TRADE & INDUSTRIAL POLICY STRATEGIES

GREENING INDUSTRIAL POLICY IN SOUTH AFRICA: INSIGHTS FROM CHINA, THE UNITED STATES AND THE EUROPEAN UNION

WORKING PAPER

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TIPS supports policy development through research and dialogue. Its two areas of focus are trade and inclusive industrial policy; and sustainable growth.

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ABBREVIATIONS

BCAs	Border Carbon Adjustments
CBAM	Carbon Border Adjustment Mechanism
CCP	Chinese Communist Party
CCS	Carbon Capture and Storage
CDR	Carbon Dioxide Removal
EGD	EU Green Deal
EU	European Union
EVs	Electric vehicles
FTAs	Free Trade Agreements
FYP	Five-Year Plan
GEFF	Green Economy Financing Facility
IP	Industrial Policy
IRA	Inflation Reduction Act (US)
JET-IP	Just Energy Transition Investment Plan
SAREM	South African Renewable Energy Masterplan
SMEs	Small and Medium-sized Enterprises
US	United States
WTO	World Trade Organisation

1. INTRODUCTION

Green Industrial Policy (Green IP) aims to advance green industries and transform existing sectors to support the move towards low-carbon economies. Traditionally, industrial policy has focused on enhancing productivity and economic prosperity by supporting specific industries. However, the growing urgency of climate change has caused a shift towards Green IP, which attempts to balance economic growth with sustainable development. Hence, the world's economic powerhouses, including the European Union (EU), United States (US), and China, have pivoted their industrial strategies to prioritise sustainability. The EU Green Deal Industrial Plan, the US Inflation Reduction Act (IRA), and China's 14th Five-Year Plan (FYP) exemplify this trend, each embodying a dual approach. These policies not only focus on domestic economic recovery and sustainable growth but also emphasise maintaining global competitiveness and securing international trade opportunities. The global response to these policies has led to a competitive push towards green technologies, with countries like Japan, India, South Korea, and Canada joining the race to innovate and invest in green technologies.

The EU's introduction of the Carbon Border Adjustment Mechanism (CBAM) – and similar measures in the United Kingdom, US, and Canada – while aimed at reducing carbon emissions, have sparked concerns about trade protectionism and potential trade disputes. The CBAM, for example, has been criticised for imposing additional burdens on the exports and potentially undermining the economic development of countries like South Africa which have carbon-intensive economies.

In this context, South Africa faces a dual challenge. The country must balance transitioning to a greener economy with trying to reduce high rates of unemployment and poverty. South Africa's economy, heavily reliant on carbon-intensive industries, faces significant structural transformation risks. This includes potential losses in competitiveness and access to crucial export markets, which could hinder production, employment, and development. The South African government has initiated efforts such as the Just Energy Transition Investment Plan (JET-IP) to support decarbonisation, but substantial hurdles remain.

This working paper aims to examine international practices of Green Industrial Policy and draw lessons for greening South Africa's industrial policy.

2. BENCHMARKING INTERNATIONAL PRACTICES

The following section explores the key features of Green IP frameworks in the EU, US, and China, and assesses the associated challenges.

2.1. European Union

The EU Green Deal (EGD) was launched towards the end of 2019 as a set of policy initiatives which aimed to achieve the EU's climate neutral goal by 2050. The overarching goal of the Green Deal is to transform the EU into a resource-efficient and competitive economic region. It was also branded as a "lifeline" out of the COVID-19 pandemic. The EGD is primarily a response to energy uncertainty in Europe, the adoption of new industrial policy in the US, and China's push to become a global leader in green technologies (Schwartzkopff and Ott, 2023). "These policy initiatives aim to make all sectors of the EU's economy fit to contribute to the region reaching its climate targets by 2030 in a fair, cost-effective way" (Cameron et al., 2021, p. vii). One of the key pillars of the EGD is to mobilise industry by transforming EU industrial strategy. According to Maimele (2023, p. 36), "… the strategy aims to

support the twin transition to a green and digital economy, make EU industries more competitive globally, and enhance the EU's open strategic autonomy".

The Green Deal builds on existing EU climate and energy-related policies such as the 2030 Climate and Energy Framework and the Renewable Energy Directive; the Circular Economy Action Plan; the Chemicals Strategy for Sustainability; and the Critical Raw Materials Act. The Green Deal fits within the EU's flagship climate initiative, "Fit for 55."[1] In line with these policies, the Green Deal Industrial Plan is specifically geared towards preparing EU region industries for the transition towards net-zero. According to the European Commission, the Plan aims to significantly enhance technological advancements, manufacturing processes, and the deployment of net-zero products and energy supply over the next decade (European Commission, 2023a).

The Green Deal Industrial Plan is based on four pillars:

1. A predictable and simplified regulatory environment;
2. Faster access to funding;
3. Enhancing skills; and
4. Open trade for resilient supply chains.

Predictable and simplified regulatory environment

The EU is a firm believer in the use of balanced and well-designed policy frameworks. Accordingly, "… a simple, predictable and clear regulatory environment is key to promoting investment"(European Commission, 2023a). Three initiatives form part of creating this predictable and simplified regulatory framework: the Net-Zero Industry Act, the Critical Raw Materials Act and the reform of electricity market design. The Net-Zero Industry Act aims to "scale up the manufacturing of clean technologies" (European Commission, no date). The hope is thus that this act will create the grounds for better market access for clean technology and boost the competitiveness of EU industries, while creating jobs (European Commission, no date). According to the Act, strategic net-zero technologies have been identified as having the potential to be scaled up – these include solar photovoltaic and solar thermal, electrolysers and fuel cells, onshore wind and offshore renewables, sustainable biogas/biomethane, batteries and storage, carbon capture and storage, heat pumps and geothermal energy and grid technologies.

