



# Enhancing a Just Transition Finance System for Carbon-Intensive Industries

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## Executive summary

Global support for climate-aligned financing has surged to address climate change. Transition finance, introduced by the Organisation for Economic Co-operation and Development (OECD), facilitates this process while ensuring social justice. This study looks at just transition challenges in China's steel, shipping, and information and communication technology (ICT) industries. The Chinese steel industry alone accounts for more than 50% of global steel output and 25% of direct industrial greenhouse gases (GHGs). With the example of decarbonization efforts underway in these massive industries in China and examples of other nations' efforts, this study provides an in-depth analysis and policy recommendations for just financing in these industries by examining transition pathways and financial needs.

To set the foundation, this report begins with an overview of the concept of a just transition and its global implications. **Chapter 1** introduces the foundational concepts and definitions of "just transition", drawing from global actions and initiatives. This first chapter details how just transition principles are embedded within China's key development concepts, setting the stage for a comprehensive understanding of the topic. **Chapter 2** examines just transition dynamics within China's steel industry, investigating the way challenges are addressed with volatile steel output and declining employment, balancing ambitious transition goals with layoff challenges, and the role of skill training and cross-sector job placements at investigated companies. Also explored within this chapter are transition finance drivers such as transition standards, bond markets, and PE/VCs, while comparative insights are gleaned by looking at transition roadmaps from the US and Japan.

**Chapter 3** studies the shipping industry, highlighting rising shipping volumes and associated emission increases. Decarbonization pressures are discussed, along with employee safety concerns with new fuel types, as well as justice initiatives in the community, workplace, and training. The chapter also investigates transition finance drivers and the use of internal capital and external tools and looks at Singapore's fiscal strategy for green shipping as a comparative model. The report then shifts focus to another critical sector in China's economic landscape: the ICT industry. **Chapter 4** analyzes the increased emissions and current reliance on thermal power for ICT sectors. This chapter also examines the circular economy as a national strategy, working condition issues, and financial support mechanisms in the Yangtze River Delta. The chapter next reviews South Korea's public-private partnerships and extended producer responsibility in ICT recycling, providing a comparative perspective.

**Chapter 5** addresses the risks of "transition-washing", emphasizing the need for a unified global transition taxonomy and stringent disclosure requirements. This chapter explores China's increasing disclosure requirements for transition plans and the integration of just transition principles into financial instruments. Building on these insights, this report provides targeted policy recommendations to enhance China's transition finance strategies. **Chapter 6** advocates for region-specific transition funds, robust training programs, leveraging carbon pricing revenues, and stricter information disclosure criteria for transition bonds and sustainable finance products.

**Chapter 7** concludes the report, summarizing the key findings and emphasizing the importance of coordinated efforts across sectors and regions both within China and internationally. The report's findings emphasize the need for comprehensive policies and practices to balance economic growth with environmental sustainability and social equity, ensuring a resilient and inclusive future for these industries in China and elsewhere. The appendix and references provide additional data, figures, and sources that support the analysis and recommendations presented in the report.

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# Abbreviations

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ADB	Asian Development Bank
AIB	Asian Infrastructure Investment Bank
BMZ	German Ministry for Economic Cooperation and Development
CBI	Climate Bonds Initiative
CCS	Carbon Capture and Storage
CCUS	Carbon Capture, Utilization, and Storage
CDP	Carbon Disclosure Project
CFEI	China Federation of Electronics and Information Industry
CII	Carbon Intensity Indicator
CMSA	China Maritime Safety Administration
CSSC	China State Shipbuilding Corporation
EEDI	Energy Efficiency Design Index
EEXI	Energy Efficiency Existing Ship Index
EIB	European Investment Bank
EMDEs	Emerging Market and Developing Economies
EPR	Extended Producer Responsibility
GFANZ	Glasgow Financial Alliance for Net Zero
GHGs	Greenhouse Gases
GRI	Global Reporting Initiative
I-JETP	Indonesia's Just Energy Transition Partnership
ICS	International Chamber of Shipping
ICT	Information and Communication Technology
IGF Code	International Code of Safety for Ship using Gases or other Low-flashpoint Fuels
ILO	International Labour Organization
IMO	International Maritime Organization
ISSB	International Sustainability Standards Board
ITF	International Transport Workers' Federation
JTF	Just Transition Fund
LNG	Liquefied Natural Gas
MEE	Ministry of Ecology and Environment, People's Republic of China
MIIT	Ministry of Industry and Information Technology, People's Republic of China
MoC	Ministry of Commerce, People's Republic of China
MoF	Ministry of Finance, People's Republic of China
MoT	Ministry of Transport, People's Republic of China
MT	Million Tonnes (million metric tons)
NDRC	National Development and Reform Commission, People's Republic of China
NGFS	Network for Greening the Financial System
NOx	Nitrogen Oxides
OECD	Organisation for Economic Co-operation and Development

PBoC	People's Bank of China
PE/VC	Private Equity and Venture Capital
PPPs	Public-Private Partnerships
PSBoC	Postal Savings Bank of China
SASAC	State-owned Assets Supervision and Administration Commission of the State Council
SMEs	Small and Medium-sized Enterprises
SMSA	Shanghai Maritime Safety Administration
SOEs	State-Owned Enterprises
SOx	Sulfur Oxides
SSP	Sustainable STEEL Principles
TCFD	Task Force on Climate-Related Financial Disclosures
TPT	Transition Plan Taskforce
UNDP	United Nations Development Programme
UNGC	United Nations Global Compact
UK	The United Kingdom
US	The United States (of America)
WBCSD	World Business Council for Sustainable Development



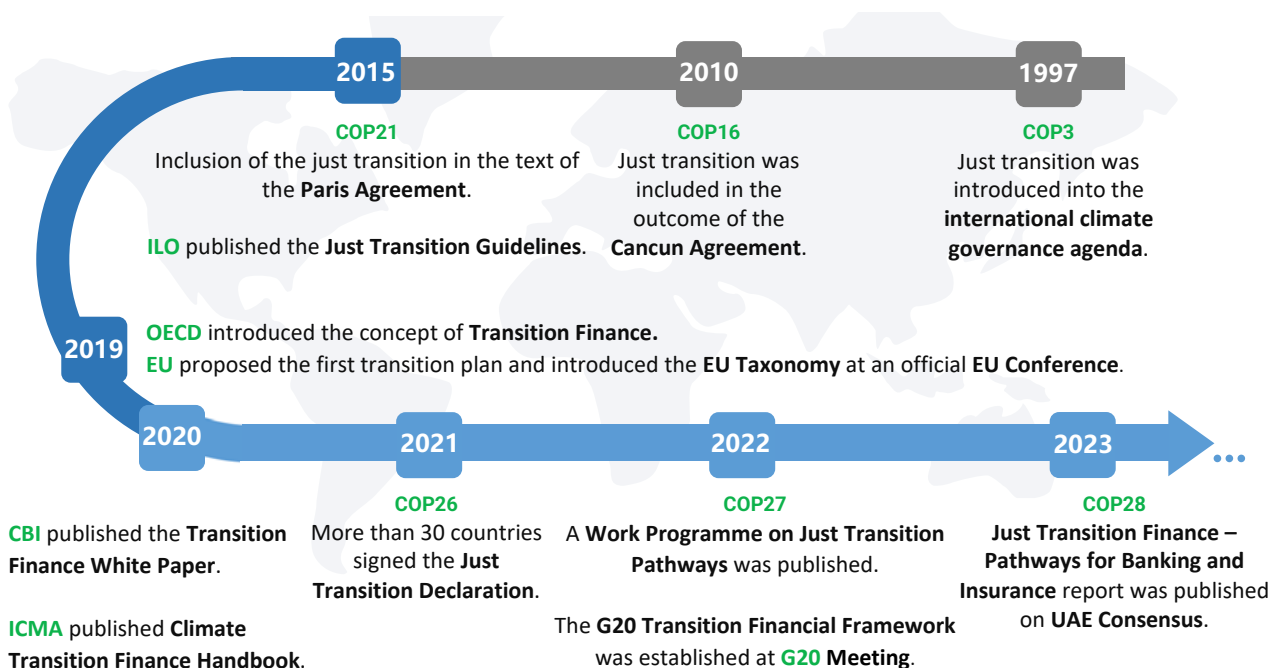
# 1. Background to the concept of just transition

## 1.1. Just transition definitions and global actions

As climate change emerges as a critical challenge of the 21st century, nations worldwide are adopting strategies to foster green and low-carbon economic transitions. These strategies increasingly integrate social justice objectives, aiming for fair processes that safeguard health, employment, and community well-being. Job losses incurred should be justly compensated. The notion of just transition originated from North American labor unions in the 1970s, initially focusing on labor issues. In 1997, this concept was incorporated into the international climate governance agenda, setting a precedent for its evolution. This idea gained formal recognition in the 2010 Cancun Agreement, followed by the 2015 Paris Agreement, which emphasized the essential role

of just transition in global climate policies. In the same year, the International Labour Organization (ILO) issued Guidelines for a Just Transition, further bolstering the framework for implementation. In 2019, the Organisation for Economic Co-operation and Development (OECD) highlighted the financial dimensions of a just transition by introducing transitional finance. The growing influence of the just transition concept was highlighted in 2021, when over 30 countries signed the Just Transition Declaration. More recently, in 2023, the UAE Consensus at COP 28 propelled this agenda forward by publishing 'Just Transition Finance – Pathways for Banking and Insurance,' demonstrating an ongoing global commitment to developing fair and equitable transitional strategies for climate and financial policies worldwide (Figure A 1).

Figure A 1 - Just Transition Global Efforts <sup>1</sup>



1. Sourced from public records by the authors

## 1.2. Just transition embedded in China's key development concepts

The concept of just transition, initiated in the US by trade unions to protect workers' rights, aligns with the core values of China's socialist system, which is inherently focused on the protection of workers' rights.<sup>2</sup> In 2015, China announced its commitment to 'Chinese-style Modernization', a form of modernization characterized by social and environmental objectives.<sup>3</sup> This approach integrates ecological conservation, resource efficiency, and low-carbon development with economic progress to achieve high-quality growth.<sup>4</sup> It further promotes social equity by linking ecological wealth with material wealth, supporting underdeveloped regions and low-income groups towards prosperity, and ensuring equitable wealth distribution—all in alignment with the principles of just transition.<sup>5</sup> In 2021, China announced the '1+N' climate policy framework, which sets forth national directives to peak carbon emissions before 2030 and to achieve carbon neutrality by 2060. This framework highlights the role of just transition in pursuing the dual carbon goals: the policy seeks to harmonize economic objectives with public interests and social responsibilities to facilitate the green transition, and to balance sectoral and regional impacts during the industrial low-carbon transition while mitigating systemic risks in high-emission industries.<sup>6</sup> In 2024, China's Central Financial Work Conference introduced the Five Priorities in Finance strategy providing financial support for just transition initiatives.<sup>7</sup> This

includes developing 'digital finance' to extend financial services to broader populations, including in rural and remote areas. Moreover, the priorities emphasize developing 'inclusive finance and elderly finance' to meet the diverse financial needs across different life stages.<sup>8</sup> This strategy ensures that disadvantaged groups and the elderly benefit from economic development, reinforcing the equitable and sustainable transition to a low-carbon economy.

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2. MGFlab, 2023, Just transition: Who pays, <https://mgflab.nsd.pku.edu.cn/qyzz/ceafd15440ad43fdb41e48b1c36fc39b.htm>
  3. Statement on the decision of the Central Committee of the Communist Party of China (CPC) on further comprehensively deepening reform and promoting Chinese-style modernization, (关于《中共中央关于进一步全面深化改革、推进中国式现代化的决定》的说明), [https://www.gov.cn/yaowen/liebiao/202407/content\\_6963773.htm](https://www.gov.cn/yaowen/liebiao/202407/content_6963773.htm)
  4. Xuexi.cn, 2023, Deng Xiaoping's exploration and contributions to Chinese-style modernization, [https://www.xuexi.cn/lqpage/detail/index.html?id=13131520670641849451&item\\_id=13131520670641849451](https://www.xuexi.cn/lqpage/detail/index.html?id=13131520670641849451&item_id=13131520670641849451)
  5. Economy and Information Technology Department of Zhejiang, 2022, Enhancing synergy between carbon peaking carbon neutrality and common prosperity (强化碳达峰碳中和与共同富裕的目标协同), [https://jxt.zj.gov.cn/art/2022/3/14/art\\_1229567693\\_58928343.html](https://jxt.zj.gov.cn/art/2022/3/14/art_1229567693_58928343.html)
  6. Finance member of Wuhan Municipal Committee, 2024, Some thoughts on just transition and coordination of Five Priorities in Finance, [https://jrj.wuhan.gov.cn/ztl\\_57/xyrd/dcczbsc/202404/t20240417\\_2389891.shtml](https://jrj.wuhan.gov.cn/ztl_57/xyrd/dcczbsc/202404/t20240417_2389891.shtml)
  7. PBoC, 2024, PBoC holds meeting on making significant efforts in the areas of technology finance, green finance, inclusive finance, pension finance, and digital finance, <http://camlmac.pbc.gov.cn/en/3688110/3688172/5188125/5259687/index.html>
  8. Ibid. 5

