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RESEARCH

China's Green Industrial Policy and World Trade Law

Xiaofeng Li[1] · **Ming Du**[1]

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Abstract

This article seeks to unpack China's green industrial policy and explore its implications for world trade law. It argues that, first, central to China's achievements in renewable energy is the role of state-level centralized green industrial policy. Second, China's approach to renewable energy features a pragmatic attitude of subordinating climate commitment to economic development prerogatives. China's pro-growth mentality has also shaped the international posture of China on climate change. Third, China's domination in green technology has raised important policy questions for world trade law. In response to China's green industrial policy, other countries are likely to enforce trade defense measures more aggressively against China and launch their own green industrial policy as a critical part of the re-balancing effort.

Keywords Green industrial policy · Renewable energy · World Trade Organization · SCM agreement

Introduction

China is the world's largest energy consumer and largest emitter of energy-related carbon dioxide (CO2), accounting for nearly 31% of the global emissions in 2022 [37, p. 236]. Driven by the acute awareness that its development model of "high energy consumption, high pollution, and high emission" is not sustainable, the Chinese government has taken on the low-carbon path by transforming its energy composition [65]. Chinese president Xi Jinping pledged in 2020 to achieve peak CO_2 emissions before 2030 and carbon neutrality by 2060 [63]. President Xi's pledge on carbon neutrality has provided a powerful political signal favoring renewable energy investments. An ambitious national strategy of actively combating climate change

✉ Ming Du
ming.du@durham.ac.uk

Xiaofeng Li
xiaofeng.li@durham.ac.uk

[1] Durham University, Durham, UK

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was introduced in 2021 [63]. China is currently the world's largest and fastest-growing producer of renewable energy and the rate of China's CO2 emission has been slowing down [68].

China's booming renewable energy sector presents both opportunities and challenges for other countries. On the one hand, China plays a pivotal role in the global green transition. China's massive production is driving solar, wind components and electric vehicles (EV) prices to all-time lows. The falling prices of clean energy will accelerate global green energy transition at a reasonable cost [83]. Moreover, there are significant collaborative opportunities between China and other countries in the green energy sector, especially in areas such as investment, research and development, joint ventures, and the exchange of expertise [6, pp. 7–9]. On the other hand, from its trading partners' perspective, China's dominance in green energy supply chains from critical mineral to manufacturing assembly line presents economic and security challenges. For one, it is alleged that China's swift scale-up of its new energy industry, facilitated by China's green industrial policy featured by centralized "top-down" approach through massive subsidies and credit incentives, has led to unfair trade practices, persistent overproduction, and excess supply, saturating global markets and crippling international competitors [75]. For another, the reliance on Chinese clean energy supply chains and the influx of affordable Chinese green energy products are perceived as an economic security risk [21, p. 4].

Against this background, this article seeks to understand China's green industrial policy and how other countries respond to the rise of China as a veritable green power. It first provides an introduction of China's green industrial policy, highlighting its underlying drivers and implications for the liberal international economic order. It then analyses critically China's main trading partners' response to alleged threats posed by China's green industrial policy, with a focus on the European Union (EU)'s countervailing duty (CVD) investigation into Chinese EVs. The article concludes by discussing the potential paths forward given the deep division on China's green industrial policy between China and other major trading powers.

China as a Veritable Green Power

China is currently the world's largest producer of renewable energy [33]. China is home to more than half of the global stock of EVs and China dominates the world's EV lithium-ion battery manufacturing market with a 79% market share in 2021 [38, p. 16; 62]. The Chinese battery-maker CATL alone controls 37% of global EV battery sales in 2022 [43]. Largely due to its extensive refining and processing capabilities, China also dominates the critical mineral market with a majority share of the global market for battery-grade graphite (99%), refined magnet rare earth (80%), refined cobalt (70%), lithium chemicals (60%), and refined copper (40%) in 2024 [39, pp. 7–8].