It is further noted that the EU seeks to set "European" standards for promoting clean and digital technologies to guide implementing environmentally friendly technologies that ensure competitiveness, investment and support Small and Medium-sized Enterprises (SMEs) (European Commission, 2024). To create a simpler regulatory environment, the Act outlines a number of strategies. These are: identifying net-zero projects; lowering administrative burdens and red tape for net-zero manufacturing projects; improving CO^2 storage sites; focusing on specific investment projects such as the Net-Zero Europe Platform and the European Hydrogen Bank to attract investment; instituting sustainability criteria in procurement procedures; creating "sandboxes" for innovation; and enhancing skills through the Net-Zero Industry Academies (European Commission, no date).

In addition, the commission proposes a Critical Raw Materials Act that focuses on diversifying sourcing and recycling the raw materials required for net-zero technologies. The purpose of this act is to "lower the EU's dependence on highly concentrated supplies from third countries and boost quality jobs and growth in the circular economy"(European Commission, 2023a, p. 6). The EU has sought to revise the

[1] The goal of "Fit for 55" is to reduce greenhouse gas emissions by at least 55% by 2030.

rules for the electricity market design to deal with market insecurity in the energy sector. The aim is to eventually replace expensive fossil fuel with cheaper renewable energy sources in line with the REPowerEU plan[2] (European Commission, 2023a). It is hoped that such reforms will create a more sustainable and consumer-friendly energy market in the EU (European Commission, 2023b).

Access to funding

To remain competitive, the European Commission has noted, the EU needs to rapidly develop its renewable energy sectors. Speeding up access to finance will boost the transition towards net-zero. Various sources of funding will be used at the national, regional and private levels. At the national level, the EU is: providing state aid to support developing key net-zero technologies; allowing member states flexibility to grant aid; using the Temporary Crisis and Transition Framework to simplify aid for renewable energy and decarbonisation efforts. At the regional level, the EU will provide funding through programmes such as the REPowerEU, InvestEU and the Innovation Fund to fund the greening of industries and to support energy-intensive sectors during their transition. Private investment is also marked as being crucial to the net-zero transition and can be a vital source of development. The EU is working on establishing the Capital Markets Union to improve and expand capital markets and their integration for finance and investment opportunities directed at individuals and companies (European Commission, 2023a).

Enhancing skills

The transition towards net-zero will undoubtably require skilled labour. Thus the third pillar of the Plan is skills enhancement. The European Commission has thus acknowledged that the transition will require an inclusive skills development programme, and it has adopted a skills-first approach while using frameworks such as the European Skills Agenda, the European Education Area and the European Pact for Skills. The commission has also proposed establishing Net-Zero Industry Academies to assist up-skilling and re-reskilling within strategic industries such as raw materials, hydrogen and solar technologies (European Commission, 2023a).

Open trade for resilient supply chains

The EU sees free, fair and open trade as being an integral part in the achievement of net-zero and the development of technologies. This pillar promotes the EU's stance as a global trading partner, especially in its advancement of the EU's Free Trade Agreements (FTAs) and World Trade Organization (WTO) standards. On the US's IRA the commission has noted that "the EU and the US are working towards pragmatic solutions to EU concerns, with a view to maintaining and reinforcing Transatlantic value chains and ensuring positive cooperation on the shared interest to achieve net-zero" (European Commission, 2023a). In addition, the EU has developed the Sustainable Investment Facilitation Agreements to strengthen its international relationships, especially with Africa. The Plan also notes new initiatives, such as the Critical Raw Materials Club to ensure a stable supply of essential raw materials for green and digital technologies; Clean Tech/Net-zero Industrial Partnerships to promote global adoption of net-zero technologies; and the development of an export credits strategy, including an EU export credit facility, to align with the EU's green policies such as the Green Deal and invest in net-zero emission infrastructure (European Commission, 2023a).

[2] The REPowerEU Plan is a strategic initiative designed to decrease the EU's reliance on Russian fossil fuels while accelerating the shift to renewable energy sources.

2.2. Existing gaps and challenges

Within the broader context of green industrialisation, the Green Industrial Plan is primarily geared to enhancing the competitiveness of the bloc's net-zero industry and its transition to climate neutrality. Overall, the Plan aims to transform the EU economy through innovations in green technology and scaling up manufacturing capacity for net-zero technologies. It is hoped that investing in green technology will allow the EU to be competitive at a global level, especially with the US and China.

However, it has been met with criticism, with some arguing that the EGD and its packages are "not equipped to put Europe on a long-term socio-ecological path"(Pianta and Lucchese, 2020, p. 1). It is argued that the EGD does not necessarily provide overhauled plans and resources but rather reuses what is readily available within the EU framework. As such, the plan is to leverage existing financial resources in a way that attracts greater private investment in green technologies. The private sector may hesitate about investing in sectors where risks may be too high, and green technologies have not yet been developed. This causes uncertainty. The policy tools also provide insufficient incentive for private sectors to invest in green technologies and sustainable production.

Efficiency considerations in the use of technology and innovation have dominated the EU's energy and resource discourse, and this is believed to be inadequate in addressing socio-economic and environmental challenges. While this approach eases bureaucratic red tape, it may risk weakening environmental safeguards and increasing social and environmental injustice (Schwartzkopff and Ott, 2023). This is especially true since EU member states are not all equal and have different macroeconomic conditions: some states are more vulnerable than others. Some member-states may be unwilling to decarbonise as it risks macroeconomic and social stability. Although the EGD is a comprehensive framework, with legally-binding targets for emissions reduction, the implementation strategies, effectiveness and enforcement of these mandates varies among member states, and this could undermine the long-term objectives of the EGD (Pianta and Lucchese, 2020). Likewise, of concern is whether the social policies of the EU are sufficiently robust and if institutional frameworks are adequately equipped to manage the challenges and disruptions linked to decarbonisation initiatives (Im et al., 2023).