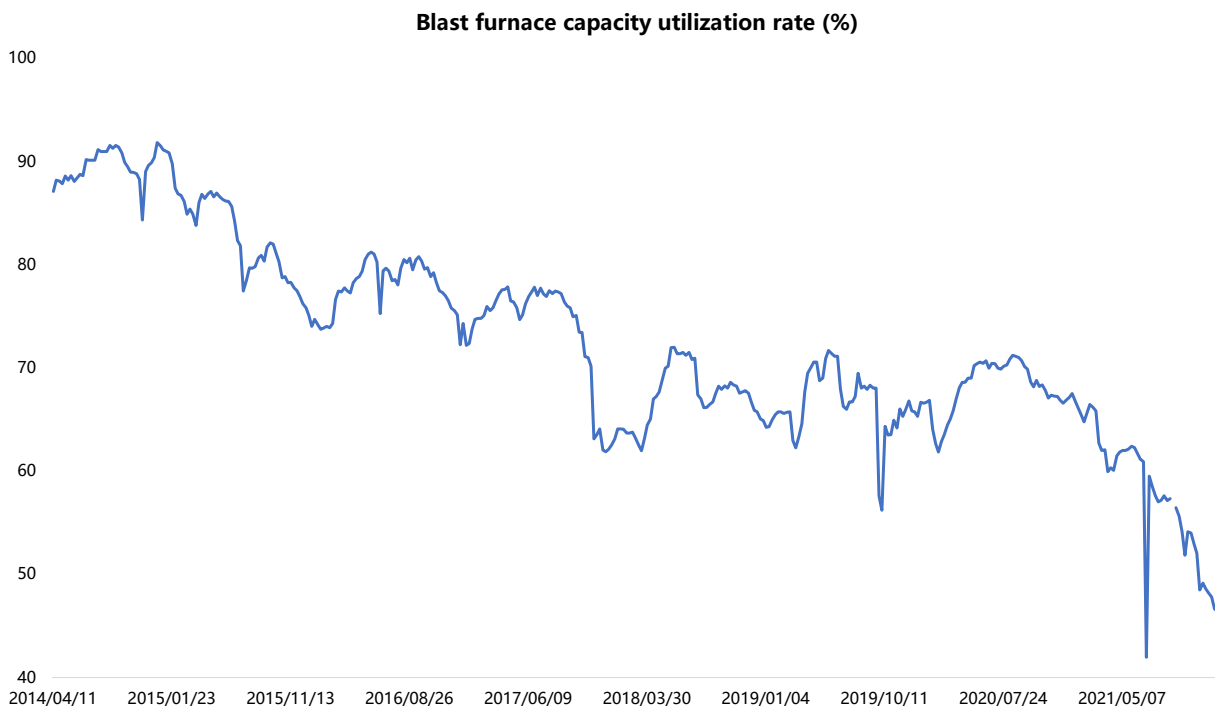
## 2. Exploring just transition dynamics in China's steel industry

### 2.1. Volatile steel output and declining employment

The blast furnace capacity utilization rate is a crucial leading indicator for production levels in the steel industry. The currently fluctuating utilization rates suggest a potential decline in China's steel production (Figure A 2). This volatility highlights underlying challenges in maintaining consistent production levels that may be attributed to factors such as market demand fluctuations<sup>9</sup>, environmental regulations<sup>10</sup>, and supply chain disruptions.<sup>11</sup> The continuous downward trend in the utilization rate implies that the steel industry could face ongoing production declines, posing concerns for industry profitability and employment stability. The

employment situation in China's steel industry has always been a matter of national concern. A persistent decline in total employment within the steel industry, particularly within State-owned Enterprises (SOEs), has been observed from 2012 to 2022 (Figure A 3). The number of people employed in the steel industry decreased from approximately 3 million in 2013 to just over 1 million in 2022, while employment in SOEs dropped from about 450,000 in 2013 to nearly negligible levels by 2022. Several key factors contribute to this downward trend in employment, including industry consolidation, technological advancements, shifts in production strategies aimed at reducing carbon emissions, and addressing overcapacity issues.

Figure A 2 - Blast Furnace Capacity Utilization Rate <sup>12</sup>



9. World Steel Association, 2023, Worldsteel Outlook, <https://worldsteel.org/zh-hans/media/press-releases/2023/worldsteel-short-range-outlook-october-2023/>

10. Ibid. 5

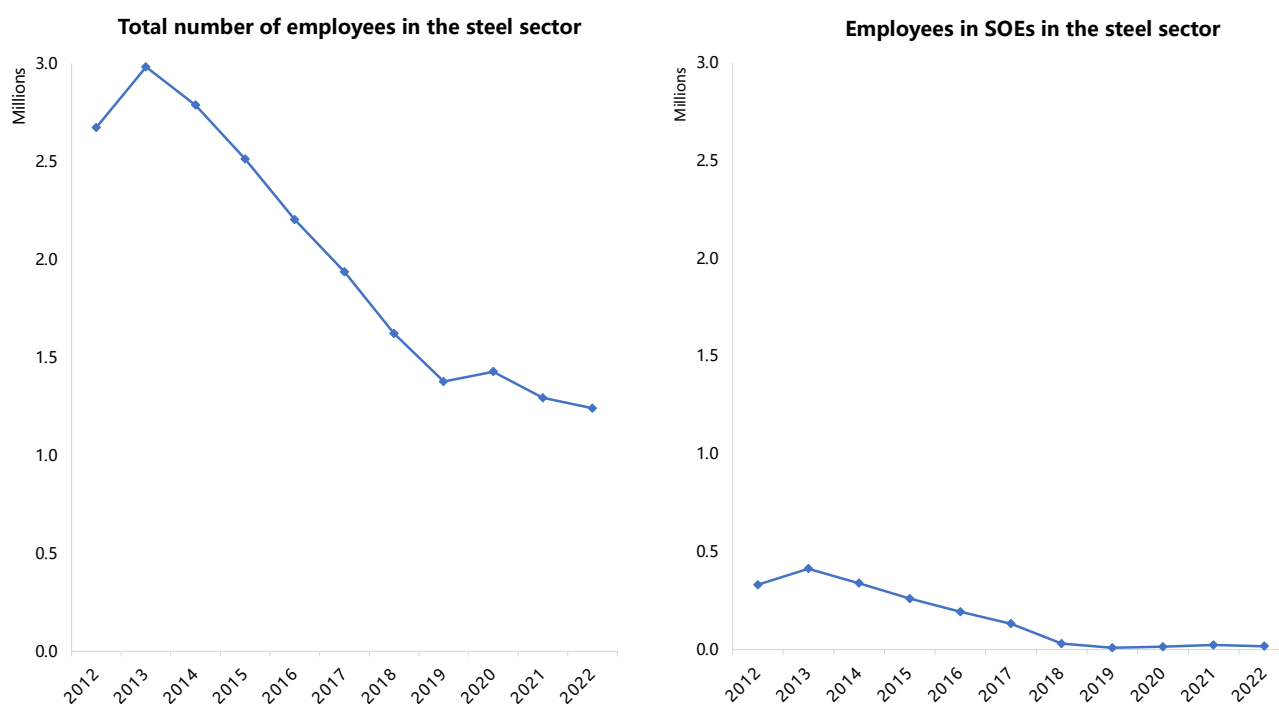
11. CFPCI, 2021, Steel industry supply chain to achieve the goal of 'dual carbon' path analysis and impact on cost, (钢铁产业供应链实现“双碳”目标路径分析及对成本的影响), [https://www.ndrc.gov.cn/wsdwhfz/202111/t20211119\\_1304410\\_ext.html](https://www.ndrc.gov.cn/wsdwhfz/202111/t20211119_1304410_ext.html)

12. Data source: Mysteel.com

Decarbonization efforts have led to the implementation of stricter environmental regulations and policies aimed at minimizing the carbon footprint of heavy industries, including steel. This transition towards greener production methods often necessitates the modernization of facilities and processes that can result in a reduced need for manual labor and a shift towards automation and more efficient technologies. For instance, China's steel industry has been under pressure to reduce emissions in line with the country's commitments under the Paris Agreement. This has prompted the closure of older, more polluting steel plants and the consolidation of production into fewer, more modern facilities. The Chinese steel industry

historically struggled with overcapacity, leading to market inefficiencies and financial strain on steel producers. The government has undertaken substantial restructuring efforts aimed at reducing excess capacity and improving industry profitability. The 'supply-side structural reform' initiative launched in 2015 aimed to cut excess capacity in various industries, including steel. This reform led to the closure of many inefficient and redundant steel mills, resulting in job losses. Additionally, the governmental guidelines in 2016 called 'Guiding Opinions on Resolving the Overcapacity in the Steel Industry,' targeted a reduction of steel production capacity by 100-150 million tonnes (MT) within five years, further impacting employment levels.<sup>13</sup>

Figure A 3 - Employees in the Steel Industry <sup>14</sup>



13. State Council of the People's Republic of China, 2016, Guiding Opinions on Resolving the Overcapacity in the Steel Industry, (国务院关于钢铁行业化解过剩产能实现脱困发展的意见), [https://www.gov.cn/zhengce/content/2016-02/04/content\\_5039353.htm](https://www.gov.cn/zhengce/content/2016-02/04/content_5039353.htm)

14. Data source: China Statistical Yearbook 2023

## 2.2. Balancing transition goals with layoff challenges

China has ambitious plans for decarbonizing its steel sector and steel has been designated as a key focus area in China's decarbonization initiatives.<sup>15</sup> The Action Plan for Peak Carbon Emissions in the Steel Industry (2024-2025) aims to strengthen capacity adjustments and accelerate low-carbon transition. Concurrently, the Implementation Plan for Carbon Peaking in Industrial Sectors establishes stringent targets for energy conservation and emission reduction, with ambitious milestones set for 2025 (Table A 1). By 2025, China aims to retrofit 80% of its 2023 steel production capacity to achieve ultra-low emissions, a commitment highlighted by the executive chairman of the China Iron and Steel Association.<sup>16</sup>

At the same time, the Chinese government is actively promoting the extensive use of scrap steel and the development of a circular economy. The '14th Five-Year Plan for Circular Economy Development' aims to increase domestic scrap steel supply to 320 MT by 2025, raising its contribution to total crude steel production from 10% in 2020 to 30% by 2025. In response to emission reduction requirements, one of the most direct measures taken by the Chinese government in 2021 was to reduce steel production, resulting in a decrease of 31.9 MT of crude steel output, lowering it to 1.0328 billion tonnes, marking the first year-over-year decline in six years. Additionally, China plans to incorporate the steel industry into the national carbon emissions trading system by 2025 to achieve carbon reduction. The RMI Think Tank projects that China's crude steel production will peak at approximately 1.1 billion tonnes by 2024 and, under a zero-carbon scenario, will decrease to about 58% of its 2020 levels by 2050.<sup>17</sup>

The Chinese government has categorized the pathway to reducing emissions in China's steel industry into three main areas: technological complexity and cost, historical overcapacity and labor reductions, and the need for digital transformation and employee retraining. First, the sheer scale and technical demands of the industry present substantial challenges. As of 2023, the Chinese steel industry accounts for more than 50% of global steel output and 15% of China's direct industrial greenhouse gases (GHGs). Mainstream technologies like hydrogen-based steelmaking and Carbon Capture, Utilization, and Storage (CCUS) are expected to reduce CO<sub>2</sub> emissions by about 43%. However, these advances are not without cost, requiring marginal abatement costs ranging from -5 USD to 0.5 USD per kg of CO<sub>2</sub> (approx. -4.48 EUR to 0.45 EUR or CNY -35.63 CNY to 3.56 CNY).<sup>18</sup> Secondly, historical overcapacity has led to significant labor force reductions, with notable declines in employment within SOEs in the steel sector (Figure A 3). This overcapacity has necessitated substantial layoffs, highlighting the socio-economic challenges of restructuring the industry. A transition plan to a sustainable model must consider these workforce implications and potential disruptions. Lastly, the industry is simultaneously embracing a digital transformation that demands substantial investment in employee retraining programs. Steel companies are allocating resources to equip their workforce with digital skills, essential for adapting to new technologies and processes that enhance operational efficiency and maintain competitive advantage in a technology-driven market.

15. Xinhuanet, 2023, The steel industry is promoting green and low-carbon transition, <http://www.news.cn/energy/20230713/8c4570a53cfb4e129723382a14db8378/c.html>

16. CISA, 2023, China's steel industry is fully implementing a green and low-carbon transition plan for the future, <https://www.chinaisa.org.cn>

17. RMI, 2021, China's zero-carbon path to steel under carbon neutrality targets, <https://rmi.org.cn/wp-content/uploads/2021/09/202109290950304147.pdf>

18. Ren, L., 2021, A review of CO<sub>2</sub> emissions reduction technologies and low-carbon development in the iron and steel industry focusing on China

### 2.3. B Steel and N Steel: cross-sector job placement and skills training

This study investigated Steel Company B in Shanghai, which has effectively reduced its carbon emissions by 20% and cut solid fuel consumption by 30% through energy substitution, process optimization, and the adoption of innovative technologies such as hydrogen-enriched carbon recycling blast furnaces.<sup>19</sup> Despite facing overcapacity challenges, Steel Company B has implemented various strategies to ensure a fair transition for its workforce. Following its acquisition of M Steel, which also faced overcapacity, the company introduced measures to protect employees' income rights during this transition. Employees were presented with two options: a consensual termination with substantial compensation, calculated as a multiple of the city's average wage and subsidies decreasing over time, or a sabbatical to pursue self-employment with two years of continued social security support (Table A 2). This approach showed a commitment from B Steel to ensuring fair treatment and economic stability for its employees amid the restructuring process.

