

GREEN INDUSTRIAL POLICY: PROMOTING U.S.-CHINA COLLABORATION ON ADVANCING ENVIRONMENTAL GOALS

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I. Introduction

Green Industrial Policies (GIP) in the United States and China represent a pivotal intersection of environmental and economic strategy, reflecting a critical shift in global policy standards towards sustainable development. This paper presents an in-depth analysis of GIPs in the United States and China, examining their impacts on economic growth, welfare, and environmental issues. It investigates various case studies, including the domestic and international effects of American and Chinese GIPs, their influence on U.S.-China relations, and their broader implications on global sustainable development goals. It also aims to evaluate the alignment of these policies with international governance frameworks and discusses the beneficiaries and disadvantaged parties within a bilateral GIP framework. Ultimately, through a comprehensive examination, the paper explores the interplay between national policies and global environmental objectives.

II. GIP in the U.S. and China

A. American Green Industrial Policy

The Green Industrial Policy of the United States encompasses a broad range of strategies and initiatives aimed at fostering the development and adoption of green technologies while transitioning industries towards environmentally sustainable practices. This policy framework is not solely centered on recent developments like the Biden administration's Inflation Reduction Act (IRA), but is part of a broader, long-term strategic approach, and historically brought many effects domestically and internationally.

1. Domestic effects

a) Job creation

The American Recovery and Reinvestment Act of 2009 (ARRA), also known as the Recovery Act, was a significant legislative response to the Great Recession. It provided more than \$90 billion in strategic clean energy investments and tax incentives to promote job creation and the deployment of low-carbon technologies. Additionally, it leveraged approximately \$150 billion in private and other non-federal capital for clean energy investments. The investments under the ARRA supported roughly 900,000 job-years in clean energy fields from 2009 to 2015. These initiatives led to a major expansion in renewable energy generation, including more than 100,000 projects across the country. For instance, solar electricity generation increased over 30 times and wind generation over three times since 2008¹. These efforts not only boosted the renewable

¹ U.S. Department of Energy. "Recovery Act." Energy.gov., <https://www.energy.gov/recovery-act>.

energy sector but also significantly reduced the cost of clean energy technologies and created jobs in the economy.²

b) Public Health

Green Industrial Policies (GIP) can yield substantial health benefits, primarily through the improvement of environmental quality. These benefits are often a result of policies aimed at reducing pollution, promoting clean energy, and enhancing sustainability.

Enacted in 1970 and significantly amended in 1990, the Clean Air Act is a comprehensive federal law that regulates air emissions from stationary and mobile sources. This act authorized the Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment. A key health benefit of the Clean Air Act has been the reduction in pollutants like sulfur dioxide (SO₂) and nitrogen oxides (NO_x). The EPA has reported that the Clean Air Act has led to significant reductions in fine particulate matter and ozone levels, resulting in fewer cases of asthma, bronchitis, and other respiratory diseases. It is even estimated that the Clean Air Act amendments of 1990 are projected to prevent more than 230,000 early deaths in 2020 alone.³

2. *International effects*

a) Supply chains

The U.S.'s rhetoric of GIP has been closely linked to a shift towards prioritizing domestic over foreign policy. The policies of the Biden administration have tended to link environmentally friendly measures to the revitalization of American industry, with an eye towards making the U.S. independent from foreign competitors in general and China in particular by developing new, domestic supply chains to undergird the new system of green industrial production.

The Federal Buy Clean Task Force was launched in December 2021 by the Biden Administration as part of the Federal Sustainability Plan, which aims to deliver an emissions reduction pathway consistent with President Biden's goal of reducing U.S. greenhouse gas emissions by 50-52 percent from 2005 levels by 2030 and limit global warming to 1.5 degrees Celsius.⁴ Since its inception, the Federal Buy Clean Initiative has driven more than \$300 billion in private sector investments into industries whose objectives align with GIP, including clean energy, electric vehicles, semiconductors, and advanced batteries.⁵

In February 2023, the Department of Treasury and IRS announced their intention to release approximately \$4 billion in a first round of tax credits supporting projects that expand U.S.

² U.S. Department of Energy. (n.d.). Recovery Act. Energy.gov. <https://www.energy.gov/recovery-act>

³ U.S. Environmental Protection Agency, "The Benefits and Costs of the Clean Air Act from 1990 to 2020," *epa.gov*, April 2020, April 2020, [//www.epa.gov/clean-air-act-overview/benefits-and-costs-clean-air-act-1990-2020-report-documents-and-graphics](https://www.epa.gov/clean-air-act-overview/benefits-and-costs-clean-air-act-1990-2020-report-documents-and-graphics).

⁴ Office of the Chief Federal Sustainability Officer, Federal Sustainability Plan

⁵ The White House, Fact Sheet: Biden-Harris Administration Advances Cleaner Industrial Sector to Boost American Manufacturing and Cut Emissions

supply chains in the sectors of green energy technologies and critical materials, and for projects that reduce greenhouse gas emissions at industrial facilities.⁶ Policymakers in the U.S. have focused a lot of their efforts on making the supply chains of coal production in particular more environmentally friendly. Approximately \$1.6 billion of the February 2023 tax credit investment has been set aside for projects in coal communities.⁷

The creation of new clean supply chains has the effect of shifting production away from China and back to countries which prioritize environmentally friendly modes of production, of which the U.S. strives to be one. China can overcome this strategic maneuver by itself becoming an environmentally friendly production site, offering a rationale for the US to link its new supply chains to China. In this way, competition and enmity between the two countries can be harnessed to make both economies more environmentally friendly.

b) Export/Imports

A similar mechanism is at work in the balance of trade. In addition to strengthening domestic supply chains through GIP, the U.S. has sought to reduce its dependence on foreign countries through GIP by making imports unsavory to domestic consumers.

The Biden administration has placed manufacturing at the center of its GIP efforts, which have manifested themselves primarily in the form of production tax credits and additional loan guarantee authority.⁸ The Advanced Manufacturing Production Tax Credit, part of the Biden administration's Inflation Reduction Act (IRA), is an example of federal subsidies constructed to directly compete with Chinese manufacturing and regain global market share - to good effect: Credit Suisse predict that U.S. solar modules will be 50% cheaper than China modules with the tax credits in question.⁹ The Green Hydrogen Production Tax Credit, which offers \$3 per kg of green hydrogen production, seeks to double the current market price of hydrogen in the U.S. in order to give the U.S. a competitive edge in a relatively new industry.¹⁰ Both of these pieces of tax credit legislation are designed to reduce imports and make the U.S. ever-more independent as it shifts towards environmentally friendly policies.

Where the legislation does allow for imports, it is careful in specifying that these should come from trade partners which do not compromise U.S. economic independence. The IRA includes

⁶ The White House. "Fact Sheet: Biden-Harris Administration Advances Cleaner Industrial Sector to Boost American Manufacturing and Cut Emissions," [//www.whitehouse.gov/briefing-room/statements-releases/2023/03/08/fact-sheet-biden-%E2%81%A0harris-administration-advances-cleaner-industrial-sector-to-boost-american-manufacturing-and-cut-emissions/](https://www.whitehouse.gov/briefing-room/statements-releases/2023/03/08/fact-sheet-biden-%E2%81%A0harris-administration-advances-cleaner-industrial-sector-to-boost-american-manufacturing-and-cut-emissions/)

⁷ The White House. "Fact Sheet: Biden-Harris Administration Advances Cleaner Industrial Sector to Boost American Manufacturing and Cut Emissions," [//www.whitehouse.gov/briefing-room/statements-releases/2023/03/08/fact-sheet-biden-%E2%81%A0harris-administration-advances-cleaner-industrial-sector-to-boost-american-manufacturing-and-cut-emissions/](https://www.whitehouse.gov/briefing-room/statements-releases/2023/03/08/fact-sheet-biden-%E2%81%A0harris-administration-advances-cleaner-industrial-sector-to-boost-american-manufacturing-and-cut-emissions/)

⁸ Carey, Lachlan. "Green Industrial Strategy," Phenomenal World, 20 May 2023, <https://www.phenomenalworld.org/analysis/green-industrial-strategy/>.

⁹ Carey, Lachlan. "Green Industrial Strategy," Phenomenal World, 20 May 2023, [//www.phenomenalworld.org/analysis/green-industrial-strategy/](https://www.phenomenalworld.org/analysis/green-industrial-strategy/).