3. UNITED STATES

The Inflation Reduction Act, signed into law in 2022, and a signature initiative of former President Joe Biden, is viewed as the largest investment in the US economy at the time. The overall theme of the IRA is the move towards clean energy[3]. The IRA commits to "build a new clean energy economy, powered by American innovators, American workers, and American manufacturers, that will create good-paying union jobs and cut the pollution that is fuelling the climate crisis and driving environmental injustice" (The White House, 2023a, p. 2). The IRA built on previous climate-change related policies, such as the Clean Air Act, the Energy Policy of 2005, the American Recovery and Reinvestment Act of 2009, the Clean Power Plan of 2014 and the US's commitments to the Paris Agreement (rejoined under the Biden administration and committing to reduce GHG emissions before being exited by the Trump administration again in 2025). The IRA focus areas are:

- ***Advancing and deploying American-made clean energy technology***: The IRA makes funds available funds for clean energy development and deployment. In addition, several tax incentives were introduced to encourage the development and use of clean energy.

[3] The Trump administration may seek to modify or repeal some aspects of the IRA going forward.

- ***Revitalising American manufacturing to build the clean energy economy****:* The IRA introduces several funding and tax programmes to boost domestic manufacturing of job-creating clean energy technologies.
- ***Investing in America's electricity grid:*** The IRA commits to investment schemes to modernise and improve the reliability of the US electricity grid. Furthermore, the aim is to power the modernised grid with clean and affordable energy for American citizens and businesses.
- ***Investing in affordable and reliable clean energy in rural America and on tribal lands***: This is part of the IRA's environmental and social-justice imperatives. The focus on working alongside rural and tribal communities to support developing clean energy technologies and sources in those areas.
- ***Incentivising and supporting deployment of clean vehicles:*** The IRA provides incentives for transforming the transportation sector. In addition, incentives aim to develop and deploy of electric vehicles (EVs) and make EVs more affordable.
- ***Expanding America's leadership in industrial decarbonization and carbon management:*** The IRA is positioned to help decarbonise key industrial sectors (aluminium, steel, concrete) through measures such as carbon capture and storage (CCS) and governmental grants to lower emissions.
- ***Investing in clean hydrogen:*** The Biden Administration Clean marked hydrogen as a key component of the decarbonisation of US industries. The IRA outlines incentives (chiefly, the Hydrogen Production Tax Credit) and funding schemes to develop, produce and use clean hydrogen as a source of energy.
- ***Protecting communities from harmful air pollution:*** The IRA directs billions of dollars to reducing emissions that are harmful to human and environmental health, especially within vulnerable communities. Part of this effort will also be to improve pollution monitoring and tracking
- ***Making homes and buildings cleaner and more efficient to save consumers money and cut pollution:*** The IRA plan is to lower the cost of energy for American households through tax incentives to make energy efficient appliances and technologies more affordable, and to modernise residential and commercial buildings to be more energy efficient.
- ***Investing in a sustainable, lower-carbon federal government:*** Federal government will take the lead in transforming its procurement and operations practices to be in line with sustainable and lower-carbon efforts, through net-zero initiatives such as the Federal Buy Clean Initiative.
- ***Harnessing nature-based solutions and climate-smart agriculture to deliver economic, climate, and resilience benefits:*** The IRA outlines the federal government's commitment to the conserving natural areas, restoring habitats, especially water and land, and promoting sustainable farming. The IRA also makes funds available for distressed farmers and those affected by market-related shocks as a result of the Covid-19 pandemic and climate change
- ***Increasing the resilience of our communities in a changing climate***: The IRA plans to put into place several funding schemes/programmes that will assist climate change-stricken areas and communities in the US, providing financial and technical assistance. Part of such efforts is also directing investment towards improving climate science.

3.1. Existing gaps and challenges

According to the White House (2023b), the IRA created over 170 000 jobs in the clean energy sector and billions of US dollars were invested into local clean energy manufacturing projects. However, the IRA is not without problems. One is the IRA's use of CCS and Carbon Dioxide Removal (CDR) technologies. It has been noted that "many carbon management technologies are 'pure climate technologies,' meaning that their sole purpose is to mitigate the effects of climate change and often do not come with significant monetizable co-benefit" (Goddard, 2023, p. 5).

The result has been a finance gap that needs to be filled by government support. The IRA does give effect to the use of a tax credit (45Q) but it is argued that this may be insufficient, particularly when dealing with industrial processes from which it is difficult to reduce or eliminate emissions, such as the cement and energy sectors. It has been recommended that a blended finance model be used to attract private investment and support. Blended finance can be especially important for climate projects as "it can be particularly useful in explaining and anticipating the needs and preferences of investors in areas with an array of complex risks, like CCS and CDR"(Goddard, 2023, p. 8).

The Climate Group (2024) points out that the IRA has not been deficient in taking action, as it made strides in sectors like the EV industry. However, the main issue highlighted is the pace at which these actions are being executed. For example, within the energy sector, changes have been slow. Among barriers that have slowed the uptake of renewables in the US is the power grid and questions around its ability to handle larger amounts of energy generated by renewable technology. Other barriers include bureaucratic red-tape, local opposition and supply-chain issues (Plumer, 2024). As of this writing, the specific actions the newly elected Trump administration could or would take regarding the IRA remained uncertain. However, the IRA has already been affected by the recent pause in federal funding, particularly for programs designed to curb fossil fuel development and promote electric vehicles (Reuters, 2025)[4].