Another enterprise, Steel Company N in Jiangsu Province, has invested over 10 CNY billion (approx. 1.26 EUR billion 1.4 USD billion) to advance its low-emission technologies, resulting in emission reductions of 60.5% for sulfur dioxide, 74.3% for nitrogen oxides, and 89.6% for particulate matter from pre-transformation levels of steel production.<sup>20</sup> Beyond environmental improvements, Steel Company N has focused on preserving the local environment, enhancing residents' quality of life, and maintaining employment stability. To address skill mismatches in its

workforce, the company developed a tourist district featuring an innovation center, museum, iron mine memorial hall, and an ecological wetlands park. This initiative has redirected employees with outdated skills, diversifying business operations and enhancing the local ecological infrastructure in line with China's 14th Five-Year Plan, which promotes industrial tourism to boost local economies.<sup>21</sup> Furthermore, Steel Company N's comprehensive training programs through N University have prepared employees for technological shifts and new job roles, offering over 12,000 on-site and 160,000 online training hours to 6,700 employees.<sup>22</sup> In 2023, frontline production workers make up 65% of Steel Company N's workforce, with 66% lacking a college degree (Figure A 4). Recognizing the need for upskilling, more than 6,300 training sessions were conducted that were focused on new technologies, safety, and environmental standards,<sup>23</sup> reflecting N Steel's dedication to fostering a skilled, adaptable workforce and supporting individual career development and the company's overall growth.

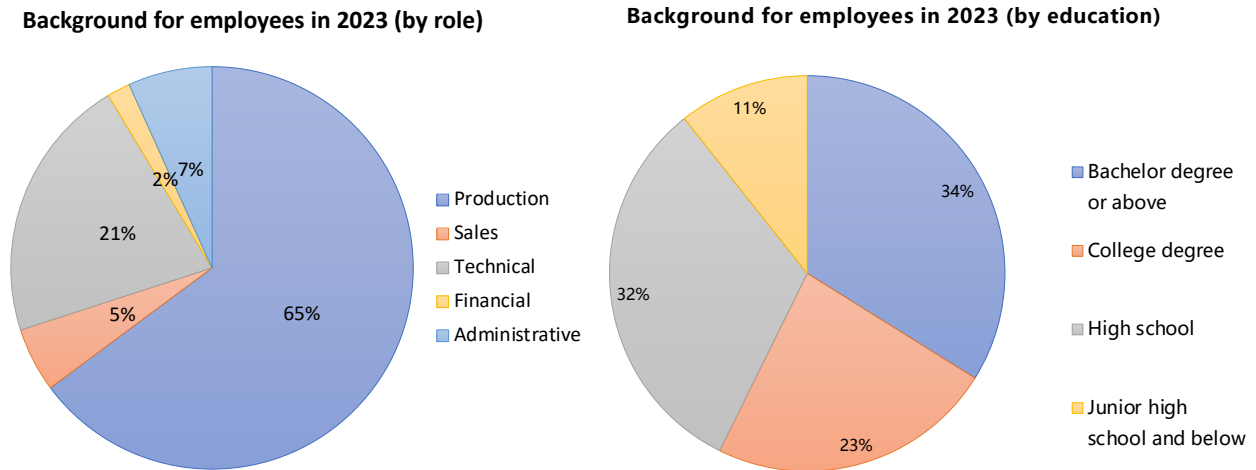
19. Source: public materials of the Steel Company B

20. Source: public materials of the Steel Company N

21. State Council of the People's Republic of China, 2021, China's 14th Five-Year Plan, (《中华人民共和国国民经济和社会发展第十四个五年规划和2035年远景目标纲要》), [https://www.gov.cn/xinwen/2021-03/13/content\\_5592681.htm](https://www.gov.cn/xinwen/2021-03/13/content_5592681.htm)

22. Ibid. 17

23. Source: fieldwork and interviews

Figure A 4 - Backgrounds of N Steel Employees <sup>24</sup>

#### 2.4. Transition finance drivers: standards, bond markets, PE/VCs

Chinese private steel enterprises face challenges in effectively utilizing financial tools to reduce costs during the low-carbon transition. In China, the industry's transition requires an estimated 5 to 6 CNY trillion by 2060 (approx. 500 to 750 EUR billion or 560 to 840 USD billion), illustrating the need for supportive transition finance mechanisms at a national level.<sup>25</sup> Local governments in Shanghai, Huzhou, and Hebei are developing transition finance standards to support the steel industry's shift towards sustainability. These standards for enterprises target capacity reduction, relocation, upgrading, and promoting sustainable development. Supported technologies include energy-efficient processes, waste heat recovery, and CCUS. Hebei emphasizes hydrogen metallurgy and intelligent manufacturing, Huzhou focuses on renewable energy integration and advanced waste treatment, while Shanghai prioritizes digital transformation and smart energy management. As a region

where heavy industry is central to its economy, Hebei has led China in crude steel production for at least the 20 consecutive years leading up to 2024. This prominent industrial status necessitates specific and precise disclosures about its just transition process (Table A 3).

China's steel enterprises predominantly use debt instruments to support their low-carbon transition. These include transition bonds for specific projects like energy efficiency upgrades and carbon capture, as well as sustainability-linked bonds tied to achieving targets such as reducing GHGs. From July 2023 to July 2024, China has issued 3 new transition bonds totaling 10.8 CNY billion (approx. 1.36 EUR billion or 1.52 USD billion) and 88 sustainability-linked bonds totaling 59.6 CNY billion (approx. 7.49 EUR billion or 8.37 USD billion). In contrast, 694 green bonds were issued, amounting to 744.8 CNY billion (approx. 93.63 EUR billion or 104.55 USD billion). The transition bond market remains relatively small because SOEs are the primary participants, while smaller companies rarely

24. Data source: N Steel financial and ESG reports

25. Csteelnews, 2023, Strengthen financial support for steel enterprises, [http://www.csteelnews.com/special/1373/202303018/202303/t20230316\\_72737.html](http://www.csteelnews.com/special/1373/202303018/202303/t20230316_72737.html)

issue such bonds. Among the SOEs, Shandong Steel aims to save 325,200 tonnes of standard coal and cut CO<sub>2</sub> emissions by 784,900 tonnes annually through energy replacement and upgrades. Baosteel targets a reduction of 630,000 tonnes of CO<sub>2</sub> emissions annually by upgrading its Zhanjiang Green Demonstration Plant. Ansteel's bonds support projects to maintain energy consumption below 565 kg of standard coal per tonne of steel. Liuzhou Steel aims to reduce unit CO<sub>2</sub> emissions to 0.935 kg per tonne by 2022, which is significantly lower than 2020 (Table A 4). These efforts demonstrate the strategic use of debt instruments in decarbonization efforts in China's steel sector but highlight the need to support smaller steel companies with transition bond financing.

Government-guided private equity and venture capital (PE/VC) funds are also crucial to support the transition. The National Green Development Fund and the Baowu Green and Intelligent Fund exemplify this role. Established in 2020, the National Green Development Fund, with 88.5 CNY billion (approx. 11.13 EUR billion or 12.42 USD billion), supports transition projects across 11 provinces, focusing on pollution control and energy efficiency. The Baowu Green and Intelligent Fund, a partnership with Baosteel, initially comprising 10 CNY billion (approx. 1.26 EUR billion or 1.4 USD billion) and growing to 50 CNY billion (approx. 6.29 EUR billion or 7.02 USD billion), targets clean energy, energy efficiency, and carbon capture in the steel industry.<sup>26,27</sup> These funds use direct investment and strategic partnerships, with government capital attracting private investments, bridging financing gaps, and advancing decarbonization technologies in steel production.

## 2.5. Transition roadmaps from the US and Japan

Pittsburgh, once known as the 'Steel City' for its coal and iron ore resources, transitioned into a high-tech hub following economic stagnation in the 1970s. The city's transition strategy had three key phases: environmental remediation and urban infrastructure development, economic restructuring through cultural and credit trust funds and high-tech incubators, and diversification into education, tourism, and services. Carnegie Mellon University played a pivotal role in fostering innovation and attracting high-tech companies like Apple and Intel (Table A 5). Throughout this transition, Pittsburgh emphasized a just transition, ensuring fairness by creating a livable environment, fostering innovation and employment, and focusing on education and workforce development.

Japan, the world's third-largest steel producer, faces challenges similar to China, including a high dependency on imported iron ore, declining steel demand, and a goal of net-zero emissions by 2050. Japan's steel transition roadmap emphasizes key emission-reducing technologies like hydrogen-based direct-reduction iron, electric arc furnace technology, and direct-reduction techniques.<sup>28</sup> With specific implementation timelines, the roadmap provides a structured approach for companies and offers detailed guidance for both enterprises and financial institutions. It outlines steps for companies to develop decarbonization plans and criteria for financial institutions to assess the viability of transition projects, ensuring investments are directed towards impactful decarbonization efforts.

26. CBCSD, 2023, 2023 China Baowu low-carbon metallurgy innovation fund project guide, <http://www.cbcsd.org.cn/xws/hydt/20231107/104374.shtml>

27. BCAA, 2022, Leverage the role of the national green development fund to help achieve the goal of 'dual carbon', <http://www.cleanairechina.org/product/11390.html>

28. Ministry of Economy of Japan, 2021, Technology roadmap for transition finance in iron and steel sector, [https://www.meti.go.jp/policy/energy\\_environment/global\\_warming/transition/transition\\_finance\\_technology\\_roadmap\\_iron\\_and\\_steel\\_eng.pdf](https://www.meti.go.jp/policy/energy_environment/global_warming/transition/transition_finance_technology_roadmap_iron_and_steel_eng.pdf)



To enhance China's steel transition finance policies by drawing on Japan's successful roadmap, China should align with global climate goals, set clear interim targets, and develop detailed implementation timelines for structured technology deployment. Policy flexibility and adaptability should accommodate transitioning projects, while enhanced transparency and reporting requirements will promote accountability and build investor confidence through regular updates on emission reductions and progress toward targets. International standards for transition finance in the steel industry are evolving to provide comprehensive frameworks for banks and financial institutions. The Sustainable STEEL Principles (SSP) offer a standardized framework for assessing and disclosing the alignment of steel loan portfolios with climate targets, encouraging financial tools and strategies that support decarbonization. This framework emphasizes transparency in reporting climate alignment scores, fostering accountability and investor confidence. The Climate Bonds Initiative (CBI) certifies steel production assets and activities, requiring detailed disclosures of emission data and reduction plans to ensure adherence to stringent environmental criteria (Table A 6).

## 3. Exploring just transition dynamics in China's shipping industry

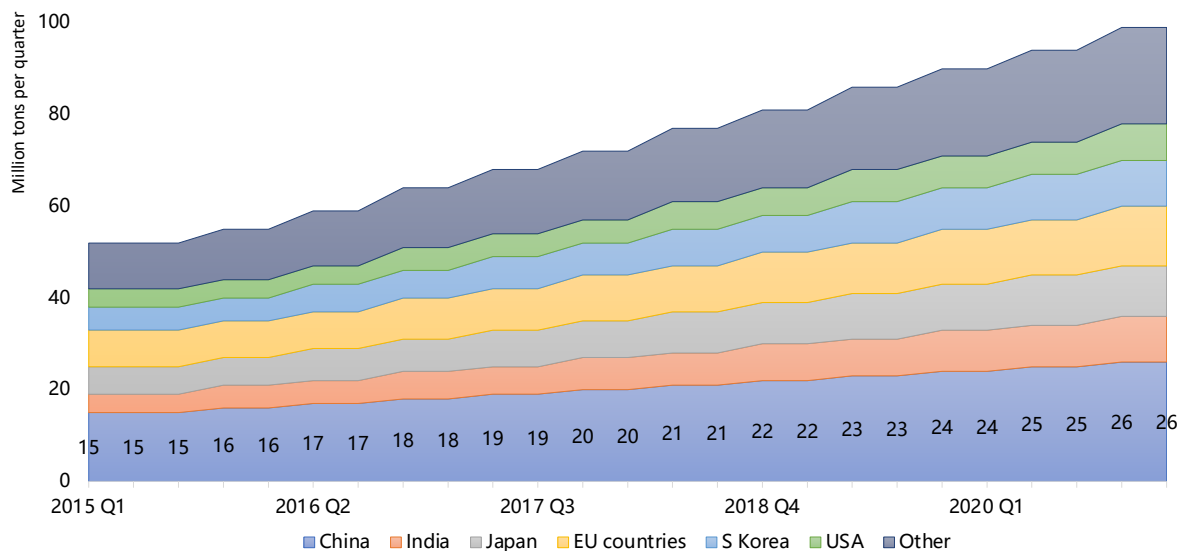
### 3.1. Rising shipping volumes and associated emission increases

The shipping market is recovering from the global pandemic, with the China Shipping Prosperity Index at 103.88 points in the first quarter of 2024, despite a slight decrease of 6.09 points from the previous quarter. Increased vessel capacity and reduced short-term supply chain disruptions have boosted market confidence. At the same time, 30.41% of shipping companies were optimistic about the industry's operations, up 11.22% from the previous quarter,<sup>29</sup> while only 21.64% were pessimistic, down 10.92%.<sup>30</sup> This reflects growing business confidence and a strong growth trend in both international and inland shipping volumes in China.<sup>31</sup> However, this rise in transport volumes will result in

increased carbon emissions if there are not significant decarbonization efforts in the shipping industry.

The International Maritime Organization (IMO) predicts that without intervention, carbon emissions from maritime transportation could increase by 50% to 250% by 2050.<sup>32</sup> In 2020, the Asia-Pacific region accounted for 52% of global shipping emissions, with China alone responsible for 30.7% – the highest of any country.<sup>33</sup> Since 2015, quarterly CO<sub>2</sub> emissions from shipping have steadily risen, notably from major emitters like India, Japan, the EU, South Korea, China, and the USA (Figure A 5). This data highlights the urgent need for effective measures to reduce emissions in the shipping sector, particularly in high-emitting regions like China.