China's lead in renewable energy has widened with an acceleration of solar and wind power capacity in recent years. According to Global Energy Monitor, China's solar capacity is now 228 GW, more than the rest of the world combined. China leads the world in wind capacity at 310 GW. China is set to double its capacity

and produce 1200 GW of energy through wind and solar power by 2025, reaching its 2030 goal 5 years ahead of time [53]. China is also the world's top supplier of renewable energy technologies. For instance, China dominates the solar panel supply chain from end to end, commanding more than 80% of the world's solar panel manufacturing capacity at every stage. It can make 1000 GW of solar modules each year, more than twice the global demand [36, pp. 7–8]. In the wind power sector, China has captured 58% of the global wind turbine manufacturing capacity in 2020 [27]. China is also the largest domestic and outbound investor in renewable energy in the world. For example, China has invested $546 billion in clean energy, including solar and wind energy, electric cars, and batteries in 2022. This funding is nearly four times the amount of US funding, which totaled $141 billion [31].

Based on official figures and commercial data, China's CO2 emissions are set to fall in 2024 and could be facing structural decline, due to record growth in the installation of new low-carbon energy sources [54]. On the current trajectory, China could easily surpass its target of supplying a third of its power consumption through renewable sources by 2030 [48, p. 141]. This feat is a testament to China's capacity to construct a mature and autonomous green energy supply chain, reinforcing its strategic independence in green energy.

China's Green Industrial Policy

What explains China's remarkable progress in growing its renewable energy sector over the past two decades? A short answer is that it is largely because of the Chinese government's commitment to transform its economic growth model towards green growth [64]. Importantly, the Chinese government's political commitment to clean energy is anchored in broad-based, top-down green industrial policies [70, pp. 263–264].

Despite more than four decades of market-oriented reforms and 20 years of WTO membership, China's economic model remains fundamentally different from both command economies and free market economies in structuring political and economic power. Featuring the melding of the power of an authoritarian state with the power of market capitalism. The government of China continues to exercise extensive direct and indirect control over the allocation of resources through instruments such as government ownership, the control of key economic actors, and government directives [19, pp. 736–739].

One key feature of China's economic model is its proactive formulation and execution of ambitious industrial policies. Industrial policy is defined as "any type of intervention or government policy that attempts to improve the business environment or to alter the structure of economic activity towards sectors, technologies or tasks that are expected to offer better prospects for economic growth or societal welfare than would occur in the absence of any such intervention" [76, p. 16]. Compared with industrial plans of other countries, China's industrial plans have a few unique features. First, the financial support that the Chinese government provides to domestic industries in pursuit of China's industrial objectives is enormous. One study estimated that it totalled at least 1.73% of GDP in 2019, equivalent to more

than $248 billion at nominal exchange rates, even using a conservative methodology. This is twice as much as South Korea's share of GDP or the USA in dollar terms [18, p. 2]. Second, adherence to the objectives of China's industrial plans is effectively mandatory. Chinese companies have little discretion to ignore them, even when market forces would dictate different commercial behaviour [73 p. 14]. Third, China's industrial planning is more comprehensive and complex than any other country. It is not limited to one overarching plan but instead includes hundreds of sub-plans and covers all sectors of China's economy. Various institutions participate in plan formulation and execution, including all levels of government and key Chinese companies [28, pp. 5–7]. Finally, other countries' industrial policies generally adopt an open approach in which a wide range of foreign partners can participate, and they generally do not set explicit market share targets for replacing imports or quotas for indigenous production [25, pp. 6–7].

One of the most far-reaching industrial plans is Made in China (MIC) 2025. This is a state-led industrial policy that seeks to reduce China's dependence on foreign technology and make China dominant in global high-tech manufacturing. The plan has identified ten high-tech strategic sectors, including advanced robotics and artificial intelligence, next-generation IT and telecommunications, new energy vehicles and equipment, and set specific targets for capacity and production levels and market shares both in the Chinese market and globally. For example, by 2025, China aims to achieve 70% self-sufficiency in high-tech industries and by 2049, the hundredth anniversary of the People's Republic of China, it seeks a dominant position in global markets [51]. To achieve this strategic goal, the Chinese government has deployed extensive government guidance, massive government subsidies, favourable taxation policies and land allocation, preferential access to government procurement contracts, overseas mergers and acquisitions, and other types of financial and regulatory support [47, pp. 10–12]. For example, firms listed on China's stock markets received a total amount of RMB 249.7 billion in subsidies in 2022. In the same year, the Chinese government spent $266 billion in energy subsidies, equivalent to 1.5% of China's GDP that year [27, p. 15]. In addition, as of March 2018, an estimated 1800 Chinese government guidance funds linked to MIC 2025 were collectively valued at $426 billion [67].