¹⁰ Carey, Lachlan. "Green Industrial Strategy," Phenomenal World, 20 May 2023, [//www.phenomenalworld.org/analysis/green-industrial-strategy/](https://www.phenomenalworld.org/analysis/green-industrial-strategy/).

several provisions requiring that certain inputs are produced domestically or within countries with whom the U.S. has a free trade agreement, so as to promote the “friend-shoring” of manufacturing capacity.¹¹ An example of this can be seen in the new EV tax credit’s requirement that 80% of critical minerals be extracted or processed in the U.S. or its allies, 100% of batteries be manufactured and assembled in North America, and that final vehicle assembly occur in North America.¹² In March 2023, President Biden put out a joint statement with European Commission President von der Leyen announcing the beginning of negotiations on an agreement which will “deepen our [U.S.-E.U.] cooperation on diversifying critical mineral and battery supply chains, recognizing the substantial opportunities on both sides of the Atlantic to build out these supply chains in a strong, secure, and resilient manner”.¹³ In practice, the agreement entails enabling relevant critical minerals extracted or processed in the E.U. to count toward requirements for clean vehicles established in the IRA. The joint statement explicitly stated that “Cooperation is also necessary to reduce unwanted strategic dependencies in [critical minerals] supply chains, and to ensure that they are diversified and developed with trusted partners.”¹⁴

Two contrasting narratives dominate the international debate over these subsidies. Biden administration officials argue that expanded deployment lowers the cost of critical clean energy technologies, increasing global access to the climate and economic benefits of GIP; countries with existing automotive manufacturing industries contend that these provisions are protectionist.¹⁵ The challenge before policymakers entrusted with U.S.-China relations should lie in reconciling these two views and finding a space for collaboration between the U.S. and China of the kind being developed between the U.S. and the E.U. Rather than compete for hegemony of global supply chains, the two countries should create mutually reinforcing GIP which promotes free environmentally friendly trade and mutual green industry standards to shape the international legal framework governing the flourishing of new green technologies.

B. Chinese GIP

1. Domestic effects

a) Optimized energy use structure

By the end of 2021, the proportion of clean energy consumption will have risen from 14.5% in 2012 to 25.5%, and the proportion of coal consumption will have dropped from 68.5% in 2012 to 56.0%; the installed capacity of renewable energy power generation has exceeded 1 billion

¹¹ Carey, Lachlan. “Green Industrial Strategy,” Phenomenal World, 20 May 2023, [//www.phenomenalworld.org/analysis/green-industrial-strategy/](https://www.phenomenalworld.org/analysis/green-industrial-strategy/).

¹² Carey, Lachlan. “Green Industrial Strategy,” Phenomenal World, 20 May 2023, [//www.phenomenalworld.org/analysis/green-industrial-strategy/](https://www.phenomenalworld.org/analysis/green-industrial-strategy/).

¹³ The White House. “Joint Statement by President Biden and President von der Leyen,” 10 March 2023, [//www.whitehouse.gov/briefing-room/statements-releases/2023/03/10/joint-statement-by-president-biden-and-president-von-der-leyen-2/](https://www.whitehouse.gov/briefing-room/statements-releases/2023/03/10/joint-statement-by-president-biden-and-president-von-der-leyen-2/).

¹⁴ The White House. “Joint Statement by President Biden and President von der Leyen,” 10 March 2023, [//www.whitehouse.gov/briefing-room/statements-releases/2023/03/10/joint-statement-by-president-biden-and-president-von-der-leyen-2/](https://www.whitehouse.gov/briefing-room/statements-releases/2023/03/10/joint-statement-by-president-biden-and-president-von-der-leyen-2/).

¹⁵ Carey, Lachlan. “Green Industrial Strategy,” Phenomenal World, 20 May 2023, [//www.phenomenalworld.org/analysis/green-industrial-strategy/](https://www.phenomenalworld.org/analysis/green-industrial-strategy/).

kilowatts, accounting for 44.8% of the total installed capacity of power generation, with installed capacity of hydroelectricity, wind power, and photovoltaic power generation all exceeding 300 million kilowatts, ranking first in the world. The installed capacity of hydropower, wind power and photovoltaic power all exceed 300 million kilowatts, ranking first in the world.

Under the guidance of green industrial policies, China has improved the clean and efficient utilization of fossil energy. With the goal of promoting the clean and low-carbon development of coal power, it has carried out energy-saving and carbon-reducing transformation of coal power, flexibility transformation, and heating transformation, and has implemented stricter energy-saving standards for new coal power units, so that the efficiency of power generation and the control of pollutant emissions have reached the world's leading level. We will promote the cleanliness of end-use energy, implement the substitution of coal by natural gas, electricity and renewable energy, and actively promote clean heating in winter in the northern regions. Implementing special actions to upgrade the quality of refined oil products, completing the road of upgrading the quality of refined oil products in developed countries over 30 years in less than 10 years, and bringing the quality of refined oil products to an internationally advanced level, effectively reducing the emission of pollutants from automobile exhaust.

b) Growth in remote areas

Accelerate the construction of large-scale wind power and photovoltaic bases focusing on deserts, the Gobi and desert areas, actively and steadily develop offshore wind power, actively promote urban and rural rooftop photovoltaics, and encourage the development of rural decentralized wind power. Focusing on the major rivers in Southwest China, the construction of large hydropower bases in watersheds will be promoted in an orderly manner. Develop solar thermal energy, biomass energy, geothermal energy and ocean energy according to local conditions, actively develop nuclear power in a safe and orderly manner, and vigorously develop urban waste incineration power generation. In the midst of these innovations and creations, more remote areas can also take advantage of local geography and the environment to participate in the national and even global energy market, leading to local employment and economic development.

c) Green transportation

By the end of 2021, China's new energy vehicle fleet has reached 7.84 million, accounting for about half of the global fleet. It has upgraded pollutant emission standards for motor vehicles, promoted the use of LNG power for ships and the transformation of shore power receiving facilities, accelerated the transformation and elimination of old vehicles and ships, and, since 2012, has eliminated a total of more than 30 million yellow-labeled and old vehicles, and dismantled and transformed 47,100 inland waterway vessels. All of the above demonstrates the level of greening of the transportation infrastructure society, improving the greening level of highways and railroad

d) Incentive schemes

Unlike traditional environmental policies that simply consider environmental performance, green industrial policies consider both economic and environmental benefits. In other words, green industrial policies simultaneously meet industrial and environmental goals. One example of this is the Implementation of the Golden-Sun Program. On July 16, 2009, the MOF jointly with MOST and NEA released the Notice on the Implementation of the Golden-Sun Program, which pointed out that to promote the technological progress and large-scale development of PV power generation and foster strategic emerging industries, the Central Government decided to allocate some special funds for renewable energy to support demonstration application of PV power generation technologies in various fields and industrialization of key technologies (the Golden-Sun Program in short) . From 2009 to 2012, a total of 655 projects in five phases were approved under the Golden-Sun Program, involving a total capacity of 5,930 MW and fiscal subsidies of 28 billion yuan on a cumulative basis. The Golden-Sun Program has pushed forward the rapid development of China's PV market as a whole. Before 2009, China's PV market developed slowly, with more than 95% of PV modules exported abroad. After 2009, the domestic PV market grew by more than 100% annually, with the export share declining from more than 95% in the years before to 82.5% in 2012. As of the end of 2012, the projects covered by the Golden-Sun Program involved a total installed capacity of 5,930 MW, wherein over 95% of such projects were distributed PV power generation projects. Therefore, China's distributed PV power generation made great headway, and the share of distributed PV systems in China's PV system market increased from 32.0% in 2011 to 36.4% in 2012. In particular, the Golden-Sun Program contributed to 80% of the development.¹⁶

e) Environmental regulation

Policies and regulations on environmental control are expected to impact the production cost and operation revenue of enterprises. This kind of GIP's requirement of cleaner energy and low-pollution production will inevitably increase cost burden to the enterprises , which may prompt them to postpone investment and develop new products, resulting in lower profit and production efficiency. This strand of literature essentially argues that increasing environmental regulation intensity will bring negative effects. On the other hand, the Porter Hypothesis holds that environmental regulation will promote technological development, organizational innovation, and production process innovation, resulting in improvement of TFP growth for enterprises.¹⁷ In addition, subsequent enterprise innovation and productivity growth will also effectively drive general social and economic growth and improve the efficiency of resource allocation , leading to high-quality green development .

¹⁶ Wang, Yonghua, Guoliang Luo, and Huang Kang. "Successes and failures of china's golden-sun program." *2017 6th International Conference on Energy, Environment and Sustainable Development (ICEESD 2017)*. Atlantis Press, 2017.

¹⁷ Zhang, Yijun, et al. "Can green industrial policy improve total factor productivity? Firm-level evidence from China." *Structural Change and Economic Dynamics* 59 (2021): 51-62.