4. CHINA

In 2021 China implemented its 14th Five-Year Plan (FYP) (2021-2025), with a key focus being on the greening of the state's industrial sectors. This post-pandemic plan is part of China's long-term industrial development goals – which is built on the three key pillars of development, economic, social and environmental – although green development does feature strongly. The FYP is divided into 19 sections and 65 chapters with a focus on China's development plans from 2021 to 2025 and the state's 2035 vision.[5] Among the key points of the plan, such as setting new energy and food security targets, a commitment is made to introducing a "new development concept that combines sustained and healthy economic development with obvious improvements in quality and efficiency"(UNDP, 2021). Overall, the 14th FYP outlines a shift towards making industries less resource-intensive through new technologies, re-designing transport and energy systems, and greater investments in natural and human capital. The goal is to not only make China more sustainable, but also position China as a (competitive) global leader in the green economy (Hepburn et al., 2021).

[4] The IRA is unlikely to be repealed entirely, though climate-related provisions may be at risk. However, tax credits for carbon capture, biofuels, and hydrogen are expected to remain in place due to bipartisan support. For more see: What will happen to IRA clean energy tax credits in the Trump Administration?

[5] China's Vision 2035 aims to create large urban centres that will enhance regional trade and investment ties with ASEAN, the Belt & Road region, and emerging economies.

The ruling Chinese Communist Party (CCP) seeks to modernise and green industrial sectors in the country, building on previous Five-Year Plans and its Made-in-China-2025 strategic plan. However, compared to the 13th FYP (2016-2020), mandatory environmental targets were lowered from 10 to five. In addition, unlike the 13th FYP, the 14th FYP does not set a specific target for the share of green energy in the country's overall energy consumption. The focus of the CCP is now on capping energy and carbon intensity per unit of GDP, rather than setting a cap on the total amount of carbon emitted (UNDP, 2021). The transformation of China's energy sources have been a staple of the FYPs since the 11th FYP in 2006, where a commitment was made to cut coal consumption. The 14th FYP continues this rhetoric with a commitment to green development and a green energy transition in addition to greening its Belt and Road Initiative (Hepburn et al., 2021). With the demand for electricity on the rise in China, especially in the service and residential areas, further investment in the development of clean energy technologies will thus be vital to not only secure the country's energy security, but also meet environmental targets (Hepburn et al., 2021). This comes at a particularly interesting time, as the global market for renewable energy is becoming increasingly competitive.

4.1. Existing gaps and challenges

China's increased focus on renewable energy and greening industrial sectors is linked to its commitment of reaching the ambitious goal of carbon neutrality by 2060. However, a recent study has suggested that "China would need to transform its energy mix dramatically by boosting its share of non-fossil fuel energy to 84% and completely phasing out coal-fired plants by 2060" (Hepburn et al., 2021, p. 3). The challenge here is thus how the state manages plants that are either already under construction or planned for a later stage. In addition to the increased demand for electricity in China, many local governments also rely on the royalties that come from mining operations (Hepburn et al., 2021). This undoubtedly will result in tension and a push-back by local government officials who may perceive the move towards renewable energy as being a threat to their livelihoods. This thus brings into question of a "just transition," especially for the mining communities.

5. EXTERNAL IMPACT(S) OF GREEN IP

The following section explores the external impact of Green IP, especially with the introduction of Border Carbon Adjustments (BCAs) such as CBAM.

The EU Green Deal Industrial Plan, the US IRA, and China's 14th FYP are all substantial policies with the potential to profoundly influence the transition to greener economies in these regions. However, while these policies are "green focused," they are integral components of broader strategies aimed at recovering from the 2020 pandemic in economic and social terms, as well as bolstering competitiveness on the global stage for their respective regions and states. Importantly, these policies reflect a dual approach: they are inward-looking, emphasising sustainable economic growth and strengthening domestic industries and taking socio-economic factors into account, while also outward-looking, focusing on maintaining competitiveness and securing international and regional trade and cooperation opportunities.

As with the 2008/2009 global financial crisis when there was a significant move towards the green economy for recovery, the aftermath of the 2020 COVID-19 pandemic has similarly compelled nations to reconsider their development trajectories. Consequently, embracing green growth has emerged as the primary approach to rebounding from the pandemic. This has led to a competitive push, observed in regions like the EU, US, and China, towards greening pivotal industrial sectors, integrating renewable energy options, and engaging in a "green technological race." The knock-on effect of such

policies has not only caused a competitive drive to invest in green technologies, but has also resulted in many countries responding with similar policies or measures. The result has been that countries such as Japan, India, South Korea, Canada and the UK have entered the race for green technologies.

South Korea's strategy, the Korean New Deal, is designed to fast-track the transition to a digital and eco-friendly economy. A key component of this initiative is the Green New Deal, which focuses on investments in renewable energy, subsidies for electric and hydrogen fuel-cell vehicles, the green renovation of buildings, and various projects that integrate digital technologies with green projects (Ministry of Economy and Finance: South Korea, 2020). In response to the US's IRA, Canada has launched a broad strategy to enhance its clean energy sector and attract further investments in green technology. The Trudeau government unveiled a C$80 billion tax credit for clean technology over the next 10 years, with C$25 billion earmarked specifically for green technology investments. As the Canadian Finance Minister stated, "without swift action, the sheer scale of U.S. incentives will undermine Canada's ability to attract investments needed to establish Canada as a leader in the growing and highly competitive global clean economy" (Forrest, 2023).