Specifically, energy transition, upgrading of the electricity grid, and the development of renewable energy manufacturing industry have been consistently identified as priority growth areas in key Chinese industrial policy documents over the past two decades. For example, in 2010, the identification of seven Strategic Emerging Industries singled out the clean energy industry as one area that would be targeted for state support and for leveraging access to China's market in exchange for foreign technologies [69]. Similarly, the Made in China 2025 initiative called for China to dominate the manufacturing of energy-saving and new energy vehicles as well as maintain an 80% share of renewable energy equipment production. These state-led industrial policies seek to make China dominant in global renewable energy manufacturing and set specific targets. Some of the industrial policies incentivized both the supply of renewable energy and the demand for it. Take the EVs as an example. China began handing out financial subsidies to EV companies for producing buses, taxis, or cars for individual consumers in 2009. From 2009 to 2022, the Chinese

government poured over 200 billion RMB ($29 billion) into relevant subsidies and tax breaks. The generous subsidies enabled EV companies to keep spending to improve their models and consumers to spend less to get an EV of their own. The government also helped domestic EV companies stay afloat in their early years by handing out procurement contracts for EVs to be used in China's vast public transportation system [85].Subsidies and tax breaks are not the whole picture and there were yet other state policies that encouraged individuals to purchase EVs. In populous cities like Beijing, car license plates have been rationed for more than a decade, and it can still take years or thousands of dollars to get one for a gas car. However, the process was basically waived for people who decided to purchase an EV.

In addition to offering incentives, the Chinese government also imposes regulations and applies pressure on both generating companies and provincial governments to meet renewable energy targets. For example, large generating companies have been required to meet specific renewables targets such as a minimum of 9% of power generation from renewables by 2020. There is also an annual set of province-level minimum targets for the percentage of total electricity consumption from non-hydro renewables. The central government audits the provincial performance in detail. National plans and campaigns to build large renewables bases, launched in coordination with provinces eager to obtain investment, are themselves a type of pressure on the state-owned generators to participate, which they inevitably do [53].

The Chinese government has also ensured financing not just for the plants themselves but also for the supply chain and construction infrastructure necessary to build clean energy projects. By taking advantage of Chinese industrial policies, China's suppliers have relentlessly driven down costs, making renewable development economically competitive and sustainable while achieving dominance as the largest global supplier of renewable energy products.

This is of course not to suggest that an industry policy that features consistent state support is the only factor underpinning China's impressive growth of renewable energy. Indigenous innovation and entrepreneurship, cut-throat competition, highly integrated supply chains, huge domestic demand, and the economies of scale that only a country the size of China can offer all allowed China to develop its clean energy industry. For example, China's domestic demand for electricity, which rises 15% a year, has created a large market for clean energy [9]. The same is true with EVs. China is the world's largest EV market with 6.8 million sold in 2022. The point is only that China's success in renewable energy is due in no small measure to its green industrial policy.

The Drivers of China's Green Industrial Policy

There are three main drivers underlying China's green industrial policy. The first is the rising concerns of environmental degradation in China. In the early stages of China's economic development since its adoption of the reform and opening up policy in 1978, China's rapid economic growth was accompanied by massive consumption of resources and enormous pressure on the environment and ecology. Urban water pollution, declining air quality, land degradation, and the increasing frequency

of natural disasters highlighted the severe environmental costs of rapid economic growth without due regard to environmental protection [87]. After its accession to the WTO in 2001, China has been the world's factory. The sharp increase in energy demand led to a further significant rise in China's share of global energy consumption and pollution emissions [40, p. 322]. Environmental imperatives forced China to shift towards a path of sustainable development and a low-carbon economy.

The second driver behind China's push for renewable energy is acute energy security concerns. Fast economic growth rates accompanied by increasing energy demand are rapidly depleting China's own fossil fuel deposits. China is currently the world's largest importer of oil, coal, and liquefied natural gas [71]. The dependency on foreign energy consequently makes China more susceptible to the turbulence of foreign supply sources. This is potentially further compounded by volatility in international prices for oil, gas, and coal [81, pp. 4–5]. By comparison, renewables have the advantage of being inherently indigenous energy sources, thus providing a long-term solution to foreign energy supply risk [17, pp. 33–34].