Previous studies have established an “inverted N” relationship between the intensity of environmental regulation and total factor productivity (TFP) of enterprises.¹⁸ That is, in the initial stage of environmental regulation, the low external cost or penalty is not sufficient to induce the enterprises to comply and engage in technological innovation, and TFP exhibits a downward trend. As environmental regulation intensifies, enterprises are motivated to innovate and TFP rises. Finally, when environmental regulation intensifies even more substantially to exceed the endurance limit of the enterprises, TFP will start to fall.¹⁹ Also, previous studies have shown that environmental regulation exerts an elimination mechanism on enterprises. That is, low-efficiency and high-pollution enterprises will be driven out of the market, and new industries such as energy-efficient green industry, high-tech industry, and information industry will enter the market. This dynamic evolution process of enterprises’ entry and exit is the source and driving force for enterprises to improve their TFP and efficiency.²⁰

Studies have also shown that this kind of GIP can promote TFP growth of firms, thus promoting country’s GDP. Out of various policies and regulations on environmental control, the “Cleaner Production Promotion Law of the People’s Republic of China” (approved on 29 June 2002, enacted and effective on 1 January 2003) is considered the landmark piece of legislation that initiated a “revolution” in cleaner industrial production. It mandates cleaner production to be included in the national economic and social development plan, environmental protection, resource utilization, industrial and regional development plans, etc. At the same time, it requires that the backward production technology, process, equipment, and products of microenterprises should be eliminated within a time limit, and scientific research, technology development, and international cooperation on cleaner production should be encouraged.²¹

Using China’s firm-level data from 1998 to 2007, Pei Liu and his fellow researchers took the 2003 “Cleaner Production Promotion Law of PRC” as the turning point of GIP implementation, showing that this law can enhance the enterprise’s resource allocation capability and TFP growth.²²

2. *International effects*

a) Exports/Imports

China’s green industrial policies also have an important impact on its import and export trade. Taking the green industrial policy of new energy vehicles as an example, China’s five key policy support tools for new energy vehicles include tax cuts, direct subsidies to manufacturers,

¹⁸ Liu, Pei, Wei-Chiao Huang, and Hao Chen. "Can the national green industrial policy improve production efficiency of enterprises?—Evidence from China." *Sustainability* 12.17 (2020): 6839.

¹⁹ Khanna, Neha, and Florenz Plassmann. "Total factor productivity and the Environmental Kuznets Curve: A comment and some intuition." *Ecological Economics* 63.1 (2007): 54-58.

²⁰ Mattar, Yasser. "Arab ethnic enterprises in colonial Singapore: Market entry and exit mechanisms 1819–1965." *Asia Pacific Viewpoint* 45.2 (2004): 165-179.

²¹ Liu, Pei, Wei-Chiao Huang, and Hao Chen. "Can the national green industrial policy improve production efficiency of enterprises?—Evidence from China." *Sustainability* 12.17 (2020): 6839.

²² Liu, Pei, Wei-Chiao Huang, and Hao Chen. "Can the national green industrial policy improve production efficiency of enterprises?—Evidence from China." *Sustainability* 12.17 (2020): 6839.

consumer subsidies, mandatory government procurement, and the Made in China 2025 industrial policy. These kinds of policies began in the early 1990s. In 2009, the Ministry of Finance proposed the “Guidelines for Adjusting and Promoting the Automobile Industry” report which aimed to build the new infrastructure of new energy vehicles through the tax system.

What’s more, the government has provided billions of dollars in direct subsidies to manufacturers. For example, BYD, a major new energy vehicle producer, received about \$435 million in subsidies between 2010 and 2015, making it become the champion in electric and hybrid vehicles in China. Besides, the central government launched a consumer subsidy program for purchasing new energy vehicles from 2010, offering approximately \$8,700 and \$7,250 subsidies per vehicle for buying electric vehicles and plug-in hybrid vehicles. In addition, the government stimulated the demand of new energy vehicles through the official procurement contracts, which required the government fleet to include a certain proportion of new energy vehicles. More importantly, in 2015, China launched the Made in China 2025 industrial policy to comprehensively promote the implementation of a manufacturing power and the new energy vehicle industry is the focus of this program. However, in order to standardize the market order, the central government requires localities not to subsidize new energy vehicles from the end of 2018 and at the end of 2022, China’s new energy vehicle subsidies have been completely withdrawn.

These green industrial policies have greatly promoted the development of the new energy vehicle industry. Enterprises have completed technological upgrading and gained huge advantages in the world market. In 2023, China exported 1.203 million new energy vehicles, accounting for more than 60% of global new energy vehicle production and sales, ranking first in the world for nine consecutive years. However, some manufacturers from other countries voiced their concerns. For example, European Commission president Ursula von der Leyen used her 13 September State of the Union speech to make an important announcement: the launch of an anti-subsidy investigation into electric vehicles coming from China. France and its manufacturers such as Renault strongly supported the decision, and the European Automobile Manufacturers Association also welcomed it as a "positive signal." However, the Association of the German Automotive Industry, which represents the interests of German manufacturers, warned the EU that it must fully take into account the possible strong reaction from China. China’s countermeasures may hurt the interests of European exporters and make it tougher for European companies investing in China.

C. Bilateral GIP

1. Bilateral

a) US-China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s

At the 26th session of the Conference of the Parties (COP26), China, and the United States released the China-US Joint Glasgow Declaration on Enhancing Climate Action in the 2020s to the United Nations Framework Convention on Climate Change. Both nations issued a joint declaration to commit to collaborate on a variety of climate change issues, especially on developing regulatory frameworks and environmental standards to reduce greenhouse gas emissions, encouraging decarbonisation and electrification of end-use sectors and more.

The Declaration specifically recognised the role of methane emissions in climate change, prompting both nations to commit to increased action in the 2020s. Cooperative measures include enhancing the measurement of methane emissions, exchanging policy information, and conducting joint research on strategies for methane reduction. Both countries expressed their intention to implement additional measures at both national and subnational levels, with China planning to develop a comprehensive National Action Plan on methane.

The joint commitment extends to individual, joint, and collaborative efforts with other nations, tailored to respective national circumstances, to reinforce and expedite climate action and cooperation. This includes hastening the transition to green and low-carbon practices, fostering innovation in climate technology, and addressing regulatory frameworks and environmental standards related to greenhouse gas emissions reduction in the 2020s. Areas of intended cooperation also encompass maximizing societal benefits from the clean energy transition, policies encouraging decarbonization and electrification of end-use sectors, and key aspects of the circular economy, such as green design and the utilization of renewable resources.

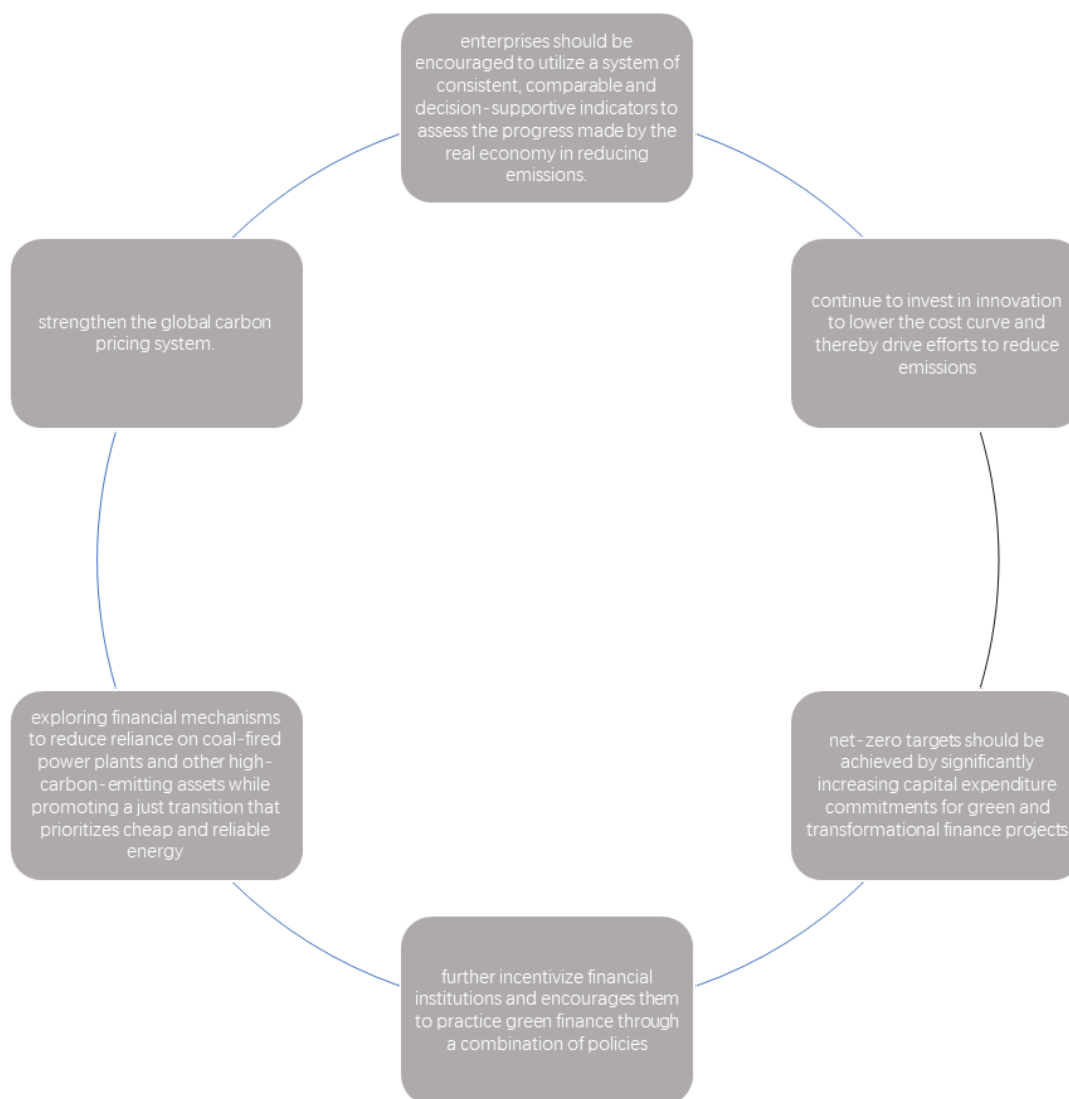
This collaboration showcased at COP26 signifies the ongoing efforts of the United States and China to work together on critical climate change issues. It aligns with the broader theme of bilateralism in green industrial policies discussed earlier, showcasing how these two influential nations are actively engaging in collaborative initiatives, not only through governmental channels but also by involving diverse stakeholders such as NGOs and enterprises. The specific measures outlined in the joint declaration reflect a comprehensive approach to addressing environmental challenges, underscoring the importance of international collaboration in the pursuit of sustainable and green industrial policies.