As one might expect, these green industrialisation policies have undoubtedly had geopolitical consequences. The EGD, particularly with the introduction of the CBAM, has elicited global responses. The EGD is expected to transform Europe's energy systems and reshape the EU's relationships with its international trade partners. Countries like Russia, Algeria, and Norway, which have heavily relied on the EU as a key market for their energy exports, are likely to be adversely affected. In 2019, the EU imported €320 billion worth of energy products, with over 60% coming from Russia. Additionally, the EU is responsible for about 20% of global crude oil imports, and the shift away from fossil fuels is poised to hit the global oil market, reducing revenues for major exporters like Saudi Arabia (Leonard *et al.*, 2021). The US IRA has also sparked concerns from the US's trade partners, particularly in the EV market. The EV tax credit, which encourages vehicle assembly in the US and offers a 100% tax credit[6] for both new and used EV purchases, while penalising the use of batteries containing Chinese minerals, has become a source of controversy. This is especially frustrating for the EU, as it has increasingly relied on Chinese minerals for its green technology supply chain.

5.1. The CBAM: Promoting green industries or protectionist measure?

The EU's CBAM in particular, has provoked retaliatory measures from trade partners who perceive it as protectionist and could spark a trade war as many countries have now responded with similar or counter measures. The United Kingdom (UK) has unveiled its own CBAM that will take effect in 2027 (Dev and Goswami, 2024). The US, although its response has so far been "measured," has responded with regulations aimed at the carbon intensity of production and introduced fees and taxes on emission-intensive imported goods. In 2023 several bills were put forth such as the PROVE IT Act, Foreign Pollution Fee Act, Clean Competition Act and the Market Choice Act (Gangotra, Carlsen and Kennedy, 2023). Canada has started the process of considering its own BCA to ensure that Canadian industries remain competitive in the transition to a low-carbon economy (Department of Finance: Canada, 2021)[7].

In theory, trade policies such as BCAs can further promote the greening of industries. Tariffs, border adjustments and trade agreement provisions can support green industrial policies. For instance,

[6] For new vehicles, a minimum of 50% of critical battery materials must be sourced from North America or countries with a free trade agreement with the US, rising to 60% in 2024 and 100% by 2029. In addition, at least 60% of battery components must be assembled in North America, with this requirement increasing to 100% by 2032.
[7] As of this writing, Canada has not yet implemented its own BCA.

lowering tariffs on imports of environmental goods and sustainable plastic alternatives — whether through bilateral or regional trade agreements or frameworks like the WTO's Environmental Goods Agreement — can encourage the uptake of green technologies (Berahab, 2024). However, green policies may be perceived as protectionist. Both the EU's Green Deal, particularly the CBAM, and the US IRA have faced accusations of being protectionist policies (Reinsch, Benson and Denamiel, 2023).

As of now, the WTO has not issued a formal response to the introduction of the CBAM. However, concerns have emerged that CBAM may function as a trade barrier, prompting potential disputes from countries such as China and India. Notably, China's former premier Li Keqiang described CBAM as creating "green barriers to trade" (Flekkoy, 2024). The central issue is the perception that CBAM serves as a form of protectionism under the guise of environmental policy, disproportionately affecting developing countries. Additionally, CBAM could be classified as a non-tariff barrier if its implementation results in excessive administrative burdens or red tape, or if its effects are unevenly distributed across industries in certain countries. "These concerns could arise if CBAM's requirements for measuring and verifying carbon content are overly complex, or if it applies different standards to goods from different countries" (Dev and Goswami, 2024, p. 33).

What is clear is that these policies can economically hurt countries in the global South. Since the introduction of the Green Deal and the IRA, push-back from the international community, especially from developing countries, has been considerable. Brazil has expressed concerns about the impact of the CBAM on countries, specifically developing countries, which have relied on sectors such as iron and steel for economic development. In particular, the Brazilian government has raised the possibility that CBAM may violate the principles of non-discrimination laid out in the General Agreement on Tariffs and Trade of the WTO, as it believes the mechanism and others like it introduce differential treatment between countries (IISD, 2024).

CBAM and similar measures could have uneven impact, particularly on the exports of developing countries. Although these policies may create a domestic incentive for economies such as the EU and the US, they may also create a competitive disadvantage and impose additional decarbonisation burdens on developing countries. Given that developing countries typically have lower GDP per capita than developed economies like the EU and the US, and their manufacturing sectors are often more carbon-intensive, applying uniform carbon prices or tariffs across all economies can be seen as inequitable (Dev and Goswami, 2024).

