal in particular, are likely to affect the evolution of supply chains in the context of the energy transition. The paper will first consider the growing contested geoeconomics landscape and its effects on the energy transition. Then it will analyse where the European Union stands in the evolving landscape – especially regarding key clean energy supply chains – in order to assess opportunities and risks. Finally, the paper will investigate some measures and actions undertaken within the Green Deal framework that the EU could use to seize opportunities and manage risks.

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