b) The US-China Green Finance Working Group White Paper 2022

Under the theme of "World Turning Points: Symbiosis and Reconstruction", the International Finance Forum (IFF) 2022 Annual Global Conference was held in Guangzhou on December 2-4 in the form of an online conference. During the IFF Night Talk on "Responding to Global

Climate Change", the *US-China Green Finance Working Group White Paper 2022* was released at the same time, and the participating experts and industry leaders discussed green technology, green finance, green policy and green measurement in the White Paper.

The White Paper makes six recommendations around accelerating the global transition to a low-carbon economy.



*Graph 1:
Six Recommendations around Accelerating the Global Transition to a Low-carbon Economy*

In summary, the White Paper describes in some detail the direction of investment and the ways and means of cooperation between the two countries.

Of note are: (1) the paper expands on the players in the green economy between the U.S. and China, and provides an in-depth analysis of the role of private enterprise and NGOs, and (2) the paper provides an in-depth analysis of the "institutionalization" of the green economy between the U.S. and China. Institutionalization is a necessary indicator of green industry or green finance. Institutionalization brings green finance into the realm of global public policy and ensures that the concept of sustainability green is integrated into everyday policy regulation, no longer as green consciousness, but as a green system.

2. Public sector cooperation

The potential for revitalizing public sector cooperation between the United States and China offers a strategic opportunity to address global climate challenges. Historically, the collaboration between these two nations, particularly during the Obama administration, was pivotal to the success of international climate initiatives, including the Paris Agreement. This partnership significantly contributed to global efforts in climate change mitigation through joint research projects, regulatory best practices exchanges, and high-level summits. A notable example was the 2014 Beijing summit where Presidents Barack Obama and Xi Jinping made landmark commitments towards climate action, a precedent-setting move for the Paris Agreement. President Obama announced a new target for the United States to cut net greenhouse gas emissions by 26-28% below 2005 levels by 2025. This goal was grounded in extensive analysis and was aimed at maintaining the United States on the right trajectory to achieve deep economy-wide reductions of around 80% by 2050²³. Meanwhile, President Xi Jinping of China announced targets for China to peak CO₂ emissions around 2030, aiming to peak early, and to increase the share of non-fossil fuels in primary energy consumption to around 20% by 2030²⁴. This was the first time China agreed to peak its CO₂ emissions. These initiatives were supported through existing vehicles like the U.S.-China Climate Change Working Group and the U.S.-China Clean Energy Research Center.

3. Private sector cooperation

Private sector cooperation between the United States and China in the field of clean energy and climate change has seen significant developments in the realm of technology and innovation. A notable example of such cooperation is the case of LP Amina, a North Carolina-based company. LP Amina developed and patented a new coal classifier technology that helps reduce nitrogen oxide emissions from coal boilers. Initially, this technology faced challenges in gaining traction in the U.S. market due to a lack of demonstration opportunities. However, through joint research and development initiatives and workshops facilitated by the U.S.-China Clean Energy Research

²³ U.S.-China Joint Announcement on Climate Change." The White House, Office of the Press Secretary, 11 Nov. 2014, <https://obamawhitehouse.archives.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change>

²⁴ Fact Sheet: U.S.-China Joint Announcement on Climate Change and Clean Energy Cooperation." The White House, Office of the Press Secretary, 11 Nov. 2014, <https://obamawhitehouse.archives.gov/the-press-office/2014/11/11/fact-sheet-us-china-joint-announcement-climate-change-and-clean-energy->

Center (CERC), LP Amina was able to install its classifier at the Fengtai Power Station in Anhui Province, China. This successful demonstration in China provided LP Amina with the credibility needed to market its technology back in the United States and globally²⁵. The technology not only helps reduce pollution from coal plants but also creates manufacturing jobs in the U.S., with manufacturers in Michigan, Ohio, and West Virginia producing these classifiers.

Such collaborations can lead to technological advancements that have positive impacts on both countries and globally. The exchange of data and ideas between Chinese and U.S. scientists and engineers, such as in carbon capture and storage (CCS) cost modeling, is another area where collaboration has proved beneficial. Furthermore, business collaboration between U.S. and Chinese companies, like the joint efforts by Boeing, Honeywell, PetroChina, and Air China to develop biofuels for passenger jets, demonstrates the potential for cooperative efforts to expand market opportunities and accelerate the development of clean technologies²⁶.

III. Global Implications of GIP in the U.S. and China

This section focuses on the international dimension of GIP efforts in the U.S. and China. Our analysis includes an overview of the international governance frameworks in which both countries operate in carrying out their policies, as well as an overview of the condition in which U.S. and China GIP efforts leave other countries.

A. International Governance Frameworks

1. WTO rules

The World Trade Organization (WTO) oversees global trade by establishing rules that promote smooth, predictable, and free trade among nations. The core of the WTO is its agreements, collectively serving as the legal framework for international commerce. These agreements, negotiated by a majority of trading nations, create binding contracts that limit governments to agreed-upon trade policies. This "rules-based" trading system provides clarity and stability, fostering confidence for individuals, businesses, and governments engaging in global trade. According to the World Trade Organization (WTO), the WTO rules are agreements that cover goods, services and intellectual property. They outline principles of liberalization and permissible exceptions, requiring countries to commit to reducing customs tariffs and trade barriers.²⁷

²⁵ Forbes, Sarah, and Jonathan Moch. "How U.S.-China Cooperation Can Expand Clean Energy Development." World Resources Institute, 25 Apr. 2014, www.wri.org/insights/how-us-china-cooperation-can-expand-clean-energy-development

²⁶ "Common Challenge, Collaborative Response: A Roadmap for U.S.-China Cooperation on Energy and Climate Change." *Asia Society*, asiasociety.org/center-us-china-relations/common-challenge-collaborative-response-roadmap-us-china-cooperation-energy-and-climate-change.

²⁷ *WTO | Video - Let's Talk Trade - Let's Talk Rules-based Trade*. www.wto.org/english/res_e/webcas_e/ltt_e/ltt10_e.htm#:~:text=What%20are%20the%20WTO%20rules.

With reference to the international governance frameworks and the WTO rules, there needs to be a nuanced analysis of the United States and China's trade practices and their GIP's adherence to WTO agreements. For the United States, there have been several green industrial policies put into place. According to a study by Energy Innovation, the IRA will reduce greenhouse gas emissions by 820-1200 mn metric tonnes (MMT) of CO₂ equivalent by 2030, allowing the United States to meet its goal of reducing greenhouse gas emissions by 50% from 2005 to 2030.²⁸ The IRA would also provide subsidies, loans and tax incentives to support the development of US manufacturing of components and assemblies for solar and wind energy, electric vehicles and more. To align with WTO rules, the United States would have to ensure transparency by notifying the WTO about the IRA's provisions that may affect international trade, especially if there is involvement of subsidies or trade-related measures. Not only so, the IRA's transition towards renewable energies should also be implemented without discrimination against foreign products or services to align with the non-discrimination principle in WTO rules.

However, protectionist measures may be observed in some GIPs. In the case of the "Buy American" provisions in the IRA, electric vehicle tax credits are tied to vehicles built in North America to boost demand for U.S production.²⁹ However, this may lead to disputes by relocating investments from one country to another, becoming more misaligned from WTO goals of non-discrimination. Protectionist measures that result in the relocation of investments may also disrupt the balance and fair competition in the global market.

For China, the Chinese central government has presented the Made in China 2025 plan, emphasizing on five basic principles, with that being green development, innovation-driven, quality-first, structural optimisation and talent training.³⁰ In the pursuit of green development, its green industrial policy prioritizes green manufacturing and outlines specific requirements for energy use, production processes and product life cycles in traditional manufacturing. According to the WTO principles, subsidies provided by the Made in China 2025 should not distort international trade, and its impact on trade liberalization is a key consideration of whether it aligns with international governance frameworks.³¹ With this plan's emphasis on developing domestic technologies and industries, it may result in the hindrance of promoting open markets due to the lack of entry of foreign products and services. This may also lead to concerns about technology transfer and potential protectionist measures. If policies favor domestic industries at the expense of foreign competitors or if there are barriers to technology transfer, this can be seen as inconsistent with the WTO rules.