Figure A 5 - Shipping Emissions for Main Countries<sup>34</sup>



29. SISI, 2024, Global shipping climate index report for the first quarter of 2024, <http://www.sisi-smu.org/2024/0507/c8724a234200/page.htm>

30. Ibid. 17

31. MoT, China Port Operation Analysis Report (2024), 《中国港口运行分析报告(2024)》, [https://www.gov.cn/yaowen/liebiao/202407/content\\_6962026.htm](https://www.gov.cn/yaowen/liebiao/202407/content_6962026.htm)

32. Gov.cn, 2021, A 'China solution' for global shipping, (为全球航运业减排提供“中国方案”), [https://www.gov.cn/xinwen/2021-06/03/content\\_5615100.htm](https://www.gov.cn/xinwen/2021-06/03/content_5615100.htm)

33. Rhodium Group, 2021, <https://rhg.com/research/chinas-emissions-surpass-developed-countries/>

34. Data source: VesselsValue, Xindemarine

### 3.2. Decarbonization pressure and employee safety concerns in fuel transition

China's maritime decarbonization efforts are shaped by both international and domestic contexts. Internationally, the UN targets net-zero emissions by 2050, with IMO measures such as the Energy Efficiency Design Index (EEDI), Energy Efficiency Existing Ship Index (EEXI), and Carbon Intensity Indicator (CII) for energy efficiency and emissions reduction. The Getting to Zero Coalition aims for zero-emission vessels by 2030 and full decarbonization by 2050. Domestically, China's dual carbon strategy aims to peak emissions by 2030 and achieve carbon neutrality by 2060, targeting a 3.5% reduction in shipping carbon intensity by 2025 (Table A 7). In pursuit of these goals, China is investing in hydrogen propulsion systems, including ammonia and methanol, CCUS, and alternative fuels like Liquefied Natural Gas (LNG), biofuels and synthetic fuels produced with hydrogen, along with operational improvements in energy efficiency, speed optimization, and hull design enhancements.

The decarbonization of shipping presents structural challenges, including high costs, technological immaturity, and regulatory readiness. Converting ships to dual-fuel engines costs between 5 to 15 USD million per ship (approx. 4.48 to 13.43 EUR million or 35.63 to 106.88 CNY million), a significant expense for Small and Medium-sized Enterprises (SMEs). Some companies opt for partial upgrades, but dual-fuel engines require complex electronic controls and specific bore sizes, further adding to costs. Additionally, substantial investment is needed for alternative fuel bunkering facilities like LNG, ammonia, and methanol, given the current inadequate infrastructure. Technological immaturity is another hurdle, as current alternative technologies are expensive and underdeveloped,

with varying requirements for different vessel types complicating standardization. Safety concerns also arise with new fuels and technologies, contradicting just transition requirements. For instance, prolonged exposure to ammonia fuel vapors poses health risks (Table A 8). The regulatory landscape adds complexity, with varying standards across jurisdictions. Harmonizing international regulations, such as those from the IMO, with domestic legal structures is essential but challenging, complicating the implementation of uniform decarbonization measures in the shipping industry.

### 3.3. Advancing justice with community, workplace, and training initiatives

Interviews with industry practitioners revealed mixed impacts of decarbonization on China's maritime workforce. About half of the workforce reported positive effects, such as new roles for fuel storage, regulatory compliance, and equipment maintenance.<sup>35</sup> The transition has created positions for managing various fuel grades, meeting auditing requirements, and maintaining new machinery. However, many employees expressed concerns about negative impacts, including the pressure to learn new skills without adequate training and fears of job displacement. Workers felt forced to adapt to new technologies and practices without sufficient support, leading to anxiety about job security and their ability to meet new demands. The key aspects of the just transition process focus primarily on skilling, reskilling, and education to support workers in adapting to economic shifts, along with efforts to reduce pollution and toxic emissions at industrial sites such as ports.

China's maritime sector is addressing community well-being, workplace conditions, and employee training. Since 2010, promoting shore power for docked ships has reduced pollution during berthing,

35. Source: fieldwork and interviews

improving air quality and health for port workers and surrounding communities. Technological upgrades, such as converting gantry cranes from diesel to electric and using electric autonomous vehicles at container terminals, have also been implemented.<sup>36</sup> These measures reduce emissions in port areas, significantly improving working conditions by minimizing exposure to harmful pollutants. In addition, to adapt to the new green shipping environment, low-flashpoint fuels like gas have been adopted as alternatives to traditional marine fuels. These fuels are more volatile and present higher safety challenges. The IMO's International Code of Safety for Ships using Gases or other Low-flashpoint Fuels (IGF Code), adopted in June 2015, mandates training for crew members working with these fuels. In China, IGF Code dual-fuel vessel crew training programs have been established, such as those at Guangzhou Maritime Technical School and the first IGF Code class in Fujian.<sup>37, 38</sup> These programs aim to develop skilled seafarers and ensure the safe operation of clean energy vessels. Additionally, these initiatives equip employees with necessary low-carbon skills, ensuring job security and maintaining income levels, fostering a fair transition to green shipping.

### 3.4. Transition finance drivers: internal capital and available external tools

China has adopted multifaceted policies to finance the decarbonization of its shipping sector, involving interna-

tional principles, central government policies, and regional initiatives in Shanghai. Internationally, China adheres to the Poseidon Principles, guiding financial institutions to include climate factors in shipping loans and encouraging investments in lower carbon emissions. Insurers are urged to track the carbon emissions of the hull, machinery, and equipment they insure, while charterers consider the environmental credentials of ships in their decisions. Domestically, China's central government supports green shipping through policies like the Green Industry Guidance Catalogue, which includes provisions for green power equipment, low-carbon ship retrofits, pollution control, and green port development.<sup>39</sup> The Green Bond Endorsed Projects Catalogue targets green shipbuilding and shore power facilities for bond financing, and the Guidelines for Green Insurance Catalogue provides insurance options for green energy ships and port power facilities.<sup>40, 41</sup> In Shanghai, the Shanghai Transition Finance Catalogue aligns financial services for shipping enterprises with international standards, emphasizing financial derivatives related to green fuels and exploring innovative financial instruments to facilitate the transition.<sup>42</sup>

After the global pandemic, the shipping industry saw continuous high profits.<sup>43</sup> Interviewed industry experts noted that the sector has sufficient funds for decarbonization.<sup>44</sup> Despite their substantial profits, China's shipping sectors embrace transition and green finance policies, benefiting from various financial

36. Ibid. 25

37. China water transport, 2024, The first IGF Rules training program in Guangdong-Hong Kong-Macao Greater Bay Area was launched in Guangzhou, <https://www.zgsyb.com/news.html?aid=673163>

38. Eol.cn, 2024, The first IGF Code dual-fuel ship crew training course in Fujian Province was successfully completed in Quanzhou Marine Vocational College, [https://fujian.eol.cn/fjgd/202407/t20240719\\_2625039.shtml](https://fujian.eol.cn/fjgd/202407/t20240719_2625039.shtml)

39. NDRC, 2023, Green Industry Guidance Catalogue (2023) (《绿色产业指导目录(2023年版)》)

40. PBoC, 2021, Green Bond Endorsed Projects Catalogue (2021) (《绿色债券支持项目目录(2021年版)》)

41. Insurance Association of China, 2023, Guidelines for Green Insurance Catalogue (2023) (《绿色保险分类指引(2023年版)》)

42. PBoC, 2024, Shanghai Transition Finance Catalogue (Trial) (《上海市转型金融目录(试行)》)

43. Allianz Commercial, 2023, Economic outlook on shipping industry, <https://commercial.allianz.com/news-and-insights/expert-risk-articles/shipping-safety-23-economic-outlook.html>

44. Source: fieldwork and interviews

products. These include a sustainable development-linked syndicated loan from China Merchants Leasing, tied to targets like public transportation, clean energy and solid waste treatment. China State Shipbuilding Corporation (CSSC) issued 500 USD million (approx. 447 EUR million or CNY 3.56 billion) in green and blue bonds for energy efficiency upgrades, pollution prevention, low-carbon fuels, and sustainable transportation. China Construction Bank in Zhejiang offers a 'Green Shipping Loan' for ships with pollution prevention systems. China Merchants Financial Leasing provides a sustainability-linked loan for two energy-efficient bulk carriers, with an interest rate reduction for continuous greenhouse gas reduction (Table A 9). These products show China's proactive approach to promoting sustainable practices in the shipping industry through innovative financial mechanisms.

### 3.5. Singapore's fiscal strategy for green shipping

The Maritime Just Transition Task Force, which includes the International Chamber of Shipping (ICS), the International Transport Workers' Federation (ITF), the United Nations Global Compact (UNGC), the ILO, and the IMO, has recommended a fair transition for seafarers amid shipping decarbonization. The action plan involves integrating just transition principles into public policy, providing local support, offering retirement pathways, transitioning workers to sustainable jobs, and investing in community infrastructure.<sup>45</sup> To ensure a just transition in China's maritime sector, it is crucial to embed just transition principles in public policy, develop a comprehensive decarbonization plan, and integrate these principles into national laws. Also, establishing a long-term research fund can help study the impacts of the ongoing transition on stakeholders. Local support includes funding transition centers in port cities,

creating pension-bridging programs for early retirees, and offering to fund income support, education, skills building, and re-employment. Investing in community infrastructure will support economic diversification and improve living standards. Inclusive transition funding programs and direct community engagement can address community needs and connect these with national resources.

To support transition funds, Singapore's fiscal approach to promoting green shipping serves as a model. The Maritime and Port Authority of Singapore's Maritime Singapore Green Initiative, enhanced in 2019, includes the Green Ship Programme (GSP) and the Green Port Programme (GPP). The GPP offers discounts on registration fees and annual tonnage taxes for low-emission vessels, with ships exceeding the IMO's Marpol Annex VI Phase 3 EEDI by 10% receiving significant rebates.<sup>46</sup> LNG-fueled ships get higher discounts, and zero-carbon fuel ships are fully exempt from fees. The GPP offers port dues reductions for ships using low or zero-carbon fuels, with a 30% reduction for zero-carbon fuels and a 25% reduction for low-carbon fuels, plus an additional 10% reduction for vessels serviced by low-carbon fuel harbor craft.<sup>47</sup> China adopting similar incentive mechanisms, such as tax incentives and subsidies, would motivate shipping companies to invest in green shipping initiatives.

45. UNGC, 2024, About the Just Transition Maritime Task Force, <https://unglobalcompact.org/take-action/think-labs/just-transition/about>

46. HKTDC, 2022, Singapore: new green shipping incentives introduced, <https://research.hktdc.com/en/article/MTA2MTEwMDQ2OQ>

47. PwC, 2024, Singapore corporate – tax credits and incentives, <https://taxsummaries.pwc.com/singapore/corporate/tax-credits-and-incentives>

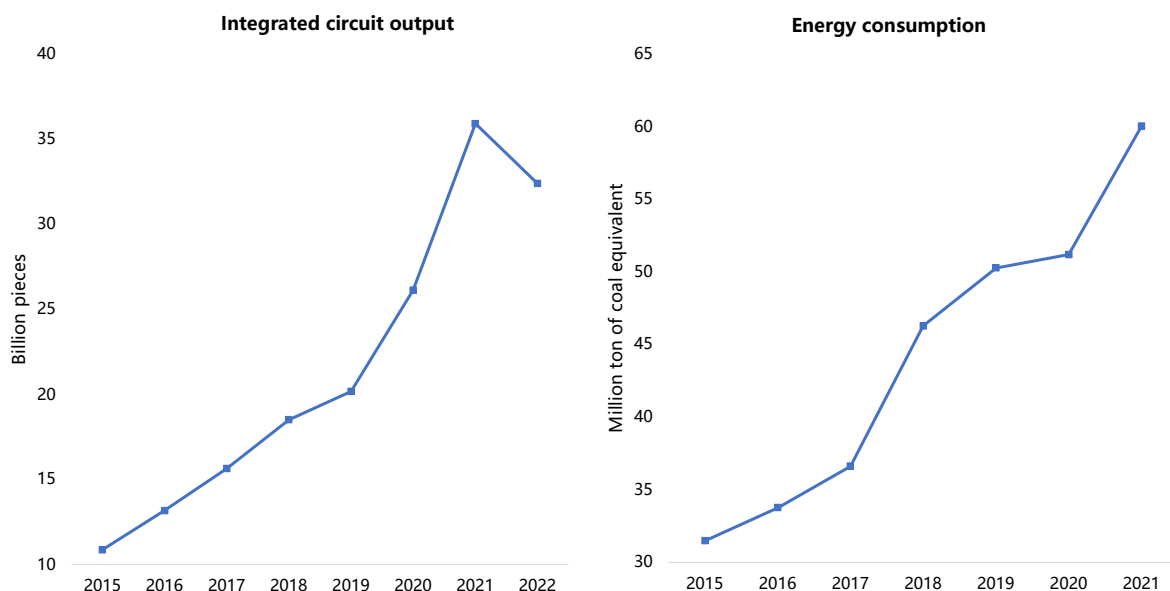
## 4. Exploring just transition dynamics in China's ICT industry

### 4.1. ICT sectors projected to increase emissions

The Information and Communication Technology (ICT) sector's carbon emissions are substantial, posing significant environmental challenges, both in China and the rest of the world. In 2020, ICT accounted for 1.8% to 2.8% of global greenhouse gas emissions. If current trends continue, ICT could emit 830 MT of CO<sub>2</sub> by 2030, highlighting the urgent need for sustainable practices.<sup>48</sup> In China, the situation is critical as most data centers rely on coal-fired electricity. If unchecked, emissions from China's data centers could rise from 96 MT of CO<sub>2</sub> in 2020 to 340 MT by 2030, surpassing the UK's annual energy-related CO<sub>2</sub> emissions.<sup>49</sup> At

the same time, China's ICT manufacturing sector is expected to maintain high output levels in the short term, though growth rates are decelerating. From 2015 to 2021, output of integrated circuits steadily increased, with a slight dip in 2022 (Figure A 6). Fixed asset investments in the ICT industry from 2019 to 2023 peaked in 2022 but are now slowing, indicating a shift from rapid expansion to optimizing existing capabilities (Figure A 7). The China Federation of Electronics and Information Industry (CFEII) forecasts the ICT manufacturing sector will grow above 7% in 2024, implying increased energy consumption.<sup>50</sup> This trend aligns with rising CO<sub>2</sub> emissions predictions, highlighting the need for sustainable practices in the ICT sector.