The third driver relates to tremendous economic opportunities offered by green industrial policy [46]. China believes that the green transition to reduced carbon intensity and climate adaptation worldwide will unlock new sources of economic growth, innovation, and job creation [86]. As a global manufacturing hub, China is well-positioned to turn climate action into an economic opportunity. In fact, China initially made forays into clean energy technology as a means for export. It was precisely the recognition of the immense economic opportunities in the green energy innovation that drove China to harness its competitive advantage in consistently adhering to industrial policy and lower-cost capital to lead the market in low-carbon industries [12]. When conditions for outward investment and trade turned sour, China was able to adroitly set up a domestic market. In other words, the pro-economic growth mentality has boosted China's clean energy sector.

The green industrial policy has also been customized to suit China's development needs. A case in point is the Solar Energy for Poverty Alleviation Program (SEPAP) which aims to increase the 3000 Yuan annually for poor people by installing solar panels. In 2021, the SEPAP could increase by roughly 2700 Yuan for poor households, which is 90% achieved the governmental goals [41, p. 1]. Various projections suggest that the transition to carbon neutrality in China will result in more job gains than losses [79, p. 30; 35, p. 16]. China already has an estimated 54 million "green jobs", with over 4 million jobs in renewable energy [79].

China's strong pro-growth mentality means that its climate commitment may sometimes be subordinated to other policy objectives such as energy security, employment, and economic growth. For instance, China's rapid clean energy expansion goes head to head with its continued expansion of new coal power. Despite the negative impact of coal on China's decarbonization agenda, coal has the advantages of cost-effectiveness and supply stability to ensure energy security compared with clean energy [77]. Coal combustion is currently projected to increase at a "reasonable speed" into 2030 [30]. China's strong pro-growth mentality also shapes the international posture of China on climate change. China has refused to make a much-needed political decision to start phasing out coal plants, which is necessary to meet the pledge to carbon neutrality by 2060 [80, p. 800]. Two weeks before the COP28

climate conference, China and the USA have agreed to back a global target to triple global renewable energy capacity by 2030. Still, China only agreed to "accelerate the substitution for coal, oil, and gas generation" but did not mention phasing out fossil fuels, a goal that China has described as "unrealistic". China argued that countries must refrain from "empty slogans" that are divorced from reality [61]. In other words, possible de-growth due to environmental concerns is not an option for China.

Global Implications of China's Green Industrial Policy

It is widely alleged that China's green industrial policy has posed some challenging questions to the international economic order. The world trading system was based on the liberal understanding that market forces will dictate competitive outcomes and that governments do not pre-empt the market mechanism [50], pp. 162–166]. Therefore China's specific industrial targeting of clean energy sectors for global dominance and its use of non-market policies and practices to achieve the objective are alleged to be inconsistent with the WTO rules [72].

The market-distorting effects of Chinese industrial policy affect not only trading partners' goods into the Chinese market but also Chinese exports to the world market. In particular, China's massive subsidies led to severe and persistent overproduction and excess supply in global markets. This is concerning for foreign policy makers and businesses because overcapacity incentives firms to lower prices in search of markets for their excess capacity, leading to global over-supply, price declines, weak profitability, bankruptcies, and job losses. This pattern has happened to manufacturing industries such as steel and aluminium [73, p. 35]. For instance, as the world's biggest steel producer, China exported more than 100 million metric tons of steel in 2024, inundating the world with low-cost supply and threatening to inflame global trade tensions [34].

More recently, excess capacity in clean technology sectors has emerged. Capacity utilization rates for silicon wafers, by far the most widely used semiconductors in solar panels, have dropped from 78% in 2019 to 57% in 2022. China's production of lithium-ion batteries reached 1.9 times the volume of domestically installed batteries in 2022 [7, p. 2]. The most notable concerns Chinese EVs. China is now home to more than half of the global stock of electric vehicles. In 2023, the number of EVs exported from China was 7 times greater than in 2019 and 1.7 times greater year-on-year, accounting for nearly 60% of global EV purchases [38, p. 16].

China's green industrial policy has also raised economic security and national security concerns. For example, China is in the process of consolidating control of the supply chain for EVs—from mineral extraction and battery production to manufacture and sales of the vehicles themselves. In the EU, the risks to the resilience of supply chains, such as the unavailability or scarcity of critical products, including but not limited to those linked to the EU's green transition, are considered economic security risks [21], p. 4]. Similarly, the USA has justified the imposition of tariffs and other restrictions on Chinese electric vehicles, minerals, and batteries on national security grounds [10].