²⁸ "Implementing the Inflation Reduction Act Report Series - Energy Innovation: Policy and Technology." *Energy Innovation: Policy and Technology*, 22 May 2023, energyinnovation.org/publication/implementing-inflation-reduction-act.

²⁹ Ho, Kyle. "Clean Vehicle Tax Credit: A New Industrial Policy and Its Impact." Stanford Institute for Economic Policy Research (SIEPR), 2021, <https://siepr.stanford.edu/publications/policy-brief/clean-vehicle-tax-credit-new-industrial-policy-and-its-impact>.

³⁰ ISDP. "Made in China 2025: The Making of a High-Tech Superpower and Consequences for Industrial Countries." ISDP, June 2018, <https://isdpr.eu/content/uploads/2018/06/Made-in-China-Background.pdf>.

³¹ Policy Institute at Indiana University. "Made in China 2020: A New World Order." The Policy Institute at Indiana University, n.d., <https://policyinstitute.iu.edu/doc/mp/made-in-china-2020.pdf>.

With this in mind, ensuring China's manufacturing practices align with international standards, particularly those set by the WTO, is of paramount importance given its central role in global production, epitomized by the ubiquitous "Made in China" label. As a major player in the global economy, China's adherence to WTO principles is critical for maintaining fair and open global trade. The country's substantial manufacturing output impacts the international economic landscape profoundly, and compliance with trade liberalization principles is crucial for fostering competition, innovation, and sustaining an equitable global marketplace.³² The emphasis on domestic technology development in the "Made in China 2025" plan highlights the delicate balance required for responsible technology transfer, essential for collaborative and mutually beneficial international economic relations. Failure to comply not only risks trade disputes and legal challenges but may also impede China's access to global markets, diminishing its reputation as a responsible global economic actor. In summary, China's commitment to compliance with WTO rules is not just a legal obligation but a strategic imperative for promoting open markets, fair competition, and contributing to the achievement of shared international goals, especially in the context of its significant influence on the global manufacturing landscape.

However, challenges arise in the potential misalignment with international governance frameworks, particularly WTO rules. Both countries exhibit protectionist measures that, if not carefully implemented, have the potential to distort international trade and competition. In the United States, the "Buy American" provisions in the IRA, while intended to boost domestic production, may raise concerns about fair competition and could lead to disputes. Similarly, China's focus on developing domestic technologies and industries under the "Made in China 2025" plan raises concerns about barriers to the entry of foreign products and potential technology transfer issues.

Looking ahead, the assessment of alignment or misalignment will depend on how these policies are implemented and the degree of transparency maintained by both nations. It is crucial for the United States and China to ensure that their green industrial policies adhere to the principles outlined in WTO agreements. This includes transparency in notifying the WTO about provisions affecting international trade, avoiding discriminatory practices against foreign products or services, and facilitating fair competition in the global market.

In summary, while positive strides have been made in environmental sustainability and green development by both the United States and China, the potential misalignment with international governance frameworks, particularly in the form of protectionist measures, underscores the importance of careful implementation, transparency, and a steadfast commitment to upholding the principles outlined in WTO agreements. The ongoing assessment will be essential to determine the overall impact of these policies on global trade dynamics and sustainable development goals.

³² The Global Trade Lawyer and the State Capitalist. "China and the WTO Dispute Settlement System." *China Perspectives*, vol. 2012, no. 1, 2012.

B. Winners and Losers in a Bilateral GIP Framework

1. *Winners*

a) Nations Invested in Green Technologies

Nations that have invested in green technologies and renewable energy may gain a competitive edge and access to new markets, capitalizing on the increased global demand for sustainable products. A simple example would be the case Germany.

The first German Feed-in Tariff (EEG) came into force in 2000, with the goal of promoting the production of renewable energy. These tariffs guarantee renewable energy generators a fixed payment for the energy they feed into the grid, offering long-term security for investors. Impact was summarized by Future Policy in 2023: “the production of electricity from renewable sources in Germany was only 6.2% in 2000, increasing to 23.7% by 2012 and up to about 28 % in 2014. If this growth continues accordingly, Germany could be powered by 100% renewable electricity by 2030.”³³ The German FIT achieved economies of scale, bringing down the price of solar. In large part because of its FIT, solar prices have plummeted since the German FIT was enacted in 2000.³⁴

b) Industries in Renewable Energy and Sustainable Practices

Companies in sectors like renewable energy, energy efficiency, and sustainable agriculture stand to benefit as policies and incentives under GIP support their growth and innovation. For example, the European Union's Green Deal Industrial Plan, introduced in 2023, exemplifies such a policy in action. It focuses on creating a predictable and simplified regulatory environment, providing faster access to funding through streamlined subsidy policies, enhancing skills, and promoting open trade for resilient supply chains. These pillars are aimed at supporting the transition to a net-zero age, demonstrating the practical application of green industrial policies.³⁵

c) Workforce in Green Sectors

Employees and entrepreneurs in industries that align with GIP objectives may find increased job opportunities and investment in skills development. Going back to the earlier example with Germany, their GIP's focus on research and development has substantially grown the renewable energy sector, doubling the number of jobs since 2004 to over 371,000. These policies encourage investment in new green technologies and sectors, known as sunrise policies, which lead to increased employment, economic growth, job stability, and higher salaries. Additionally, GIP involves sunset policies to support workers in declining industries through retraining schemes

³³ FuturePolicy.org. "The German Feed-in Tariff." Future Policy, World Future Council, <https://www.futurepolicy.org/climate-stability/renewable-energies/the-german-feed-in-tariff/>.

³⁴ "Lessons from Germany." Clean Coalition, <https://clean-coalition.org/feed-in-tariffs/lessons-from-germany/>.

³⁵ Reinsch, William Alan, Emily Benson, and Thibault Denamiel. "Green Industrial Strategies: Takeaways for Transatlantic Trade." Center for Strategic & International Studies, 15 Mar. 2023, <https://www.csis.org/analysis/green-industrial-strategies-takeaways-transatlantic-trade>.

and funding to adjust production technologies, ensuring a just transition to more sustainable industries.³⁶

d) Local Communities

Last but not least, Regions that adopt GIP can experience improved environmental conditions and reduced health risks associated with pollution and climate change. The green transformation of industrial parks in China's Jiangsu Province is one such example. This initiative, reported by UNEP within the Partnership for Action on Green Economy (PAGE) framework, showcases a regional policy that effectively greens industrial parks.³⁷ This has implications for improved regional environmental quality and public health by reducing pollution levels associated with traditional industrial practices.

2. *Losers*

a) Fossil Fuel-Dependent Countries

Nations that rely heavily on fossil fuels for their economic output might face challenges in transitioning to a green economy and may experience short-term economic losses. Nations, which include Iraq, Libya, Venezuela, and others, often have economies deeply intertwined with fossil-fuel income and carbon-intensive industries³⁸. They struggle with diversification and are vulnerable to the impacts of climate change, particularly in regions with widespread poverty and conflict.³⁹

b) Traditional Heavy Industries

Industries that are slow to adapt to green practices may lose out due to stricter regulations and a potential decline in market share as consumer preferences shift towards sustainable options. Direct emissions from heavy industries account for a significant portion of global GHG emissions, with iron and steel production and cement production alone contributing about 27 percent each. These industries often require high-temperature heat, generally produced by burning fossil fuels, a method that is challenging to replace with electricity or other less carbon-intensive sources. Decarbonizing these sectors will likely require new processes and technologies, which are currently in nascent stages and will need further research and development, as well as rapid scaling to meet the 2050 deep decarbonization goals.⁴⁰

³⁶ "Green Industrial Policy." Wikipedia, Wikimedia Foundation, https://en.wikipedia.org/wiki/Green_industrial_policy.

³⁷ "Green Industrial Policy." UNEP - UN Environment Programme, United Nations Environment Programme, <https://www.unep.org/explore-topics/green-economy/what-we-do/economic-and-trade-policy/green-industrial-policy>.

³⁸ Peszko, Grzegorz, Amelia Midgley, Dimitri Zenghelis, and John Ward. "Diversification and Cooperation in a Decarbonizing World: Climate Strategies for Fossil-Fuel Dependent Countries." World Bank Blogs, 2 July 2020, blogs.worldbank.org/climatechange/diversification-and-cooperation-decarbonizing-world-climate-strategies-fossil-fuel.

³⁹ "Diversification and Cooperation in a Decarbonizing World: Climate Strategies for Fossil-Fuel Dependent Countries." World Bank Blogs, blogs.worldbank.org/climatechange/diversification-and-cooperation-decarbonizing-world-climate-strategies-fossil-fuel.