Figure A 6 - Output and Energy Consumption for Integrated Circuits <sup>51</sup>

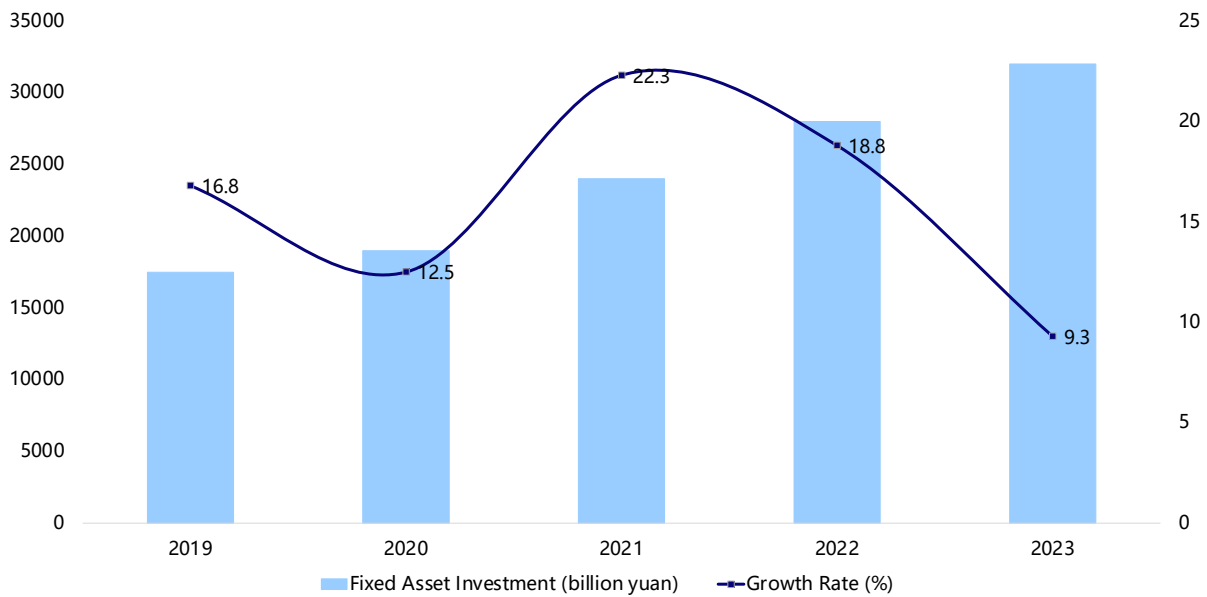


48. Allianz Research, 2022, More emissions than meet the eye: decarbonizing the ICT sector, [https://www.allianz.com/content/dam/onemarketing/azcom/Allianz\\_com/economic-research/publications/specials/en/2023/july/2023\\_07\\_04\\_Decarbonization-ICT.pdf](https://www.allianz.com/content/dam/onemarketing/azcom/Allianz_com/economic-research/publications/specials/en/2023/july/2023_07_04_Decarbonization-ICT.pdf)

49. Tan, D., C. T. Low, 2024, China ICT running dry?, <https://chinawaterrisk.org/wp-content/uploads/2024/04/CWR-2024-China-ICT-running-dry-The-rise-of-AI-climate-risks-amplify-existing-water-risks-faced-by-thirsty-data-centres.pdf>

50. CFEII, 2024, Economic report of ICT industry in 2023, <http://lwzb.stats.gov.cn/pub/lwzb/bzt/202405/W020240527578179800425.pdf>

51. Curran et al., 2022, Making transition plans just, <https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2022/10/Making-Transition-Plans-Just-2.pdf>

Figure A 7 - Fixed Asset Investment in ICT <sup>52</sup>

#### 4.2. Reliance on thermal power: circular economy as a strategy

The ICT manufacturing sector needs a stable power supply to maintain operations, and electronics factories consume vast amounts of energy. Transitioning to renewable energy is challenging due to potential power outages that can cause production disruptions and affect yield stability, unlike reliable thermal power. Additionally, managing the cost of carbon emission allowances becomes increasingly difficult. Rapidly reducing emissions through process improvements or energy-efficient upgrades can extend the timeline for achieving decarbonization goals, adding to the sector's challenges.

The production of electronic components involves complex processes that also make precise emission reduction challenging. Manufacturing generates several pollutants, including GHGs, wastewater, solid waste,

and various waste gases. These emissions come from multiple stages: fossil fuel combustion produces CO<sub>2</sub>, production processes emit harmful gases like HFCs, PFCs, NF<sub>3</sub>, and SF<sub>6</sub>, and significant carbon emissions arise from the electricity and heat purchased. The production occurs in closed areas with chemical supplies piped through tubes, complicating emissions mitigation. Materials like fiber optic cables, LCD modules, and printed circuit boards contribute to the environmental footprint, making comprehensive emission reductions in the ICT manufacturing sector particularly difficult.

China's efforts to reduce ICT carbon emissions are bolstered by adopting a circular economy supported by various policies and regulations (Table A 10). The 'Carbon Peak Implementation Plan for Industry Sectors' (2022) aims to decrease energy consumption per unit by 13.5% and reduce emissions per unit of GDP by 18%.<sup>53</sup> The '14th Five-Year Plan for Circular Economy Development' (2022)

52. Data source: China Electronic Information Industry Federation

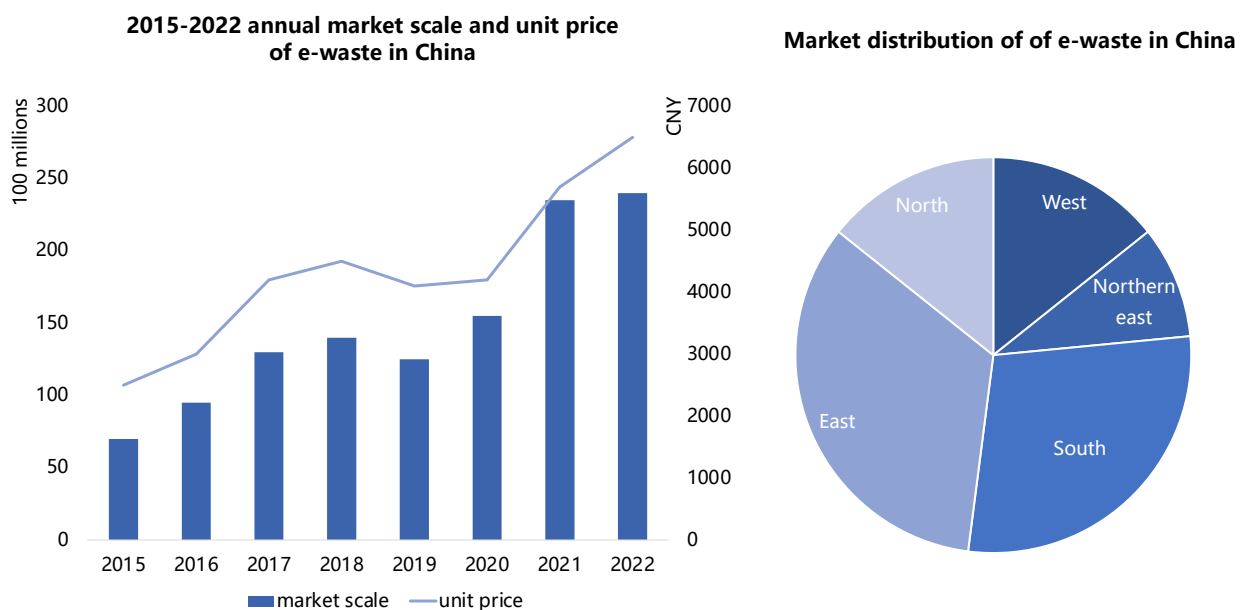
53. State Council of the People's Republic of China, 2022, Carbon Peak Implementation Plan for Industry Sectors, (《工业领域碳达峰实施方案》), <https://www.gov.cn/zhengce/zhengceku/2022-08/01/5703910/files/f7edf770241a404c9bc608c051f13b45.pdf>

emphasizes sustainable practices.<sup>54</sup> Additional measures like ‘Guiding Opinions on Accelerating the Construction of Waste Material Recycling System’ (2022) and ‘Several Measures to Promote Consumption of Electronic Products’ (2023) aim to improve recycling channels and waste management.<sup>55, 56</sup> Pivotal elements of the ICT circular economy are e-waste collection and disposal directories, along with waste collection and distribution centers. E-waste directories guide consumers and businesses to certified collection points and recycling centers, while distribution centers aggregate, sort, and prepare e-waste for recycling. This growth has made East China the largest regional hub for ICT recycling (Figure A 8).

### 4.3. Issues of working conditions with corresponding regulations settled

In the push for a circular economy within the ICT sector, labor conditions and environmental injustice have become significant issues. Workers in recycling operations are often exposed to toxic substances, leading to serious health risks.<sup>58</sup> The informal sector, characterized by unsafe working conditions, processes most end-of-life batteries and electronic waste in small, unregulated workshops. These operations lack proper safety measures, exposing workers to hazardous materials without adequate protective equipment, perpetuating poverty and exploitation. Environmental

Figure A 8 - China's E-waste Market Size <sup>57</sup>



54. NDRC, 2022, 14th Five-Year Plan for Circular Economy Development (《“十四五”循环经济发展规划》), [https://www.ndrc.gov.cn/xwdt/ztl/sswxhjzgh/index\\_1.html](https://www.ndrc.gov.cn/xwdt/ztl/sswxhjzgh/index_1.html)

55. NDRC, 2022, Guiding Opinions on Accelerating the Construction of Waste Material Recycling System, (《关于加快废旧物资 循环利用体系建设的指导意见》), [https://www.gov.cn/gongbao/2024/issue\\_11186/202402/content\\_6934547.html](https://www.gov.cn/gongbao/2024/issue_11186/202402/content_6934547.html)

56. NDRC, 2023, Several Measures to Promote Consumption of Electronic Products, (《关于促进电子产品消费的若干措施》), [https://www.gov.cn/zhengce/zhengceku/202307/content\\_6893477.htm](https://www.gov.cn/zhengce/zhengceku/202307/content_6893477.htm)

57. Data source: Zhiyanzhan.cn, Leadleo.com

58. Schneider, A. F., X. Zeng, 2022, Investigations into the transition toward an established e-waste management system in China: Empirical evidence from Guangdong and Shaanxi



injustice also affects marginalized communities. Areas with developed ICT industries, such as the Yangtze River Delta, suffer from lower water quality due to pollution from electronic waste processing.<sup>59</sup> These vulnerable communities bear the brunt of the negative environmental impacts, impacting their access to clean water.

The National Development and Reform Commission of the People's Republic of China (NDRC) has issued guidelines to improve electronic waste recycling. Key actions include enforcing the Extended Producer Responsibility (EPR) system and holding manufacturers accountable for their products' entire lifecycle to promote responsible recycling.<sup>60</sup> The guidelines emphasize transparency by strengthening supervision of second-hand electronic product recyclers and publicly disclosing information. The NDRC also advocates for the 'Internet plus Recycling' model, integrating online platforms with traditional methods to make recycling more accessible and affordable. By encouraging postal, courier, and logistics companies to reduce shipment and collection costs, the policy aims to enhance recycling efficiency and reduce environmental impact. Additionally, the government supports establishing temporary recycling points and transfer stations in communities to address spatial challenges and boost participation. These efforts will address electronic waste's environmental impact, safeguard workers' rights, and contribute to sustainable development and social equity.

#### 4.4. Financial support schemes in the Yangtze River Delta lack taxonomy

The Yangtze River Delta has implemented financial solutions to support ICT decarbonization and green transformation. 'Jiangsu Province's Action Plan for Financial Support of Green Transformation in Manufacturing' aims to invest over 500 CNY billion (approx. 62.86 EUR billion 60.10 USD billion) between 2023-2028. This investment will create over 400 provincial-level green factories and 10 green parks annually, upgrading ICT manufacturing processes to reduce carbon emissions and enhance energy efficiency.<sup>61</sup> In Shanghai, the draft policy 'Pudong New Area Financial Institutions Carbon Emission Accounting and Information Disclosure Guidelines' mandates that financial institutions assess and disclose the carbon emissions of their client companies, including those in the ICT sector.<sup>62</sup> This policy promotes transparency, accountability, and the adoption of greener practices by integrating carbon accounting into financial evaluations, making it a critical factor in funding decisions. Zhejiang Province is dedicating 250 CNY billion (approx. 31.43 EUR billion 30.05 USD billion) to expand medium- and long-term loan investments for the ICT manufacturing sector, supporting sustainable production methods, energy-efficient technologies, and renewable energy sources.<sup>63</sup> This long-term financial support ensures ICT companies can make significant operational changes, contributing to sustainability goals. Additionally, in 2023, the China Development Bank issued 479.5 CNY billion (approx. 60.28 EUR billion 57.64 USD billion) in medium- and

59. Huang et. al., 2018, Resource and Environmental Issues and Countermeasures for the Development of Yangtze River Delta Industrial Parks, <https://www.china-eia.com/ghhp/202007/P020200706401094046612.pdf>

60. Ibid. 48

61. PBoC Jiangsu Branch, 2023, Jiangsu Province's Action Plan for Financial Support of Green Transformation in Manufacturing (《江苏省金融支持制造业绿色转型行动方案》)

62. Pudong Development and Reform Commission, 2024, Pudong New Area Financial Institutions Carbon Emission Accounting and Information Disclosure Guidelines (《浦东新区金融机构碳排放核算与信息披露指引》)

63. Department of Economy and Informatization of Zhejiang Province, 2024, Implementing Rules for the Management of Green (Low-Carbon) Factory in Zhejiang Province (《浙江省绿色(低碳)工厂梯度培育管理实施细则》)

long-term loans for environmental protection and green development in the Yangtze River region.<sup>64</sup> These loans back large-scale green projects, including those in the ICT sector, help reduce the overall carbon footprint of ICT manufacturing activities.