Countering China's Industrial Policy

Faced with China's emerging dominance in the clean energy sector, China's trading partners have adopted a two-prong strategy. The first prong is to follow China's rulebook and turn to their own green industrial policies. For example, the Biden Administration enacted the Inflation Reduction Act (IRA) to ensure that the USA retain its leadership in clean energy industry. The landmark US clean energy legislation provides subsidies, mostly in the form of tax credits, for electric vehicles and other clean energy priorities [19]. It is widely acknowledged that elements of the IRA, such as local content requirements, are inconsistent with the WTO rules [59, p. 7]. It was also reported that the USA would defend key provisions of the IRA on national security grounds before the WTO [56]. However, the invocation of the national security clause is likely to fail because these measures were not taken in time of an "emergency in international relations" as required by GATT Article XXI(b) (iii) [19, pp. 763–765].

The second prong is to resort to trade-restrictive measures to protect domestic firms from competition with Chinese renewable energy products. For example, the USA imposed a 100% tariff on Chinese EV imports, 50% on solar cells, and 25% on EV batteries, critical minerals, and other products under Sect. 301 of the Trade Act of 1974 [74].

By contrast, the European Commission has launched a countervailing duty (CVD) investigation into Chinese EV imports and imposed definitive CVDs of between 17 and 38% in October 2024 [24]. As the blunt unilateral imposition of tariffs on Chinese EVs without restort to WTO dispute settlement processes is very unlikely to be consistent with WTO rules, this article will only focus on the EU's use of CVD investigation as a weapon against Chinese EVs.[1]

A Case Study of the EU's Countervailing Duties on Chinese EVs

As active governmental intervention in the market is a key feature of China's economic model, the WTO agreements, in particular the Antidumping Agreement and the Agreement on Subsidies and Countervailing Measures (the SCM Agreement), are powerful tools to regulate China's industrial policy [20], p. 448]. Indeed, as the EU's recent CVD investigation of the Chinese EV sector has illustrated, the SCM Agreement is remarkably resilient to address the alleged challenges posed by Chinese subsidies. Still, as discussed below, it remains an open question whether the SCM Agreement is effective in disciplining China's green industrial policy [8]. P. 578].

[1] Almost all countries have introduced some kind of support measures to help develop the clean energy sector, Such support measures have been frequently challenged at the WTO. Most disputes on clean energy up to date are concerned with the discriminatory treatment to foreign clean energy products, which is not the key issue with regard to China's green industrial policy. By contrast, the WTO jurisprudence has provided little guidance on the application of the SCM Agreement to clean energy products [3, p. 467].

In October 2023, the European Commission (the Commission) launched on its own initiative a countervailing duty (CVD) investigation into imports of Chinese EVs on the grounds that they are being subsidized and are thereby causing injury to the EU industry [55]. On 29 October 2024, the Commission concluded the investigation by imposing definitive CVDs, ranging from 17.4 to 37.6% of the import price on top of the EU's 10% tariff on all important vehicles, on imports of Chinese EVs for a period of 5 years [24]. The EU is the largest overseas market for China's EV industry and China is counting on high-technology products to help revive its flagging economy.The CVDs imposed on Chinese EVs therefore represent a formidable barrier for the Chinese EV industry where average profit margins are typically in the range of 4 to 8% [15]. The Commission's investigation describes in detail how Chinese EVs benefit from subsidies as part of China's sophisticated industrial policy and how Chinese EV imports are causing injury to the EU industry [13]. It has therefore provided an opportunity to conduct an in-depth case study of how China's green industrial policy works in practice, and how the EU utilizes domestic trade law to counter China's industrial policy.