⁴⁰ Levi, Michael, Sarah Ladislaw, et al. "Climate Solutions Series: Decarbonizing Heavy Industry." Center for Strategic & International Studies, 22 Apr. 2021, www.csis.org/analysis/climate-solutions-series-decarbonizing-heavy-industry.

c) Workers in Declining Industries

Individuals employed in sectors that are negatively impacted by GIP, such as coal mining, may face job losses and require retraining for new green jobs. The Global Energy Monitor (GEM) found that over 400,000 workers are employed in mines slated to close before 2035. If global warming is to be limited to 1.5 degrees Celsius, the coal workforce would need to be reduced to less than 10% of its current size, indicating a drastic decrease in available coal mining jobs.⁴¹ This further emphasizes the scale of the workforce challenge as the world moves towards greener energy sources.

IV. Conclusion

In conclusion, this paper sheds light on the significant impact of Green Industrial Policies on economic growth, welfare, and environmental issues in the United States and China. Through detailed case studies and analysis, it becomes evident that these policies play a crucial role in shaping the future of sustainable development and green economies.

In the US, initiatives like the Federal Buy Clean Task Force have driven substantial private sector investments into industries aligned with GIP objectives, such as clean energy and electric vehicles. The focus on developing environmentally friendly supply chains, particularly in coal communities, reflects a commitment to reducing greenhouse gas emissions and promoting clean energy investments. On the other hand, China has made remarkable advancements in renewable energy and green transportation under the guidance of green industrial policies. The country has achieved significant milestones in renewable energy power generation capacity and has implemented measures to promote clean and low-carbon development, including the transition to cleaner energy sources and stricter energy-saving standards.

Moreover, the examination of US-China relations in Green Industrial Policy reveals both disputes and opportunities for bilateral dialogue and cooperation. Despite challenges such as protectionist tactics and job losses in declining industries, the U.S. and China have developed policies to support renewable energy and reduce greenhouse gas emissions. This paper also finds that synergies between the public and private sectors are essential to address the global climate dilemma and promote clean technologies, and the compliance with the rules of the World Trade Organization and responsible technology transfer are key to promoting fair competition and sustainable economic development.

Ultimately, the winners and losers within a bilateral Green Industrial Policy framework must be carefully identified and addressed to create a more inclusive and equitable transition towards green economies. By fostering collaboration, innovation, and shared responsibility, Green

⁴¹ Stanway, David. "Coal Industry Faces 1 Million Job Losses from Global Energy Transition - Research." Reuters, 10 Oct. 2023, www.reuters.com/markets/coal-industry-faces-1-million-job-losses-global-energy-transition-research-2023-10-10/.

Industrial Policies can pave the way for a greener, more sustainable future for both China and the US.

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Appendix

Appendix I. Comparative Case Studies: GIP in Other Countries

The U.S. and China are both major political and economic powers whose economies are intricately interwoven with those of other countries. As such, GIP efforts in the U.S. and China are best understood in the context of priorities arising from the situations of other global players. This paper has focused on the effects of GIP in the U.S. and China on other countries. The following appendix provides an overview of GIP efforts in countries other than the U.S. and China. We focus on case studies which provide particular insights into the challenges and potential of GIP globally. The reader is invited to read these case studies with an eye towards discerning which of the strategies outlined below could apply to the U.S. and/or Chinese context(s), and how the U.S. and China might use their economic and geopolitical leverage to expedite GIP efforts in the countries of interest.

a. EECCA (Eastern Europe, Caucasus, and Central Asia)

The GREEN Action Task Force was founded in 1993 following the fall of the Berlin Wall and subsequent dissolution of the USSR, with the mission of guiding improvement of environmental policies in transition economies of the post-Soviet space “by promoting the integration of environmental considerations into the processes of economic, social and political reform.”⁴² In addition to national governments of the EECCA region, the Task Force has engaged bilateral and multilateral development partners such as international organizations, Development Financial Institutions, and OECD countries.⁴³

b. India

India has been said to have skipped industrialization on its trajectory from agriculture to services.⁴⁴ For this reason, the country has potential to carry out its industrialization along GIP lines. Industrial policy in India has so far been primarily limited to the localization of components, with few clean energy and RD&D investments and GIP being market-led and politics-centered.⁴⁵ GIP would be more successful if it were made a national priority rather than a political question. As sustainability is at the heart of successful industrialization, GIP is

⁴²Organization for Economic Development. “GREEN Action Task Force: Mission, substantive focus, working methods and members,” <https://www.oecd.org/environment/outreach/green-action-taskforce-mission.htm>.

⁴³Organization for Economic Development. “GREEN Action Task Force: Mission, substantive focus, working methods and members,” <https://www.oecd.org/environment/outreach/green-action-taskforce-mission.htm>.

⁴⁴Institute for Studies in Industrial Development. “Towards Green Industrialization in India: Challenges and Opportunities,” June 2022, <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://isid.org.in/wp-content/uploads/2022/07/PB2203.pdf>.

⁴⁵Institute for Studies in Industrial Development. “Towards Green Industrialization in India: Challenges and Opportunities,” June 2022, <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://isid.org.in/wp-content/uploads/2022/07/PB2203.pdf>.

compatible with India's ambitions to make industrialization a key component of its modernization. A further key to India's green industrialization is the involvement of public research institutions and higher educational institutions, whose research capabilities can be harnessed to guide India's energy RD&D.⁴⁶

c. MENA (Middle East and North Africa)

The MENA-OECD Initiative was founded at the request of MENA countries in 2005 with the goal of facilitating cooperation between the OECD and the MENA region to "promote policies for sustainable and inclusive growth."⁴⁷ A central tenet of the MENA-OECD Initiative is the MENA-OECD Competitiveness Programme, which strives to mobilize investment, private sector development and entrepreneurship to drive inclusive growth and employment in the MENA region.⁴⁸

Middle Eastern governments have been pursuing GIP independently of the OECD as well. Saudi Arabia aims to decrease reliance on oil in power generation by investing SR 380 billion and including incentives such as tax exemptions for renewable energy projects, as well as directing its sovereign wealth fund - the PIF, or Public Investment Fund - to support green initiatives financially.⁴⁹ Among the PIF's projects is Saudi Renewable Energy, which aims to build the world's largest single-site solar power plant.⁵⁰ The Middle East Green Initiative, led by Saudi Arabia, has the goal of reducing carbon emissions from the region's oil and gas industry - one of the world's largest sources of methane - by 60%.⁵¹ No deadline has been set for the attainment of this reduction goal, tempering excitement about this pledge.⁵² Concrete progress has been achieved, however: overall investment in renewables in the Middle East has risen sevenfold in a decade, from \$960 million in 2011 to \$6.9 billion in 2021. Notwithstanding these advances, the region produced less than 4% of its electricity through renewable energy sources in 2020, compared to 28% worldwide.⁵³ It remains to be seen how OPEC countries will balance their interest in fostering the oil and gas industry integral to their prosperity with their GIP ambitions.

⁴⁶ Institute for Studies in Industrial Development. "Towards Green Industrialization in India: Challenges and Opportunities," June 2022, <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://isid.org.in/wp-content/uploads/2022/07/PB2203.pdf>.

⁴⁷ Organization for Economic Development. "The MENA-OECD Initiative on Governance and Competitiveness for Development," <https://www.oecd.org/mena/initiative-governance-competitiveness.htm>.

⁴⁸ Organization for Economic Development. "The MENA-OECD Initiative on Governance and Competitiveness for Development," <https://www.oecd.org/mena/initiative-governance-competitiveness.htm>.

⁴⁹ Larhlid, Amal. "Is a Green Deal the Middle East's Path to Sustainability?," PwC Middle East, <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.pwc.com/m1/en/publications/documents/is-a-green-deal-the-middle-east-pat-h-to-sustainability.pdf>.

⁵⁰ Larhlid, Amal. "Is a Green Deal the Middle East's Path to Sustainability?," PwC Middle East, <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.pwc.com/m1/en/publications/documents/is-a-green-deal-the-middle-east-pat-h-to-sustainability.pdf>.

⁵¹ Gibney, Elizabeth. "The Middle East Is Going Green While Supplying Oil to Others," Scientific American, <https://www.scientificamerican.com/article/the-middle-east-is-going-green-while-supplying-oil-to-others/>.

⁵² Gibney, Elizabeth. "The Middle East Is Going Green While Supplying Oil to Others," Scientific American, <https://www.scientificamerican.com/article/the-middle-east-is-going-green-while-supplying-oil-to-others/>.