China's transition finance taxonomy currently lacks specific provisions for the ICT sector. It initially focuses on high-emission industries like energy and heavy manufacturing with immediate decarbonization needs. However, as the ICT sector grows and its carbon footprint increases, future taxonomy updates are expected to address this gap. Incorporating ICT-specific criteria will align with global trends, recognizing the need to reduce emissions across all sectors.

#### 4.5. South Korea's experience with recycling in ICT industries

The ILO has proposed several solutions to address justice issues from electronic waste, including international agreements on e-waste export, EPR systems, green product design, and Public-Private Partnerships (PPPs).<sup>65</sup> South Korea exemplifies effective e-waste recycling through public-private partnerships, establishing accessible recycling centers nationwide. These centers incentivize consumers with discounts on new products for recycling old electronics. This collaboration creates a robust recycling infrastructure, ensuring responsible e-waste management. Emphasizing these partnerships highlights the importance of involving all stakeholders in transitioning to a circular economy within the ICT sector.<sup>66</sup> These initiatives address e-waste's environmental impacts and promote social equity by providing convenient and rewarding recycling options for all citizens.

Like China, South Korea has implemented an EPR system, requiring manufacturers and importers to manage the entire lifecycle of electronic products, from design to disposal. This promotes eco-design and restricts hazardous materials. The eco-assurance system complements EPR by regulating e-waste collection and recycling. Regional recycling centers in Korea use advanced shredding and separation technologies to handle e-waste safely and efficiently, focusing on minimizing hazardous exposure and improving recycling rates. Financial incentives, including cost reduction strategies and ROI calculations for recycling facilities, further enhance Korea's e-waste management efforts.<sup>67</sup> China should upgrade its existing EPR system by implementing stricter regulations and financial incentives to encourage manufacturers to adopt eco-design and reduce the use of hazardous materials. Additionally, investing in advanced regional recycling centers with the latest shredding and separation technologies will enhance the safe handling and recycling rates of electronic waste.

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64. China Development Bank, 2024, <http://baokang.cjyun.org/p/194882.html>

65. ILO, 2012, Global impacts of e-waste: addressing the challenges

66. Ewwcollabb, 2024, 8 countries leading the way in e-waste recycling and what we can learn from them

67. Park et al., 2018, Case study in Korea of manufacturing SRF for polyurethanes recycling in e-wastes

## 5. Mitigating the risks of transition-washing

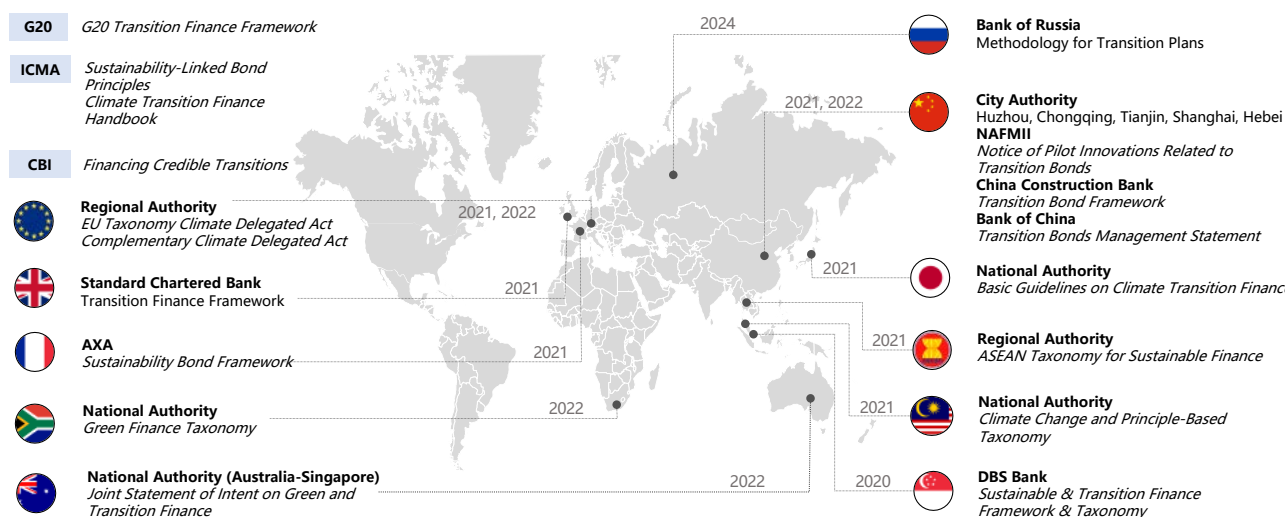
### 5.1. Global transition taxonomies: lack of a unified standard

Since 2020, regional alliances, countries, cities, and financial institutions worldwide have established transition finance frameworks (Figure A 9 and Table A 11). Recognizing the limits of public financing, particularly in low-income countries with high debt, transition finance has developed rapidly in emerging areas such as Southeast Asia and China's inland cities. Although China's national taxonomy is pending, four cities and one province have developed their own frameworks with varying focal points. For instance, Chongqing includes clean production and efficient coal use as transitional activities, while Huzhou does not. Additionally, China and Singapore are in dialogue about how to achieve taxonomy interoperability, enhance mutual understanding, and facilitate international capital flow.<sup>68</sup> Regions without established transition finance taxonomies may not urgently need transition finance due to abundant

renewable energy or significant decarbonization, such as Norway's extensive hydropower. However, in areas needing transition but lacking taxonomies, the absence of clear definitions and scopes for transitional activities can lead to underinvestment in promising technologies and exacerbate greenwashing.<sup>69</sup>

A unified international standard for transition finance is crucial for a consistent and transparent evaluation of sustainable activities. It facilitates informed investment decisions, mitigates greenwashing, and creates a common language to attract global capital to sustainable projects. It also provides policymakers with versatile tools and integrates green financing into policy development, enhancing global climate change efforts. However, the lack of a unified international taxonomy poses challenges in global climate finance, leading to inconsistencies in implementing international projects. Additionally, many existing taxonomies insufficiently address aspects of social justice.<sup>70</sup>

Figure A 9 - Worldwide Transition Taxonomy <sup>71</sup>



68. MoC, 2023, Country (region) guidelines for outbound investment cooperation, (对外投资合作国别(地区)指南), <https://www.mofcom.gov.cn/dl/gbdqzn/upload/xinjiaopo.pdf>

69. Ma, J., T. Akiko, 2022, Transition finance is critical to address climate change, <https://rksi.adb.org/publications/transition-finance-is-critical-to-address-climate-change-2/>

70. Ibid. 51

71. Organized by the authors

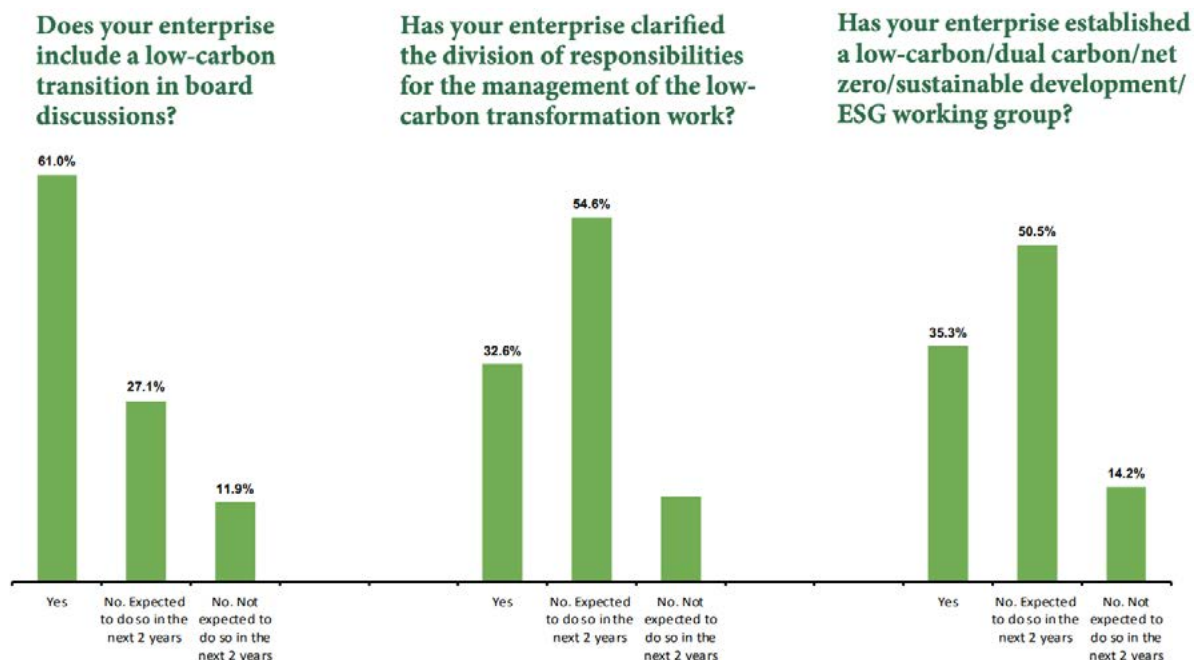
## 5.2. China's increasing requirements for disclosing transition plans

In May 2022, the State-owned Assets Supervision and Administration Commission of the State Council (SASAC) in China issued the 'Work Plan for Improving the Quality of Listed Companies Controlled by Central Enterprises,' enhancing disclosure practices for these companies.<sup>72</sup> This was followed up with disclosure templates issued in July 2023. While not explicitly mandating transition plan disclosures, the document strongly advocates including information on digital transformation and green, low-carbon transitions, both quantitatively and qualitatively. Positioned under Social Contribution, these disclosures respond to national strategies, emphasizing industrial transition alongside rural revitalization and the Belt and Road Initiative.

This reflects the state's expectations for state-owned enterprises to transparently report on their contributions to long-term strategic goals.

In February 2024, the Shanghai, Shenzhen, and Beijing Stock Exchanges jointly issued the 'Guidelines on Self-Regulation of Listed Companies - Sustainability Report (Trial)'.<sup>73</sup> This directive mandates comprehensive disclosure of transition plans, requiring companies to detail strategies, measures, and progress in addressing climate-related risks and opportunities. Chinese listed companies must elaborate on strategic adjustments, production enhancements, and transition plan formulations, including resource allocation and implementation progress. This stringent approach highlights China's commitment to corporate transparency and accountability in transition finance.

Figure A 10 - Survey of Transition in Board Discussions in China <sup>74</sup>



72. SASAC, 2022, Work Plan for Improving the Quality of Listed Companies Controlled by Central Enterprises (《提高央企控股上市公司质量工作方案》), [https://www.gov.cn/xinwen/2022-05/27/content\\_5692621.htm](https://www.gov.cn/xinwen/2022-05/27/content_5692621.htm)

73. Shanghai Stock Exchange, Shenzhen Stock Exchange, and Beijing Stock Exchange, 2024, Guidelines on Self-Regulation of Listed Companies - Sustainability Report (trial), (《上市公司可持续发展报告指引》), [https://www.sse.com.cn/lawandrules/sselawrules/stocks/mainipo/c/c\\_20240412\\_5737862.shtml](https://www.sse.com.cn/lawandrules/sselawrules/stocks/mainipo/c/c_20240412_5737862.shtml)

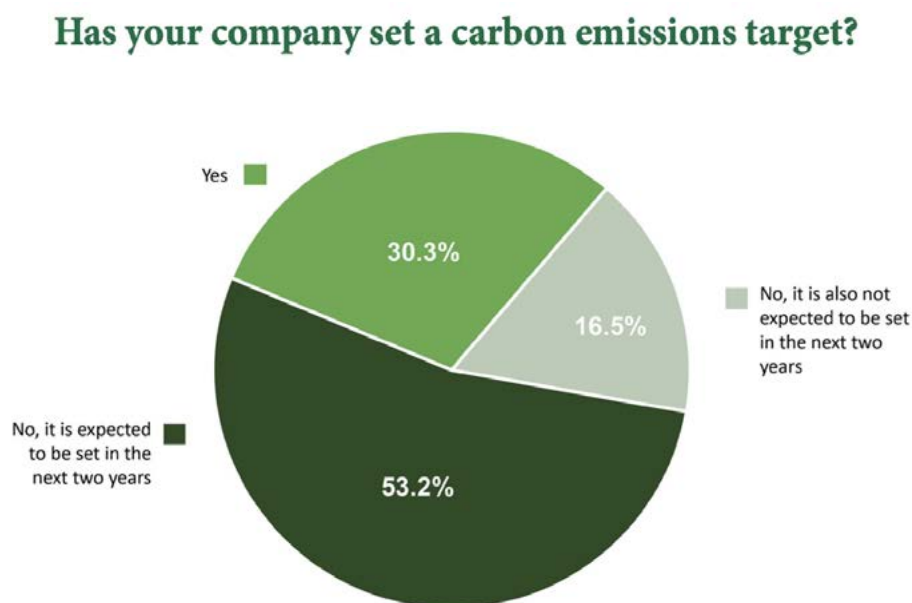
74. UNDP, 2023, Business and Sustainability in China 2022/2023, [https://www.undp.org/sites/g/files/zskgke326/files/2023-09/pwc\\_en.pdf](https://www.undp.org/sites/g/files/zskgke326/files/2023-09/pwc_en.pdf)

In May 2024, the Ministry of Finance of the People's Republic of China (MoF) released the 'Draft of the Sustainability Disclosure Standards for Business Enterprises—Basic.'<sup>75</sup> This document emphasizes that corporate objectives should reflect transition plans, focusing on setting and progressing toward goals mandated by national laws and strategic plans. While it highlights aligning corporate goals with national requirements, it does not specifically call for the disclosure of transition-related content. Instead, it prioritizes articulating corporate goals and their alignment with broader strategic objectives.