The threshold issue in any CVD investigation is whether subsidy exists. To determine whether Chinese EVs are subsidized, the Commission has chosen a sample of three Chinese EV manufacturers, namely BYD, Geely, and SAIC. The Commission has first identified a wide range of plans and programmes to show that the Chinese government has consistently and actively supported the EV industry as a key industry of strategic importance whose accelerated development is considered a policy priority. These plans and programmes include, among others, *New Energy Vehicle Industry Development Plan* (2021–2035), *the Chinese 14th National Five-Year Plan* (2021–2026), *Action Plan for Promoting the Development of the NEV Battery Industry* (2017), *Made in China 2025* (2015), *Regulation on the Standards of the Automotive Power Battery Industry* (2015), *Guiding Opinions on Accelerating the Promotion and Application of New Energy Vehicles* (2014), *Implementation Opinions on Strengthening New Energy Vehicles* (2024), and other provincial and municipal plans [13, paras. 209–251]. By implementing the related government policies designed to achieve accelerated development, the Chinese government intervenes in the EV industry to promote the sector through various means and support key steps in their production and sale.

The Commission proceeded to identify the subsidies granted to the EV industry in China, which include preferential financing (such as provision of loans, export credits, and credit lines or bonds by state-owned banks and other financial institutions); various grant programmes; government provision of goods and services (such as land use rights, batteries and key inputs for the production of batteries) for less than adequate remuneration; revenue foregone through tax exemption and reduction programmes (such as enterprise income tax reduction, preferential pre-tax deduction of research and development expenses, dividend tax exemption, accelerated depreciation of equipment, technology transfer revenue deduction, and battery consumption tax exemption) and many others. The Commission concluded that all these support measures are countervailable subsidies because (1) they constitute a "financial contribution" from the Chinese government or a "public body"; (2) they confer a benefit to Chinese EV producers

not available in the marketplace; and (3) they are specifically targeted towards the EV industry [13, para. 159].

The generous subsidies have allowed Chinese EV producers to rapidly increase their market share in the EU. For example, the market share of Chinese EVs increased from 3.9% in 2020 to 25% in 2023, an increase of roughly 21 percentage [13, paras. 162–163]. Moreover, while many Chinese EV producers were established to serve their domestic market, the Chinese industrial policies and subsidization have already led to a situation of massive increase in capacity and significant spare capacity [13, para. 180]. The Chinese government is encouraging its EV producers to explore markets overseas. In this connection, the EU is an attractive market because the EU has set up ambitious targets that 100% of the newly registered cars should be EVs by 2035, compared to only 50% in the USA. In addition, the EU market is relatively open for Chinese EVs in comparison to other key markets such as the USA, Turkey, and India [13, para. 29]. The evidence shows that the prices of the subsidized Chinese EVs are significantly lower compared to the prices of like products in the EU, thereby depressing prices or preventing price increases which otherwise would have occurred and, consequently, placing significant pressure on EU sales, market shares, and profit margins.The combination of EV production overcapacity in China with the attractiveness of the EV market for the Chinese exporting producers lead to an imminent increase in subsidized imports which represents a clearly foreseeable and imminent threat of material injury to the EU's EV industry [13, para. 188].

The EU's CVD investigation of Chinese EV producers has several key features. First, CVD investigations are normally initiated by the injured industry of an importing country. Regarding Chinese EVs, however, the Commission launched the CVD investigation on its own initiative [13, para. 1]. Second, the Commission has cast a wide net for Chinese entities which may grant countervailable subsidies. Insofar as the EV industry is concerned, the Commission concluded that all state-owned Chinese financial institutions that provided financing to the three sampled groups of cooperating Chinese EV exporting producers are "public bodies", and that all financial institutions (including private financial institutions) operating in China have been entrusted or directed by the Chinese government to pursue governmental policies. Consequently, all commercial loans from Chinese financial institutions, even private financial institutions, to the Chinese EV industry are considered financial contributions from the Chinese government [13, paras. 77–78].

Third, as the Chinese domestic market is considered "distorted" by extensive government interference with the free play of market forces, the Commission has used alternative benchmarks to calculate the amount of subsidy that the Chinese EV industry received. Putting aside the thorny issue of how to determine whether a market is "distorted" [45], how to establish market-based prices in CVD investigations against China is also highly controversial. One may wonder whether the importing country enjoys too much discretion in making such an important determination as some of the alternative benchmarks used in the investigation may be biased against China [20, p. 446]. For example, the Commission used the price of land in Taiwan as the reference point to calculate the amount of subsidy by allowing EV producers to use land at below market price. However, Taiwan is far more densely populated

than China and its income per capita is three times higher. The reference price seems to be too high [15]. As another example, when the Commission tried to establish a market-based rate as a counterfactual to the preferential financing received by Chinese EV exporters, it assigned a credit rating of B to the three sampled Chinese firms. The B rating is extremely low for large, modestly profitable firms, such as the sampled Chinese EV producers. By comparison, almost no firm in the S&P 500 is rated B or below [15].