⁵³ Gibney, Elizabeth. "The Middle East Is Going Green While Supplying Oil to Others," Scientific American, <https://www.scientificamerican.com/article/the-middle-east-is-going-green-while-supplying-oil-to-others/>.

d. Africa

GIP has great potential in Africa due to the continent's comparatively low level of industrialisation. Industrialization is widely perceived as a key to economic development and attendant improvement in living standards. Rather than follow the European and East Asian models verbatim, Africa has the potential to mold its own "green" path towards industrialization, sowing environmentally-friendly practices into its development from the outset. The main barrier to effective GIP in Africa is lack of state capacity.⁵⁴ The multiplicity of policy objectives involved in GIP both justify and complicate state intervention by leading to coordination challenges which inhibit the creation of "pockets of efficiency" within the general indeterminacy of the African policymaking space.⁵⁵ Successful implementation of GIP calls for resolution of coordination challenges born of the involvement of a plurality of international, national, and local actors from both public and private spheres in the policy process.⁵⁶

Scholars have argued that in order to be sustainable, industrial policy making in Africa must be adaptive, that is, open to experimentation to account for the unique challenges of contemporary industrialization; capacitated, or headed by effective, resourceful government institutions; consultative, based on collaboration between policymakers and business to expedite the transition from policy to practice; partnership-based, taking advantage of foreign investment and economic trends; and transboundary, uniting African countries in their common pursuit of sustainable industrialization and involving foreign partner states with a stake in African trade and by extension industrialization.⁵⁷ Political turmoil in Ethiopia and declining US support have jeopardized the successes of African GIP initiatives, illustrating the importance of government commitment and foreign partnerships in Africa's green industrial development.⁵⁸

i. Nigeria

Nigeria's 2021 Climate Change Act marks a milestone as the first comprehensive climate change legislation in West Africa, reflecting Nigeria's commitment to climate action. The Act was

⁵⁴ Shen, Wei et al. "The political economy of green industrial policy in Africa: Unpacking the coordination challenges in Ethiopia," ScienceDirect, August 2023.

⁵⁵ Luke, David et al. "White Paper on Sustainable Industrialisation in Africa: the Art of Upgrading Industrial Policymaking Itself," Firoz Lallji Institute for Africa, LSE, June 2023, <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.lse.ac.uk/africa/assets/Documents/White-Paper-on-Sustainable-Industrialisation-in-Africa.pdf>

⁵⁶ Luke, David et al. "White Paper on Sustainable Industrialisation in Africa: the Art of Upgrading Industrial Policymaking Itself," Firoz Lallji Institute for Africa, LSE, June 2023, <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.lse.ac.uk/africa/assets/Documents/White-Paper-on-Sustainable-Industrialisation-in-Africa.pdf>

⁵⁷ Luke, David et al. "White Paper on Sustainable Industrialisation in Africa: the Art of Upgrading Industrial Policymaking Itself," Firoz Lallji Institute for Africa, LSE, June 2023, <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.lse.ac.uk/africa/assets/Documents/White-Paper-on-Sustainable-Industrialisation-in-Africa.pdf>

⁵⁸ Luke, David et al. "White Paper on Sustainable Industrialisation in Africa: the Art of Upgrading Industrial Policymaking Itself," Firoz Lallji Institute for Africa, LSE, June 2023, <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.lse.ac.uk/africa/assets/Documents/White-Paper-on-Sustainable-Industrialisation-in-Africa.pdf>

enacted following Nigeria's participation in the 2021 UN Climate Change Conference (COP26), where it pledged to achieve net-zero emissions by 2060⁵⁹. The law serves as a framework for national climate actions, building upon prior climate change policies such as the Revised National Climate Change Policy and the First Nationally Determined Contribution (NDC)⁶⁰.

The Climate Change Act aims to mainstream climate actions in line with Nigeria's development priorities, setting ambitious targets for net-zero emissions between 2050-2070. It mandates the Ministry of Environment to establish a carbon budget and create a National Climate Change Action Plan every five years. The Action Plan focuses on identifying actions for climate adaptation and mitigation, enhancing energy efficiency, and promoting renewable energy use across various sectors. The Act also emphasizes the integration of climate change strategies into national development plans and mobilizes finance for climate change policies and actions⁶¹.

The Act imposes obligations on both public and private entities, requiring them to implement mechanisms for a low-carbon, environmentally sustainable, and climate-resilient society. Private entities with more than 50 employees must achieve annual carbon emission reduction targets and appoint a climate change officer to oversee compliance. The National Council on Climate Change, chaired by the President, coordinates national climate actions, administers the Climate Change Fund, and collaborates with the Nigerian Sovereign Green Bond to meet Nigeria's NDCs. The Council also has the power to enforce compliance, with potential penalties for non-compliance, reflecting the Act's emphasis on accountability and legal enforcement in climate actions. The Climate Change Act lays the groundwork for increased climate litigation in Nigeria, enabling legal actions against entities that fail to comply with climate obligations. This potential for litigation, alongside the Act's requirements and objectives, signifies a robust legal framework that aligns Nigeria's climate actions with its national development goals.

ii. Kenya

Kenya's Vision 2030 is the nation's long-term development blueprint aimed at creating a globally competitive and prosperous country with a high quality of life by 2030. Integral to this vision is the Green Economy Strategy and Implementation Plan (GESIP), launched in 2017⁶². GESIP is a comprehensive strategy that seeks to transition Kenya to a sustainable path by enhancing low-carbon, resource-efficient, equitable, and inclusive socio-economic development⁶³. The

⁵⁹ A Review of Nigeria's 2021 Climate Change Act: Potential for Increased Climate Litigation." International Union for Conservation of Nature, 28 Mar. 2022, www.iucn.org/news/commission-environmental-economic-and-social-policy/202203/a-review-nigerias-2021-climate-change-act-potential-increased-climate-litigation.

⁶⁰ The Climate Change Act 2021: Sectoral Imperative." KPMG, Apr. 2022, kpmg.com/ng/en/home/insights/2022/04/the-climate-change-act-april-2022.html

⁶¹ Lambo, Jumoke, et al. "The Climate Change Act 2021: Key Points for Consideration." Mondaq, 10 Feb. 2023, www.mondaq.com/nigeria/climate-change/1281268/the-climate-change-act-2021-key-points-for-consideration

⁶² Green Economy Strategy and Implementation Plan (GESIP)." Kenya Climate Innovation Center, 23 Aug. 2017, www.kenyacic.org/2017/08/the-green-economy-strategy-and-implementation-plan-gesip/.

⁶³ Kenya Green Economy Strategy and Implementation Plan." International Institute for Sustainable Development, www.iisd.org/projects/kenya-green-economy-strategy-and-implementation-plan.

strategy aims to address social and economic constraints and align with the outcomes of the United Nations Conference on Sustainable Development.

GESIP outlines five thematic areas: promoting sustainable infrastructure, building resilience, managing natural resources sustainably, enhancing resource efficiency, and fostering social inclusion and sustainable livelihoods. Within these themes, GESIP proposes various strategies such as revising the Feed-in-Tariff policy to include off-grid generation, promoting drought-tolerant crops, and increasing water availability. These strategies are designed to guide both the public sector and stakeholders in developing programs that support a green economy⁶⁴.

The implementation of GESIP is governed by principles of sustainable development, such as sustainable consumption and production, equity, and social inclusion. These principles ensure that Kenya's approach to the green economy is holistic, taking into account ecological, economic, and social factors. The private sector plays a crucial role in this transition, especially in adopting green economy technologies and practices in a sustainable manner. The Kenya Climate Innovation Center (KCIC) supports this transition by enhancing green growth awareness and catalyzing the adoption of climate change solutions, focusing on policy dialogues and stakeholder engagement to promote sustainable growth⁶⁵.

Kenya's GESIP represents a strategic commitment to transforming the country's socio-economic trajectory into one that is more sustainable, inclusive, and resilient. By incorporating green growth initiatives into national development goals, GESIP signifies Kenya's dedication to balancing economic growth with environmental stewardship and social equity. This approach is crucial for achieving sustainable development and serves as a model for other countries looking to integrate environmental sustainability into their development agendas.

e. France

In May 2023, France's "Projet de loi relatif à l'industrie verte" (Green and Sustainable Industry Draft Law) was approved by the Conseil des Ministres⁶⁶. The bill has three primary objectives: promoting the establishment of industrial sites in France, financing green industrial projects, and enabling greener public procurement. The legislation represents a significant move to restructure the French economy with a greater emphasis on environmental sustainability, particularly in industrial practices. The bill also includes provisions for amending existing French legislation to prepare for the direct application of the European Union's ELTIF 2.0 regulation from January

⁶⁴ Green Economy Strategy and Implementation Plan (GESIP)." Kenya Climate Innovation Center, 23 Aug. 2017, www.kenyacic.org/2017/08/the-green-economy-strategy-and-implementation-plan-gesip/.

⁶⁵ Green Economy Strategy and Implementation Plan (GESIP)." Kenya Climate Innovation Center, 23 Aug. 2017, www.kenyacic.org/2017/08/the-green-economy-strategy-and-implementation-plan-gesip/.

⁶⁶ ELTIF 2.0 and Green Industry Draft Law: France's First Measures to Strengthen ELTIF Product Offerings Among Other Sustainable Initiatives." Dechert LLP, 19 June 2023, www.dechert.com/knowledge/onpoint/2023/6/eltif-2-0-and-draft-law-on-the-green-industry---first-french-i.html

2024. This would involve changes in the eligibility of certain financial instruments and funds, enhancing the flexibility of green investments in France.