Chinese companies are increasingly recognizing the importance of low-carbon transformation. 61% of over 200 surveyed enterprises include low-carbon transition discussions at the board level, showing

strong recognition at the highest levels of corporate governance. Additionally, 32.6% have clarified responsibilities for managing this transition, and 50.5% have established working groups dedicated to low-carbon initiatives (Figure A 10). This demonstrates a growing commitment among companies to incorporate low-carbon practices into their operations, even if there is still room for improvement in clearly defining roles and responsibilities at the managerial and executive levels. In addition, 30.3% of companies have already set carbon emission targets, and 53.2% expect to set targets within the next two years, while only 16.5% do not plan to set targets within this period (Figure A 11). This indicates a strong commitment from the majority of companies to actively establish carbon emission reduction goals, reflecting an overall positive trend towards the transition.

Figure A 11 - Survey of Setting Carbon Emission Targets in China <sup>76</sup>



75. MoF, 2024, Corporate Sustainability Disclosure Guidelines—Basic Guidelines (Exposure Draft), 《企业可持续披露准则——基本准则（征求意见稿）》, <https://www.casc.org.cn/2024/0527/256555.shtml>

76. Ibid. 55

### 5.3. Embedding the just transition into financial instruments

Government support is crucial for a just transition, and establishing dedicated funds to address the socio-economic impacts of transitions is essential. The European Union's Just Transition Mechanism includes the Just Transition Fund (JTF), the Just Transition Scheme under the InvestEU programme, and European Investment Bank (EIB) loans, focusing on mitigating social impacts by supporting employment, training, and other social issues. The JTF provides financial support to the most affected regions, helping retrain workers, supporting job creation, and fostering economic diversification. Similarly, Alberta in Canada has the Coal Community Transition Fund to support coal workers affected by plant closures, providing financial assistance for retraining and reskilling to ensure displaced workers transition into sustainable employment sectors.

Integrating just transition considerations into financial institutions' operations and products is effective. In August 2023, the Postal Savings Bank of China (PSBoC) issued China's first just transition loan, aligning with the G20 Transition Finance Framework. This 1 CNY billion (approx. 140.35 USD million or 125.68 EUR billion) loan was granted to Jinneng Holding Coal Industry Group Co., Ltd., focusing on socio-economic equity during the transition process. A portion of the loan will fund rotational and operational qualification training for employees, enhancing their skills, labor standards, and employability.<sup>77</sup> This initiative sets a precedent for incorporating just transition principles into financial products, providing a valuable reference for other banks in China.

Leveraging blended finance within the private sector, supported by government initiatives, is also crucial. Multilateral financial institutions like the Asian Development Bank (ADB) and Asian Infrastructure Investment Bank (AIIB) should incorporate just transition considerations into their transformative projects in developing countries. An example is Indonesia's Just Energy Transition Partnership (I-JETP), which was launched in 2022 with the International Partners Group and ADB as the lead partners.<sup>78</sup> I-JETP aims to mobilize 20 USD billion (approx. 17.91 EUR billion or 142.5 CNY billion) in public and private financing over three to five years through grants, concessional loans, market-rate loans, guarantees, and private investments. Half of this funding will come from the International Partners Group, with the rest expected from private investments. This blended finance mechanism focuses on sustainability and resilience, includes a United Nations Development Programme (UNDP) working group to assess social impacts, and facilitates regional financial inflows.

77. PSBoC, 2023, PSBoC landed the country's first just transition loan, <https://www.chinapost.com.cn/html1/report/2308/8090-1.htm>

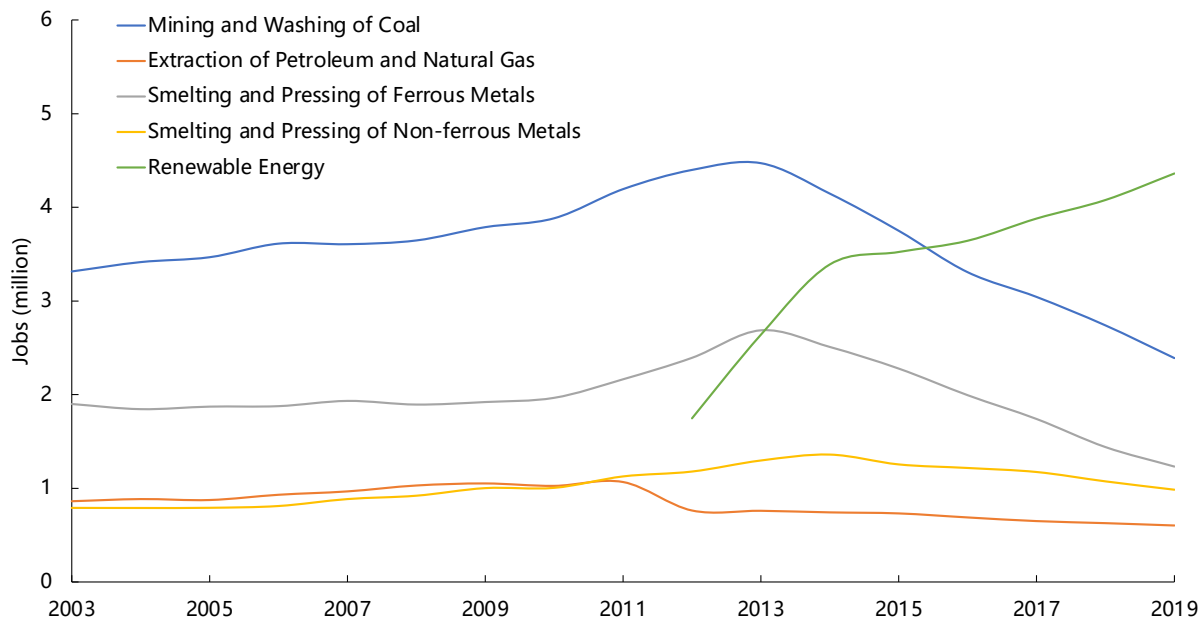
78. UNDP, Indonesia Just Energy Transition Partnership, <https://www.undp.org/indonesia/projects/indonesia-just-energy-transition-partnership-jetp>

## 6. Policy recommendations for transition finance in a just transition

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National governments should recognize that the impact of energy transitions on employment varies across regions due to differences in resource endowments and industrial structures. In the Yangtze River Delta, Jiangsu Province's advanced manufacturing and investment in high-tech and renewable energy sectors can offset job losses from the decline of the steel sector. Conversely, Anhui Province, reliant on traditional heavy industries, may face severe employment disruptions. Therefore, more labor policies should be emphasized in Anhui. For instance, with measures that allocate more funding for job creation programs, including direct subsidies for companies that hire and train workers from traditional steel industries. Making sure policies are flexible and adaptive to local conditions will make the transition measures more effective and making the transition strategy beneficial for specific communities will ensure social sustainability through just transition. Establishing region-specific transition funds can mitigate the adverse effects of energy transitions on employment by providing targeted financial support to regions reliant on traditional industries. These funds foster the development of new, sustainable industries, ensuring economic diversification and job creation. Additionally, issuing bonds linked to education and training programs can finance specialized training initiatives, equipping workers with skills for emerging industries. These bonds attract investors by offering returns tied to the success of the training programs. Funds are allocated to educational institutions and training centers to develop courses on renewable energy technologies, energy efficiency, and sustainable practices. The programs focus on reskilling workers from traditional industries, aligning investor interests with successful workforce transition, and influencing bond coupon rates.

Provincial governments should monitor local employment changes and provide workforce training for transition roles. Figure A 12 illustrates how the transition impacts employment trends: traditional sectors like coal mining and petroleum extraction are declining, while renewable energy jobs are rising. However, new jobs in renewable energy may not fully compensate for losses in traditional industries due to different skill requirements. The demand for skilled labor in new technologies is creating a global competition for qualified workers, further intensifying the challenge. This also brings the possibility of labor migration. This gap highlights the need for robust reskilling and upskilling programs to ensure an inclusive transition. International examples include the German Development Ministry (BMZ)'s global training in energy and transport transition, the UK's 'Green Jobs Taskforce' to identify and fill skill gaps, and Denmark's integration of vocational training with industry needs through apprenticeships in green technologies. China can draw from these practices to enhance its workforce training initiatives. Each province should leverage pilot carbon markets to implement carbon pricing revenue recycling. Enterprises benefiting from carbon markets should allocate a portion of their revenues to support the transition, directing funds towards financial assistance for affected workers, the production of renewable energy for local communities, and community development programs. This mitigates employment impacts and promotes sustainable local economic development. For enterprises not profiting from carbon markets, provincial governments should establish dedicated funds for employee retraining, provide subsidies for adapting to the green economy, and offer tax relief to companies participating in a just transition, including reduced corporate income tax and R&D tax credits.

Figure A 12 - Job replacement during the transition in China <sup>79</sup>

Industry associations should encourage and assist companies in developing feasible transition strategies. Many companies struggle due to insufficient understanding, leading to ineffective plans that lack short-term goals and clear management responsibilities. Associations can guide companies to align with international frameworks like Task Force on Climate-Related Financial Disclosures (TCFD), Carbon Disclosure Project (CDP), and OECD, providing guidelines on setting climate targets, developing action plans, and establishing disclosure mechanisms. Associations can bridge the gap between government initiatives and corporate action by advocating for policies, subsidies, and support mechanisms that facilitate sustainable investments. They can create networking platforms for companies to share experiences and solutions, fostering peer-to-peer learning and innovation. For instance, the World Business Council for Sustainable Development (WBCSD) provides a platform for collab-

oration on sustainability initiatives. Additionally, associations can offer workshops and training on best practices for climate action, such as risk assessment and integrating climate strategies into business models. The CBI offers various training programs to help companies implement sustainable practices. China's current disclosure regulations should incorporate more elements of the just transition, such as employee retraining programs, social equity considerations, and community engagement initiatives related to decarbonization. Financial institutions can consider linking the interest rates of financial products to the target company's commitment to a just transition and the effectiveness of its disclosures. Stricter criteria for green bonds and sustainable finance products should require detailed disclosures on using proceeds for just transition initiatives. Companies should provide transparent reports on training programs for workers transitioning from high-carbon industries, including

79. Goron, C., J. Zhang, 2023, Pathways Towards a Just Transition to Carbon Neutrality in China, <https://library.fes.de/pdf-files/bueros/china/20324.pdf>



metrics on the number of employees trained, skills acquired, and employment outcomes.

Implementing these policies will promote China's Transition Finance by ensuring that financial products and green bonds are directly tied to the effectiveness of just transition initiatives, enhancing transparency and accountability. These approaches are expected to drive investments towards sustainable practices, supporting a fair and equitable transition for workers and communities.

## 7. Conclusion

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The journey towards a just transition in China, encompassing the steel, shipping, and ICT industries, mirrors challenges faced globally, showing issues that national governments should and can collectively address internationally. These industries show significant strides and ongoing challenges. Integrating social equity and environmental sustainability, just transition and transition finance principles are being increasingly embedded in both global and national strategies. However, practical implementation requires tailored approaches for each sector and region.

In the steel industry, volatile output and declining employment highlight the need for skill training and job placements. Transition finance, driven by evolving standards, bond markets, and private equity, supports this shift. Learning from the US and Japan, China can enhance its strategies to ensure a balanced transition. The shipping industry faces rising volumes and emission increases, coupled with decarbonization pressures and employee safety concerns. Community, workplace, and training initiatives are also crucial. Leveraging internal capital and external tools, such as Singapore's fiscal strategy for green shipping, can provide robust models for sustainable practices. The ICT sector's projected emissions and reliance on thermal power necessitate a circular economy strategy. Enhanced regulations and financial support for improving working conditions, especially in the Yangtze River Delta, are critical. South Korea's public-private partnerships and extended producer responsibility in ICT recycling offer effective models for China to emulate.

Mitigating transition-washing risks during the transition process necessitates a unified global transition taxonomy and robust disclosure requirements. While the transition scale and investment in China make this particularly critical, it remains a global issue, emphasizing the international significance

and collective benefits of such frameworks. China's evolving regulations stipulate detailed transition plans, integrating just transition principles into financial instruments. This alignment ensures financial products are tied to just transition initiatives, enhancing transparency and accountability. The path to a just transition in China requires coordinated efforts across sectors and regions. Embracing comprehensive policies and practices, China can balance economic growth with environmental sustainability and social equity, leading to a resilient and inclusive future. With strategic planning and robust financial frameworks, China can achieve its just transition goals and positively enhance global imperatives and international efforts.

## Appendix

**Table A 1 - Steel Industry Transition Plans and Policy Design in China <sup>80</sup>**

Document Title	Issuing Body	Issuance Date	Key Contents
Action Plan for Peak Carbon Emissions in the Steel Industry (2024-2025)	NDRC	2024/05	Strengthen capacity adjustments; deepen product structure adjustments; accelerate transitions.
Work Plan for Stabilizing Industrial Growth in the Steel Industry	MIIT, NDRC	2023/08	Enhance industry environment; improve industrial structure, high-end, intelligent, and green levels.
Implementation Plan for Carbon Peaking in Industrial Sectors	MIIT, NDRC, MEE	2022/06	Establish energy conservation and emission reduction work pattern; achieve significant results by 2025.
Industrial Energy Efficiency Improvement Action Plan	MIIT, NDRC, MoF	2022/06	Improve energy efficiency; green development; energy consumption of key products reduced by 13.5% by 2025.
Guidance on Promoting High-Quality Development of the Steel Industry	MIIT, NDRC, MEE	2022/02	80% energy and emission reduction; reduce water and energy usage by 10%; achieve breakthroughs by 2030.
Guidelines for Energy Conservation and Carbon Reduction Transformation and Upgrading in the Steel Industry	NDRC	2022/02	Improve energy efficiency by 30% by 2025.
Implementation Plan for Accelerating the Comprehensive Utilization of Waste Resources in the Steel Industry	MIIT, NDRC	2022/02	Enhance utilization rate of solid waste to 73% by 2025.