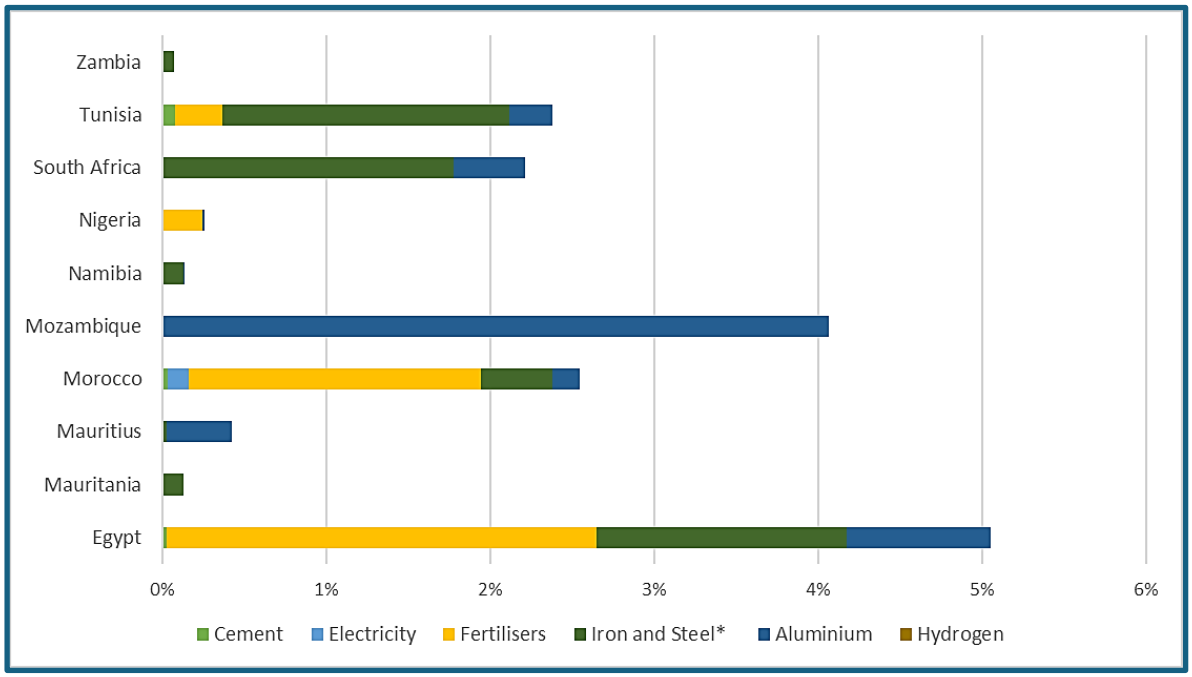
5.2. Impact of CBAM on Africa

This section examines Africa's vulnerability to mechanisms like the CBAM, highlighting their disproportionate impact on low-income and middle-income countries, the trade and economic implications for key African exporters, and the adaptive strategies pursued by Morocco to mitigate these challenges.

According to Maimele (2023, p. 22), Africa is "being squeezed in the middle, trapped between development and fighting the impact of climate change". Measures like CBAM are expected to disproportionately affect low-income and middle-income countries. Although African countries benefit from preferential market mechanisms, their trade footprint remains limited and heavily dependent on extractive industries. The African Group, in its WTO communique, highlighted the limited flexibility available to African members in dealing with trade challenges within specific WTO agreements and policies. Similarly, the EU's CBAM lacks adaptability, applying uniformly across countries without accommodating the unique circumstances of African states or supporting their efforts to implement climate measures (Ramos, 2023).

Among African nations, Mozambique, Egypt, Morocco, Tunisia, and South Africa are particularly vulnerable due to their significant exports of products such as iron and steel and aluminium to the EU, with the production of these products historically being carbon intensive (graph 1).

Graph 1. CBAM goods as percentage of African country's exports (products)



Source: Maimele, 2023.

A study by the African Climate Foundation and the LSE Firoz Lalji Institute for Africa (2023) has noted that CBAM is expected to reduce Africa's exports to the EU by only 1.32%, but many of these products would likely find new markets, particularly in China and India. The impact on African GDP is a modest decline of 0.58% or around US$16 billion based on 2021 GDP. However, African states would still be worse affected than other states due to their higher carbon emissions in production and their heavy reliance on the EU as their primary export destination.

5.2.1. Responding to CBAM: Lessons from Morocco

Morocco has raised concerns about the impact of mechanisms such as CBAM on its economy and production of cement, steel, iron and fertilisers. Niama Myara, the President of Morocco's House of Councillors, has emphasised the substantial challenges posed by CBAM to Morocco, particularly due to the country's significant export volumes to the EU (Ramos, 2023). In addition to joining Egypt and Algeria in initiating the process of implementing carbon credit markets for EU exports, Morocco has adopted a collaborative strategy to deal with the implications of CBAM. It has pursued bilateral discussions with the EU to mitigate the mechanism's impact on its domestic industries and to advocate for financial support measures to alleviate potential challenges.

In 2022, Morocco and the EU signed a Memorandum of Understanding on the establishment of a Green Partnership (the first of its kind) which aims to offer "real opportunities for political, economic, technical and technological cooperation…" (Ministry of Foreign Affairs, African Cooperation and Moroccan Expatriates, 2022). The EU has also committed substantial financial support for greening Morocco's economy through initiatives such as the €150 million Green Economy Financing Facility (GEFF Morocco II, 2021-2025) for financing sustainable energy, resource efficiency and climate resilient technologies. In 2024, the European Investment Bank pledged €1 billion to support Morocco's

reconstruction efforts following the 2023 earthquake. The funding targets three strategic priorities: rebuilding schools, hospitals, and road infrastructure in the hardest-hit areas; enhancing seismic standards to improve disaster resilience; and integrating sustainable energy solutions to advance climate adaptation and energy efficiency, in line with the goals of the EU-Morocco Green Partnership (EIB, 2024).

Morocco's reliance on energy imports, which account for nearly 90% of its energy needs, highlights the pressing need to green its industrial processes. The country's rich renewable energy resources offer a significant opportunity to diversify its energy mix and enhance energy independence. This shift gained momentum in 2009 with the introduction of the National Energy Strategy, designed to reduce greenhouse gas emissions and improve energy security through renewable energy adoption and diversification. Additionally, the Moroccan Innovation Initiative, launched the same year, has supported advancements in clean-energy technologies through research and innovation (Berahab, 2024; ITA, 2024).