Finally, when calculating the amount of subsidy for below-market provision of batteries and their inputs for SAIC and Geely, the references used are the differences between the export and domestic prices of batteries. However, it is a standard practice for many exporting firms to price to market and the fact that the export price of these inputs is higher than the domestic price is not necessarily because of subsidies [57, p. 4]. This is particularly true for Chinese EVs, as the highly competitive markets for EVs, batteries, and minerals in China could drive domestic prices lower than export prices, independent of any subsidies.

Going forward, the EU is likely to make active use of trade remedy laws to mitigate market distortions stemming from China's industrial policy. However, the active use of trade remedies laws is a double-edged sword as it could actually slow the EU's green transition in view of China's dominance in the renewable energy sector [4]. Moreover, there is an emerging trend of countries launching their own industrial policy as part of their new development strategy as well as a critical part of the rebalancing effort to address other countries' state-directed industrial dominance policies [16]. The EU itself is no exception. For example, the EU issued the EU's Green Deal Industrial Plan for the Net-Zero Age in February 2023, calling for providing direct support to clean energy industries in Europe [22]. The debate on the merits of industrial policy and the rising industrial policy arms race will make it even harder to decry China's industrial subsidies.

Finally, the use of trade remedy laws to protect domestic industry is prone to trigger tit-for-tat retaliation in international trade. For instance, in response to the EU's imposition of CVDs on Chinese EVs, Beijing has initiated anti-dumping probes into European dairy products, cognac, and pork as well as filing a complaint against the EU with the WTO [78]. China and the EU have been exploring price undertakings by Chinese EV exporters as a mutually agreeable solution, which involves a minimum price commitment by individual Chinese EV exporters and a cap on volumes. However, the two parties have not yet reached any agreement by December 2024 [5].

The Limits of WTO Law

The EU's approach to Chinese EVs is an illustration of how major Western countries have become "norm entrepreneurs" in applying WTO rules proactively and innovatively in response to China's industrial policies. To begin with, the Chinese government uses extensive governmental planning to rationalize investment and guide economic development. These policies typically include government funds to support selected sectors by way of equity injection, loans and loan guarantees, tax

exemptions and reductions for eligible enterprises in priority sectors, the provision of production inputs (such as land and electricity) at preferential rates, and input materials at less than adequate remuneration, and preferential government procurement in favour of domestic goods and services [20, pp. 443–444]. In light of the WTO Appellate Body's (AB) interpretation, such financial support falls squarely within the scope of financial contributions covered by the SCM Agreement.

Furthermore, China's key industrial policy documents, such as the Five-Year plans and Made in China 2025 and their implementing regulatory instruments at both national and local levels, typically set out the priority sectors and projects. These documents usually also specify the development goals and direct the provision of a variety of financial contributions to the identified sectors. The AB's interpretation of the specificity requirement in the SCM Agreement has made it rather straightforward to establish that many Chinese subsidies are *de jure* specific [14]. Finally, the wide latitude enjoyed by the investigating authorities to use out-of-country benchmarks to calculate the amount of benefit that Chinese enterprises have received is likely to make all loans made by all Chinese commercial banks to any of the industries featured in government planning documents countervailable subsidies. The same is true with regard to all land-use rights granted by the Chinese government [2, p. 764].

The innovative application of the SCM Agreement has significant long-term consequences for the use of CVDs against China. The EU's imposition of CVDs on Chinese EVs demonstrated that the SCM Agreement is remarkably flexible when addressing Chinese industrial policies. Indeed, the SCM Agreement has been interpreted in such a manner that many key features of Chinese industrial policies could easily be challenged by its trading partners through national trade laws in an arguably WTO-consistent manner [20, p. 448].

Despite the proactive and innovative application of the SCM Agreement against China, it has become a growing concern that the SCM Agreement may not be effective in disciplining China's industrial subsidies [73, p. 5]. First, some well-known birth defects of the SCM Agreement, including the narrow definition of subsidies, a high evidentiary burden in proving the existence of a subsidy, the failure of the notification process, and the ineffectiveness of remedies in disciplining subsidies, have rendered the SCM Agreement ineffective in dealing with the complexity of the subsidy problem [8].