**Table A 2 - Employee Termination Plans at M Steel <sup>81</sup>**

	Plan I: Consensual termination of labor contracts	Plan II: Rest from work and take self-employment
Applicable Employees	Employees of M Steel with a perpetual contract and 25 years of service.	Employees with 10 or more years of continuous service.
Placement Benefits	Workers get 5x M City's average annual wage as compensation. If their monthly salary is over 3x the city's average, they'll receive 3x their wage.	M Steel pays only social security and provident fund for two years. After this period, M Steel will end contracts without any further payments.
Other Details	M Steel offers a 50,000 CNY employment subsidy for early departures; this decreases over time and drops to 40% of the original amount by year's end.	Individuals joining this program and starting a business cannot be employed by another organization.

80. Source: public materials

81. Source: fieldwork and interviews

Table A 3 - Transition Finance for China's Steel Industry <sup>82</sup>

Document Title	Applicable Entities	Supported Technologies	Disclosure Requirements
Shanghai Steel Industry Low-Carbon Transition Pilot (Trial)	Selected steel enterprises in Shanghai actively involved in low-carbon projects and seeking sustainable development	<ol style="list-style-type: none"> <li>1. Advanced blast furnace technology</li> <li>2. Efficient smelting processes</li> <li>3. Emission reduction innovations</li> <li>4. Resource-efficient production</li> <li>5. Energy-saving logistics</li> <li>6. Waste recycling and reuse</li> <li>7. Smart energy management</li> <li>8. Carbon emission tracking</li> <li>9. Automated production systems</li> <li>10. Green supply chain integration</li> </ol>	<ol style="list-style-type: none"> <li>1. Compliance with Shanghai's environmental regulations</li> <li>2. Proof of significant reduction in emissions</li> <li>3. Inclusion of innovative low-carbon technologies</li> <li>4. Collaboration with financial institutions for sustainable financing</li> <li>5. Regular performance and progress reports</li> </ol>
Huzhou Province Special Financial Support Plan for Low-Carbon Transformation of the Steel Industry	Steel enterprises involved in industrial upgrading, energy efficiency improvements, and environmental protection in Huzhou City	<ol style="list-style-type: none"> <li>1. Renewable energy integration</li> <li>2. Advanced waste treatment</li> <li>3. Industrial process optimization</li> <li>4. High-efficiency energy storage</li> <li>5. Digital transformation</li> <li>6. Low-carbon transport systems</li> <li>7. Water resource management</li> <li>8. Circular economy practices</li> <li>9. Pollution control technologies</li> <li>10. Decarbonization strategies for supply chains</li> </ol>	\
Hebei Province Steel Industry Transformation Financing Work Plan	Enterprises in Hebei Province undergoing capacity reduction, relocation, or upgrade	<ol style="list-style-type: none"> <li>1. Energy-efficient technology in major processes</li> <li>2. Waste heat recovery</li> <li>3. Resource recycling</li> <li>4. Efficient logistics</li> <li>5. Desulfurization and denitrification</li> <li>6. Carbon capture, utilization and storage (CCUS)</li> <li>7. Hydrogen metallurgy</li> <li>8. Intelligent manufacturing</li> <li>9. Emission monitoring</li> <li>10. Energy storage technologies</li> </ol>	<ol style="list-style-type: none"> <li>1. Annual energy/emission reduction targets</li> <li>2. Long-term reduction plans</li> <li>3. Financial risk management</li> <li>4. Plan implementation monitoring</li> <li>5. Just transition process</li> </ol>

82. Source: public materials

**Table A 4 - Examples of Transition Bonds for Steel Industry** <sup>83</sup>

Issuer and Issue Date	Bond Type	Amount	Term	Purpose	Interest Rate
Shandong Iron & Steel Group (2022/06)	Transition Bond	10 CNY billion	Perpetual	Energy replacement and technology upgrade projects to save 325,200 tonnes of standard coal annually, reduce CO <sub>2</sub> emissions by 784,900 tonnes, and enhance energy efficiency.	2.1%
Baosteel Group (2022/05)	Green Transition Corporate Bond	3.56 CNY billion	3 years	Upgrading Baosteel Zhanjiang Green Demonstration Plant, reducing CO <sub>2</sub> emissions by 630,000 tonnes annually.	2.68%
Ansteel Group	Sustainability-Linked Loan	2 CNY billion	3 years	Energy efficiency projects to keep comprehensive energy consumption below 565kgce/t.	3.08%
Liuzhou Iron & Steel Group	Sustainability-Linked Loan	3.56 CNY billion	2+1 years	Reducing unit CO <sub>2</sub> emissions to 0.935kg/t by 2022, decreasing from 2020 levels.	4.1%

**Table A 5 - Transition Experience from Pittsburgh, USA** <sup>84</sup>

Phase	Key Measures
1. Environmental and Urban Construction	Environmental remediation, infrastructure development, public spaces, and office building construction.
2. Economic Restructuring	Establishment of cultural and credit trust funds, insurance and risk capital, and the creation of high-tech enterprise incubators.
3. Talent Attraction	Transformation into education, tourism, and service industries; attracting medical and AI professionals to develop advanced high-tech industries.

**Table A 6 - Transition Finance for International Practices** <sup>85</sup>

Document Title	Applicable Users	Supported Technologies	Disclosure Requirements
The Sustainable STEEL Principles (SSP)	Banks and other financial institutions	1. Use of recycled steel 2. Emission reduction technologies	1. Investment allocation percentages and related data sources 2. A concise summary that includes the rationale for allocations
Climate Bonds Initiative (CBI) – Steel Criteria	Individual and institutional investors	1. Carbon capture and storage (CCS) and CCUS 2. Use of renewable energy	1. Decarbonization measures from investees 2. Annual carbon emission levels and targets

83. Source: the Greenpeace Organization, [www.greenpeace.cn/watch-board/green-investment-project](http://www.greenpeace.cn/watch-board/green-investment-project)

84. The City of Pittsburgh, Pittsburgh Comprehensive Plan, <https://pittsburghpa.gov/dcp/CompPlanPGH>

85. Source: public materials

Table A 7 - Shipping Industry Transition Plans and Policy Design in China <sup>86</sup>

Document Title	Issuing Body	Issuance Date	Key Contents
\	Shanghai Maritime Safety Administration (SMSA)	2024/04	Establish the first China marine emission reduction management agency in Shanghai – SMSA's Ship Energy Efficiency Management Center.
Notice on Standardizing the Use of Shore Power for International Container Ships and Ports (2023-2025)	MoT	2024/04	By the end of 2024, ensure 100% shore power coverage for container ship berths at key ports; by the end of 2025, achieve 90% shore power coverage at major ports for international container ships.
Action Plan for Building a Strong Transportation Nation (2023-2027)	MoT	2023/04	Strengthen pollution control and ecological protection in the transportation sector; promote diversified low-carbon development.
Green Transport Development Plan (14th Five-Year Plan)	MoT	2022/01	By 2025, achieve initial green production methods in the transportation sector; improve transportation infrastructure environment; enhance equipment cleanliness and transportation organization efficiency.
Regulations on Data Collection and Management of Ship Energy Consumption	CMSA	2018/08	Collect and manage ship energy consumption data; monitor and report data including fuel consumption, sailing time, distance, and cargo turnover for ships of 400 gross tonnes or more.
Regulations on Measuring Ship Emissions	MEE	2016/08	Strictly control ship engine air pollutant emissions.
Regulations on Limiting Fuel Consumption for Transport Ships	MoT	2012/06	Improve ship energy efficiency and reduce fuel consumption.
Regulations on Limiting CO <sub>2</sub> Emissions for Transport Ships	MoT	2012/06	Control CO <sub>2</sub> emissions from ships.

86. Source: public materials

**Table A 8 - Safety Risks to Employees with New Ship Propulsion Technologies and Fuels 87**

Employee Role	Traditional fuel hazards	Methanol hazards	Ammonia hazards
Engine room crew	Risk of burns from high temperatures	Toxic if ingested or inhaled	Highly toxic if inhaled or ingested
	Exposure to SOx and NOx	Requires additional gas	Requires advanced leak detection systems
	Skin irritation from oil spills	Risks of methanol vapor exposure	Requires specialized containment systems
Deck crew	Risk of oil spills leading to slips and falls	Handling methanol increases exposure to toxic substances	Risk of toxic exposure from leaks
	Exposure to hazardous fumes	Risk of leaks and vapor exposure	Requires strict access controls to areas with ammonia equipment
Maintenance crew	Contact with carcinogenic substances in fuel oil	Increased safety protocols for handling methanol	Requires specific PPE and training for handling
	Risk of explosion in confined spaces	Risk of skin absorption and inhalation	Risk of skin absorption
Bunkering operators	Risk of spills and fire	Stringent safety measures required during bunkering (additional detectors, ventilation)	Stringent safety measures required during bunkering (double-walled, piping, sensors)
	Emission of volatile organic compounds	Less flammable but still needs protection	Requires safe storage temperature

**Table A 9 - Transition Products Examples for the Chinese Shipping Industry 88**

Product Type	Financing Entity	Details
Sustainable development linked syndicated loan	China Merchants Leasing	Linked to sustainable development targets, public transportation, clean energy, solid waste treatment, and green shipping.
Green and blue bonds	CSSC	A 3.56 CNY billion bond supporting energy efficiency upgrades, pollution prevention and control, low-carbon and clean fuels, and sustainable transportation.
Inclusive financing 'Green Shipping Loan'	China Construction Bank, Zhejiang Province	Green ships equipped with pollution prevention systems and certified for safety and environmental protection.
Sustainability-linked Loan	China Merchants Financial Leasing	For the acquisition of two 210,000 Deadweight Tonnage energy-efficient bulk carriers, an interest rate reduction will apply if continuous GHGs decrease.

87. Source: public materials, fieldwork and interviews

88. Source: public materials

Table A 10 - ICT Industry Transition Plans and Policy Design in China <sup>89</sup>

Document Title	Issuing Body	Issuance Date	Key Contents
Guiding Opinions on Accelerating the High-Quality Development of Green Manufacturing	MIIR, NDRC, MoF	2024/05	By 2030, green factories to account for over 40% of manufacturing value; green development as a solid foundation for new industrialization.
Action Plan for Improving the Quality of Computing Infrastructure	MIIT	2023/10	Enhance resource utilization and computing efficiency; promote market adoption of green and low-carbon computing; empower the green transition
Notice on Printing and Distributing the Action Plan for the Electronic Information Manufacturing Industry (2023-2024)	MIIT, MoF	2023/08	Promote green manufacturing and intelligent upgrades; encourage the construction of green factories in the ICT manufacturing industry
National Industrial Energy Efficiency Technology Equipment Recommendation Catalog (2022 Edition)	MIIT	2022/11	List energy efficiency technologies for various industries (steel, electronics, renewable energy, etc.); utilize and explore energy-saving potential.
ICT Green and Low-Carbon Development Action Plan (2022-2025)	MIIT	2022/08	Build a green and low-carbon ICT foundation; upgrade ICT infrastructure and improve green development levels; encourage green transformation and applications.

89. Source: public materials



Table A 11 - Global Efforts in Standardizing Transition Plans <sup>90</sup>

Associations	Time	Documents or speakers	Main content
International Sustainability Standards Board (ISSB)	July 2024	Emmanuel Faber, Chair	Move to consolidate reporting of emissions and transition plans
Network for Greening the Financial System (NGFS)	April 2024	Tailoring Transition Plans: Considerations for EMDEs	Explore needs and challenges of emerging market and developing economies (EMDEs) related to transition plans
		Connecting Transition Plans: Financial and non-financial firms	Assess interlinkages between the transition plans of the real economy and financial institutions'
		Credible Transition Plans: The microprudential perspective	Examine credibility of financial institutions' transition plans and processes from a micro-prudential perspective
Global Reporting Initiative (GRI)	Nov. 2023	GRI Topic Standard Project for Climate Change – Climate Change Exposure draft	Enable companies to disclose climate change transition plans and actions, and on climate-related energy transition initiatives
Transition Plan Taskforce (TPT)	Oct. 2023	TPT Disclosure Framework	Develop a sectorneutral Disclosure Framework for best-practice transition plan disclosures, alongside implementation guidance and sector guidance.
Carbon Disclosure Project (CDP)	Feb. 2023	Are Companies Developing Credible Climate Transition Plans?	12.6% of the organizations reporting through CDP have many elements of a credible climate transition plan, however only 81 (0.4%) of them disclosed sufficient detail to all key indicators.
Glasgow Financial Alliance for Net Zero (GFANZ)	Sept. 2022	Introductory Note on Expectations for Real-economy Transition Plans	Bring consistency, clarity, and a global economy-wide view on information and metrics financial institutions require to assess the credibility of plans.
		Expectations for Real-economy Transition Plans	Bring consistency, clarity, and a global economy-wide view on information and metrics financial institutions require to assess the credibility of plans.
		Mary Schapiro, Vice Chair	'A global net-zero economy transition requires financial institutions and real-economy firms to work from a common set of expectations'

90. Source: public materials

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