The Moroccan government initially focused on energy security. However, this approach has evolved to include broader socio-economic goals and efforts to modernise and green its industries. In response to the introduction of the EU CBAM, Morocco has implemented various roadmaps and programmes to support industrial decarbonisation, including:

- **The *Tatwir Croissance Verte Programme*:** Assists SMEs in adopting low-carbon processes and products.
- ***Energy Sector Reforms*:** Aims to facilitate a cleaner energy transition.
- ***Bilan Carbone Tool Update*:** Led by the Mohamed VI Foundation for the Protection of the Environment, this initiative enhances the measurement and management of carbon footprints.
- ***Carbon Footprint Standards Development*:** Establishes standards aligned with European benchmarks to help national companies assess their carbon footprints and integrate into global green markets.
- ***Decarbonisation Label*:** Certifies companies committed to reducing carbon emissions, incentivising sustainable business practices.
- ***Green Hydrogen Strategy*:** Introduced in 2021, focuses on projects that combine renewable energy production, electrolysis, and the conversion of hydrogen into ammonia, methanol, or synthetic fuels for domestic consumption and export.

Morocco's energy transition has required significant capital investment, yet it has so far not fostered industrial integration. Although the country has made progress by developing large-scale renewable energy projects, most of the technology used is imported. Furthermore, the emphasis has been on large-scale initiatives rather than building a broader industrial ecosystem that could drive sustainable economic growth and generate long-term employment opportunities (Berahab, 2024).

6. GREEN IP LESSONS FOR SOUTH AFRICA

The following section focuses on the challenges and opportunities Green IP presents for South Africa. It examines the pressures of decarbonisation, the risks of an unjust transition, and the need for targeted policies and investments to build a competitive, low-carbon economy while confronting socio-economic priorities in South Africa.

With the shift towards green growth, the global development landscape is undoubtedly rapidly changing. This presents African states with a considerable challenge. African states are seeking economic growth in the face of large-scale unemployment and poverty but they need to navigate the pressure to decarbonise and commit themselves to climate change objectives. Green industrialisation may well create and opportunity for emerging African states and it has become crucial for African states to transition towards greening their industries, especially since strategies like CBAM could penalise carbon-intensive industries.

South Africa's economy is characterised by high carbon intensity. The country faces the dual challenge of meeting climate commitments while pursuing economic growth. Due to its coal-dominated energy mix, South Africa's production processes are notably carbon-intensive, putting the country at a competitive disadvantage, especially as BCAs are becoming increasingly common, particularly in more developed countries. Consequently, South Africa and other developing countries will face significant structural transformation risks from such trade-related climate change policies. Bell, Goga, and Robb (2022) classify these risks into two categories: those leading to an “unjust transition” and those locking in an “unjust future.” Risks related to an "unjust transition" involve a loss of competitiveness and access to critical export markets for South Africa, which can cascade into negative impacts on production, employment, and development. On the other hand, risks associated with an "unjust future" arise when climate policies fail to equip developing countries with the necessary tools to keep pace with green technological advancements. This, coupled with the hoarding of green resources by the global North, can discourage countries in the global South from pursuing their own green transitions.

The impact of green industrialisation on the South African economy, particularly for workers in carbon-intensive industries, is of considerable concern. The transition will need specialised skills and entail significant changes in production methods across various sectors, notably energy, transportation, and agriculture. Beyond policy measures, the success of this transition will depend heavily on the availability of appropriate institutions, technology, and skills. Well-functioning labour markets are critical for achieving socially inclusive outcomes, including job creation and the reintegration of displaced workers. This issue is especially pressing in regions like Mpumalanga, which have historically relied on coal mining and coal-fired power plants and considering that large-scale green job creation has yet to demonstrate substantial evidence (Auktor, 2020; Bell, Goga and Robb, 2022).

> *Greening the economy will inevitably change the skills required and the tasks involved in many of the existing occupations. The development of skills, of knowledge and competences, is therefore, a major component of the transition to a low-carbon economy. Such skills enable the adoption and use of resource-efficient, sustainable process and technologies by the private sector and individual consumers.*
>
> (Auktor, 2020, p. 10)

It is crucial to acknowledge that African nations lack the financial capacity of the EU, US, and China. Therefore, African states will have to adopt tailored strategies that include providing targeted

infrastructure, policy support, and limited fiscal incentives to stimulate green investments. Additionally, these nations will have to establish coordination platforms on shared challenges in promoting green industrial development, and leverage regional, continental, and international markets to advance regional value chains (Medinilla and Byiers, 2023).

To aid the transition in developing countries, the outcomes of COP29 held in Baku, Azerbaijan in 2024 increased the climate finance goal to developed countries supplying at least US$300 billion a year by 2035 to support developing countries. This replaces the previous target of US$100 billion, however, many have noted that the new target is insufficient to meet the transition needs of poorer countries. Acknowledging the need for increased funding, the COP29 outcome urged all stakeholders to work toward mobilising US$1.3 trillion in financing for developing countries by 2035. This figure aligns more closely with the resources required to help these nations mitigate escalating climate impacts and transition to a low-carbon pathway. To achieve this goal, parties agreed to initiate the "Baku to Belém Roadmap", outlining strategies to secure the additional funding (Rowling, Lo and Rodriguez, 2024; Waskow et al., 2024).

The COP29 outcomes signal a pivotal moment for aligning climate finance with the realities of a global transition, particularly for developing countries facing measures like the CBAM. While the increase in climate finance targets is a positive step, achieving these ambitions will require enhanced cooperation across stakeholders, from multilateral institutions to the private sector. For developing states, particularly those reliant on carbon-intensive exports, access to financing tailored to decarbonising industries will be critical to avoid punitive trade measures and to remain competitive in a greener global economy. The "Baku to Belém Roadmap" provides a promising framework, but its success hinges on prioritising resource mobilisation for industrial transformation, capacity building, and infrastructure development. Without these elements, the financial and policy mechanisms may fall short of supporting an equitable green transition.