An important component of this legislation is the introduction of the “Green Industry Investment” tax credit, scheduled to be incorporated into the French Finance Act of 2024⁶⁷. This tax credit is inspired by the US Inflation Reduction Act and China's subsidy policy and aims to attract investments in green technologies from French-based enterprises. It's expected to cover 20-45% of investments in strategic sectors for green reindustrialization, potentially leading to 23 billion euros in investments and the creation of 40,000 jobs by 2030. The tax credit targets investments in tangible and intangible assets related to green technology sectors, such as wind turbines, solar panels, batteries, and heat pumps. Additionally, the French government plans to allocate 500 million euros annually to this tax credit, positioning France as the first European country to leverage relaxed European state aid rules to promote green industrialization⁶⁸.

f. Vietnam

In 2021, Vietnam's Prime Minister approved the National Green Growth Strategy for 2021-2030, with a vision extending to 2050. This forward-looking strategy marks a shift in Vietnam's growth model, aiming for economic development that is both environmentally sustainable and socially equitable. It involves restructuring the economy to facilitate a transition to a green and carbon-neutral economy, contributing significantly to global efforts in reducing global warming⁶⁹.

Vietnam's Green Growth Strategy sets targets for reducing greenhouse gas emissions, improving energy efficiency, and promoting sustainable urban development. By 2030, the strategy aims for a 15% reduction in greenhouse gas emissions relative to GDP compared to 2014, and a 30% reduction by 2050. In terms of energy, the target is for renewable energy to account for 15-20% of Vietnam's energy supply by 2030, increasing to 25-30% by 2050. These goals are integral to Vietnam's commitment to sustainable urban development and energy conservation⁷⁰.

The strategy places a strong emphasis on sustainable urban development. By 2030, Vietnam aims to collect and treat 95% of urban solid waste, increase the use of clean energy in buses, and ensure that a significant percentage of urban wastewater is treated to national standards. For the year 2050, the vision includes the complete treatment of urban solid waste, comprehensive urban drainage systems, and a substantial increase in the use of clean energy in public transport⁷¹.

⁶⁷ France Introduces Its 'New Green Industry Investment' Tax Credit." Cleary Gottlieb Steen & Hamilton LLP, 6 July 2023, www.clearygottlieb.com/news-and-insights/publication-listing/france-introduces-its-new-green-industry-investment-tax-credit

⁶⁸ Thomas, Leigh. "France Budgets 500 Mln Euros Annually for Green Industry Tax Credit." Reuters, 16 May 2023, www.reuters.com/sustainability/france-budgets-500-mln-euros-annually-green-industry-tax-credit-2023-05-16/

⁶⁹ Vietnam: Vietnam Issues Green Growth Strategy 2021-2030 Vision to 2050." USDA Foreign Agricultural Service, 8 Nov. 2021, fas.usda.gov/data/vietnam-vietnam-issues-green-growth-strategy-2021-2030-vision-2050

⁷⁰ Dezan Shira & Associates. "Vietnam's National Green Growth Strategy: Unpacked." Vietnam Briefing, 7 Dec. 2023, www.vietnam-briefing.com/news/vietnams-national-green-growth-strategy-unpacked.html/

⁷¹ Dezan Shira & Associates. "Vietnam's National Green Growth Strategy: Unpacked." Vietnam Briefing, 7 Dec. 2023, www.vietnam-briefing.com/news/vietnams-national-green-growth-strategy-unpacked.html/

A key aspect of Vietnam's strategy is its focus on social justice goals. By 2030, the strategy aims to improve the human development index, ensure the majority of the population has access to clean water, and implement air quality management plans across all provinces. By 2050, these goals are set to advance further, aiming for higher human development indices and broader access to clean water, illustrating Vietnam's commitment to social equity alongside environmental sustainability⁷².

The National Action Plan on Green Growth, approved in 2022, details the specific tasks and responsibilities for achieving these goals. This plan outlines the mobilization of funds from various sources, including state budgets, international assistance, private investments, and community contributions. Additionally, Circular 10/2023/TT-BKHDT, issued by the Ministry of Planning and Investment, defines statistical indicators for measuring the impact of the strategy, breaking it down into four main goals: reducing greenhouse gas emissions, reforming the economy, developing urban areas sustainably, and enhancing social equality and resilience⁷³.

Appendix II. Fossil Fuel Companies & Green Industrial Policies

As the two largest economies in the world, it is not surprising that the US and China are also large producers and consumers of petroleum products, and coal, the two largest fossil fuel energy sources. In 2021, 55% of Chinese primary energy consumption was coal and 19% was petroleum. In contrast, only 15% was from renewable sources like hydropower, wind and solar. In 2022, US energy consumption was 36% from coal and 10% petroleum. In contrast, US consumption of renewable energy was 13%. The primary difference between the two countries' consumption is in natural gas sourced energy, which was 9% of Chinese consumption but 33% of US consumption. While natural gas is a fossil fuel, it emits significantly less greenhouse gases per energy generated. Natural gas consumption for energy emits 117 pounds of CO₂ per 1 million British thermal units (MMBtu), while coal emissions are over 200 pounds per MMBtu, and petroleum products of 160 pound per MMBtu. In this analysis of Green Industrial Policy, today often called sustainability, we will look at policy comparisons on petroleum and coal sourced energy in the US and China. The largest US based fossil fuel companies are ExxonMobil and Chevron, which are all in the oil and gas space. The largest coal producing companies are Peabody Energy Corporation and Arch Resources. In China, the largest oil and gas companies are China National Petroleum Company (CNPC) and Sinopec. In coal production, the largest Chinese companies are China Shenhua Energy Company (CSEC) and China Coal Energy Company (CCEC).

⁷² Dezan Shira & Associates. "Vietnam's National Green Growth Strategy: Unpacked." Vietnam Briefing, 7 Dec. 2023, www.vietnam-briefing.com/news/vietnams-national-green-growth-strategy-unpacked.html/

⁷³ Encouraging Green Growth Strategies for Vietnam's Industries." Ministry of Planning and Investment, Foreign Investment Agency, 3 Nov. 2021, fas.usda.gov/data/vietnam-vietnam-issues-green-growth-strategy-2021-2030-vision-2050

For the petroleum products companies, ExxonMobil states “We plan to reduce the intensity of our operated upstream greenhouse gas emissions by 15 to 20 percent by 2025, compared to 2016 levels.” While ExxonMobile has many documents relating to lowering emissions and sustainability on their website, a search of these documents yielded no additional numerical targets beyond a 15-20% reduction to 2016 levels. Many of the documents on the ExxonMobile website speak to public-private policy needs but lack specifics. There is not a sustainability, or Green Industrial Policy specific webpage on the ExxonMobile website. Chevron does have a sustainability page on their website, with a prominent link to their 2022 Sustainability report. Chevron does publish a greenhouse gas reduction target – 71g CO₂e/MJ (Scope 1, 2, and 3) by 2028, as well as investment levels targeting emissions reductions: \$2B USD in carbon reduction investments by 2028, and \$8B USD lower carbon investments by 2028. Chevron also reports they have reduced their petroleum products Scope 1 and Scope 2 carbon emissions intensity by nearly 40% from 2016 levels.

CNPC has a prominent link to “Environment and Society” on their homepage, with a stated objective of “zero defects, zero injuries and zero pollution.” CNPC has many documents on their website, and lots of words, but only a few specific actions. Most notably, CNPC states they intend to help China achieve carbon neutrality before 2060, utilizing a three-step approach of “Clean Alternatives, Strategic Replacement and Green Development.” Their strongest numerical target is to have gas production at 55% of its hydrocarbon mix by 2025. Sinopec’s website was not functioning this weekend, so I will have to revisit that when available.

For the US coal companies, Peabody Energy has a prominent link to a sustainability page. Peabody has a “net zero emissions by 2050” ambition, and specifically identifies a target of 15% reduction in Scope 1 and 2 emissions by 2026.” Arch Resources also has a prominent link to sustainability on their homepage, and highlights a 47% reduction in Scope 1 and 2 emissions since 2010, driven by a 55% reduction in thermal coal production.”

CSEC has a prominent sustainability link on its home page. Again, we see many words, and some targets, but a lack of definite action plans. CSEC’s carbon emissions are actually growing, with an expected peak in 2030 at plus 30.8% compared to 2020. They plan to reduce this by 4% by 2025 as compared to 2020. CCEC also provides a highly visible link to its sustainability goals, but provides no numerical information. In their report, they state “the Company is checking and auditing greenhouse gas data in 2021 of its key emission entities...and will disclose it in the ESG report next year.”

In summary, there is a wide variation in environmental targets, lots of discussion about public-private partnerships to achieve global climate change objectives, and a lack of specifics relating to how governments and industry can collaborate to achieve these objectives. Specifically, there are almost no plans for the worlds’ two largest economies, and governments to cooperate in a meaningful way to make meaningful progress in working toward a cleaner world.