Second, the scale and complexity of Chinese massive subsidies, combined with China's unique economic model, have amplified the weaknesses of the SCM Agreement to a new level. One typical example is the magnitude and significance of subsidies provided by provincial and local governments. The lack of transparency of how subsidies are administered in China and the failure of China to notify any sub-central government subsidies to the WTO have made the investigations to uncover China's opaque subsidization practices and litigation at the WTO extremely time-consuming and expensive. Except for large trading countries such as the USA or the EU, most other WTO Members do not have the resources to conduct these investigations [73, p. 15]. This is of course not a surprise because many unique features of China's political economy were not fully anticipated when the WTO rules were negotiated several decades ago. It is rather awkward to apply market-oriented WTO

rules to China where extensive governmental intervention is the rule, not an exception [81], p. 285]. This in turn raises the question of how much litigation is sufficient considering the scale of te problem and whether litigation is able to solve the problem after all, if China insists on its unique industrial policies and massive subsidies. It is precisely due to such concerns that the United States has imposed unilateral trade restrictions pursuant to Sect. 301 of the Trade Act of 1974 on China, without resorting to WTO rules [73].

Others challenged the diagnosis of the effectiveness of the SCM Agreement, and the WTO rules more generally, in addressing Chinese industrial policies. They argue that existing SCM rules, particularly China's WTO-plus obligations, are under-utilized. If they are better utilized and interpreted, they will help level the playing field for foreign firms. Therefore, it was suggested that major WTO Members may bring well-coordinated CVD investigations domestically and "big, bold" cases challenging China's subsidies at the WTO [32]. This seems to be exactly the path that the EU is following in counteracting China's green industrial policy.

Conclusion

China has embedded the construction of its international identity in promoting and leading global climate governance [84, p. 372]. Central to China's impressive achievements in renewable energy is the role of state-level centralized industrial policy planning, which has effectively mobilized resources towards green energy sector, sparking a cycle of green growth.

China's domination in green technology has raised important questions for China's trading partners with profound implication for geopolitical competition and the future of global economic order [60]. In an era of great power rivalry, there is no clear picture of what an ideal clean energy industrial relationship with China should look like. If China adheres to its industrial policy model, it is unlikely to revert to business as usual. But how likely is China to abandon its successful green industrial policy? As many China observers have pointed out, China's industrial policies reflect the Chinese Communist Party's long-standing economic vision that it is unlikely for Beijing to give up [49, p. 162]. Consequently, while it is impossible to decouple from China on clean energy supply chains, China should not be surprised that other powers have responded to its quest for dominance of future energy technologies with trade and regulatory measures to protect their own consumers and producers [11].

While strategic competition in clean energy sector between China and the West may be unavoidable, deteriorating trade relations would harm all economies and slow the clean energy transition. Therefore, China and its trading partners should seek to explore a clean tech deal to limit the damage from an escalating trade dispute. In this connection, a useful historical lesson may be learned from the US-Japan trade war in the 1980s when the USA was concerned about Japanese car exports undermining domestic manufacturing capability and competitiveness. Following the Japanese precedent, the Chinese clean energy sector may seek to invest in the USA and the EU markets through joint ventures, licensing agreements, and possibly

foreign direct investment. That way, the Chinese investment in clean energy could provide jobs to local labor force, deliver more affordable green products to consumers, and onshore the latest in manufacturing techniques, putting helpful competitive pressure on their local competitors to innovate. The EU, for instance, imposes CVDs with the aim of both protecting and supporting its own EV sector and inducing Chinese producers to onshore more added value processes in the EU [44]. Similarly, President Donald Trump has on a couple of occasions signaled that Chinese EV makers should establish manufacturing facilities in the USA [29]. Another potential path is voluntary export restraint. For example, it was reported that China has suggested voluntary export restraints to address the EU's concerns about Chinese EVs flooding the market [44]. Even though there is no clear way out of the controversary over China's green industrial policy, their actions are clearly worth exploring.

Author Contribution Li wrote the first draft of the paper and Du revised and finalized the paper. Both authors reviewed the full manuscript.

Data Availability No datasets were generated or analysed during the current study.

Declarations

Ethical Approval Not applicable. This study does not involve any human or animal subjects requiring ethical approval.

Competing Interests The authors declare no competing interests.

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