South Africa's shift to renewable energy does however present an opportunity to integrate energy policy with industrial strategies that foster the development of new production capabilities in wind and solar value chains. The South African government has made efforts to capitalise on green industrialisation, namely through the JET-IP to support the country's decarbonisation efforts.[8] These capabilities could serve as a foundation for reindustrialisation and sustainable growth in the country (Bell, Goga and Robb, 2022). South Africa should take advantage of this opportunity and further invest in green technologies that can diversify the country's economy in a sustainable manner (Goga and Bell, 2023).

With sufficient investment and coordination, South Africa can reduce industrial-scale carbon-intensity. The country has a well-developed renewable energy sector which is well placed to green industrial sectors. According to Bell, Goga and Robb (2022), for the energy transition to succeed, it must be closely tied to the reinvestment in key sectors such as metals, basic chemicals, and industries that rely on coal, fuel oil, or gas. However, the regulatory frameworks overseeing South Africa's energy resources lack adequate coordination and are under significant pressure from competing and entrenched interests – often referred to as the minerals-energy-complex or MEC. If these conflicts are not decisively tackled, they will hinder progress toward green industrialisation.

Moreover, capitalising on the global move towards green industrialisation is imperative for South Africa, especially for its international trade relations. For instance, initiatives such as the EU's CBAM

[8] Other efforts towards greening industrialisation in the country include the forthcoming South African Renewable Energy Masterplan (SAREM).

and China's greening of its Belt and Road Initiative are moving towards minimising financing and/or penalising carbon-intensive industries and this could impede South African industries. As such, "the external risks and internal challenges necessitate a robust and efficient industrial development finance landscape to assist in structurally transforming the economy and building a more diversified industrial base that can compete in a world where green is becoming the standard"(Goga and Bell, 2023, p. 2). Many developing countries in the Global South have already started to capitalise on the global shift towards decarbonisation. In India, for instance, the steel and iron industries are under pressure to adopt renewable energy to lower carbon emissions, aiming to mitigate the effects of policies like the CBAM (Rao, 2024).

The EU, US, and China are significant players in global climate change efforts, and South Africa can draw valuable lessons from their experiences. These lessons highlight the need for green industrial policies to further technological advancements, provide financial incentives, and deal with socio-economic impacts. They also stress the importance of engaging and including stakeholders such as the private sector, local communities, government departments, and labour. Ensuring increased investment in infrastructure and capacity building, especially in modernising electricity grids for renewable energy integration, is crucial. Apart from this, setting up effective monitoring mechanisms to track progress, address challenges, and ensure accountability, are essential. Green industrial policy in South Africa needs to be consistent to ensure long-term policy stability as the country has a history of inconsistent policy implementation.

While Green IP offers promising prospects for a sustainable future, advancing green industrialisation is no easy road for emerging economies. Challenges include limited access to green technologies, the need for skills development, and potential disruptions to employment (Medinilla and Byiers, 2023; Berahab, 2024). These challenges are particularly acute in economies like South Africa, where industrialisation has historically been rooted in carbon-intensive sectors. South Africa must adopt a pragmatic approach to green industrial policy that aligns with its industrial capacity and considers its unique political-economic and socio-economic conditions. Key priorities should include:

- ***Capacity Building*****:** Investing in skills development and training to equip the workforce for green industries.
- ***Incentivising Transitions*****:** Supporting existing industries to shift towards sustainable practices.
- ***Policy Adaptability*****:** Designing flexible frameworks that respond to changing domestic and global conditions.

The case of Morocco provides additional insights into the greening of industrial policy in South Africa, namely through the need for clear and robust institutional frameworks, proactive regulation and the need to leverage the innovation, research and development capabilities of research institutions and universities in the country (Berahab, 2024).

Strengthening international and regional trade partnerships and fostering collaboration will be essential to enhancing competitiveness and maximising domestic benefits. Advancing green industrialisation will also require a concerted effort between the state and the private sector.

7. CONCLUSION

The transition towards Green IP offers both a substantial challenge and a significant opportunity for South Africa. While moving towards a low-carbon economy is critical to fulfilling climate commitments and avoiding penalties like the EU's CBAM, it requires a delicate balance between economic growth, job creation, and social inclusion. South Africa's high carbon intensity, primarily due to its dependence on coal, highlights the urgency of this transition. However, the country's renewable energy potential, along with its existing industrial capacity in sectors like wind and solar, provides a strong foundation for reindustrialisation and sustainable growth.

Greening industrial policy is, however, far more complex than simply diversifying energy mixes and adopting renewable energy. It demands a comprehensive approach that involves simultaneous shifts in technology and policy frameworks. While Morocco's progress provides useful insights, it underscores the fact that green industrialisation extends beyond large-scale renewable energy projects. It involves systemic changes across multiple sectors, integrating innovation, skills development, and policy alignment to ensure long-term sustainability.

For South Africa to successfully navigate this transition, it must invest in skills development, foster innovation, and adopt flexible policies capable of addressing both domestic and global challenges. Climate finance, as outlined in the outcomes of COP29, will play a pivotal role in supporting these efforts – although the targets set remains insufficient to fully meet the needs of developing countries.

Ultimately, South Africa must take a pragmatic approach to green industrialisation that is tailored to its unique political, economic, and social realities. This includes offering support to carbon-intensive industries in their transition and prioritising capacity building, technological innovation, and policy stability. Only through a coordinated effort between the state, the private sector, labour and international partners can South Africa harness the opportunities of green industrialisation while mitigating the risks of an unjust transition and ensuring a sustainable future.

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