TRADE & INDUSTRIAL POLICY STRATEGIES

SOUTH AFRICA'S IRON, STEEL AND ALUMINIUM INDUSTRIES' READINESS TO RESPOND TO THE EUROPEAN UNION'S CARBON BORDER ADJUSTMENT MECHANISM (CBAM)

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Seutame Maimele

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info@tips.org.za
+27 12 433 9340
www.tips.org.za

Author
Seutame Maimele
TIPS Economist
Sustainable Growth

OVERVIEW

The European Union's Carbon Border Adjustment Mechanism (CBAM) entered its transition period on 1 October 2023, with the first CBAM report for the fourth quarter of 2023 submitted on 29 February 2024 (after the initial deadline was extended from 31 January 2024 due to technical issues faced by the CBAM registry). Key industries most affected in South Africa are iron, steel and aluminium.

The transition period will run for over two years, ending in December 2025. During this time, South African iron, steel and aluminium exporters, as well as other CBAM-covered sectors, are expected to report accurate greenhouse gas (GHG) embedded emissions data to EU importers. Once the transition period ends, a definitive period will unfold from January 2026, when exporting firms will have to buy CBAM certificates – i.e., paying a carbon tax at the EU border for the CBAM-covered goods.

South Africa is not ready financially and administratively to comply with CBAM requirements during the transition period. Issues include domestic industries struggling to deal with logistical and energy problems, i.e. the collapse of Transnet infrastructure and loadshedding, short timelines for the transition, lack of awareness of decarbonisation and climate change measures across the South African government and industries, increasing costs of accessing global markets amid greening global value chains, incompatible infrastructure of accounting GHG emissions, and the rise of carbon clubs as a form of protecting industries in the Global North.

There is a risk South African exporting firms will initially fail to report GHG emissions required by CBAM adequately. Lateness in compliance will be detrimental to business profitability, mainly because of non-compliance penalties (passed down by EU importers/declarants) to be paid during the transition period. The penalty is between €10 and €50 per tonne of unreported and incorrectly reported emissions.

It is now paramount to act collaboratively on these issues. Government and affected industries, labour unions and researchers need to work together to find solutions on CBAM for both large and small exporters. While a collaborative approach is needed domestically, more time is also needed to implement CBAM-compliant measures in South Africa. More time can be negotiated with the EU. However, with climate change impacts increasingly being felt, the Global South, including South Africa, must transition relatively quickly. Doing so has broader climate as well as economic benefits from the global shift now under way.

This paper relies heavily on industry-government-researchers workshops on the iron and steel and aluminium value chains held in November 2023, which formed part of initial efforts to raise these issues and try to find solutions in adapting trade to green international trade laws introduced in the Global North.

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ABBREVIATIONS

AfCFTA	African Continental Free Trade Area
AMSA	ArcelorMittal South Africa
CBAM	Carbon Border Adjustment Mechanism
DFFE	Department of Forestry, Fisheries and the Environment
DIRCO	Department of International Relations and Cooperation
DMRE	Department of Mineral Resources and Energy
dtic (the)	Department of Trade and Industry
EC	European Commission
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gas
MRV	Monitoring, Reporting, and Verification
NT	National Treasury
PCC	Presidential Climate Commission
SAGERS	South African Greenhouse Gas Emissions Reporting System
SEE	Specific Embedded Emissions
SPA	Single Point of Authority
UK	United Kingdom
US	United States
WTO	World Trade Organization

1. INTRODUCTION

South African iron, steel and aluminium industries are woefully underprepared to comply to the European Union's Carbon Border Adjustment Mechanism (CBAM) during the transition period. Short timelines for the transition, lack of awareness in decarbonisation and climate change measures across the South African government and industries, increasing costs of accessing global markets, incompatible infrastructure of accounting GHG emissions, and the rise of carbon clubs as a form of protecting industries in the Global North have been cited as adding to the under-preparedness for complying with CBAM during the transition period.

Slow decarbonisation of high emitting value chains, unambitious climate change policies, low domestic carbon pricing by global standards, and high dependence on coal of the South African electricity system are longer term issues adding to the unpreparedness of the South African industries to comply with CBAM and like measures (Maimele, 2023b).

These issues have cascading socio-economic implications across industries and the South African government and society at large. They make the South African economy ill-prepared to respond to CBAM positively during the transition period, let alone start reporting GHG embedded emissions accurately.

This paper is based heavily on workshops held in November 2023 (Maimele, et al., 2023; Maimele, Ramos, & Robb, 2023). The main objective was to evaluate South Africa's readiness to respond to CBAM – looking into the financial and administrative readiness of the iron and steel and aluminium industries.

The paper is structured Into three parts, the first part focuses on what to expect during the CBAM transition period; the second part focuses on issues at hand (identified during the workshops held in November 2023), specifically focusing on issues during the CBAM transition period; and the last part focuses on possible mitigation measures to limit the impact of CBAM on local industries.

1.1. Background

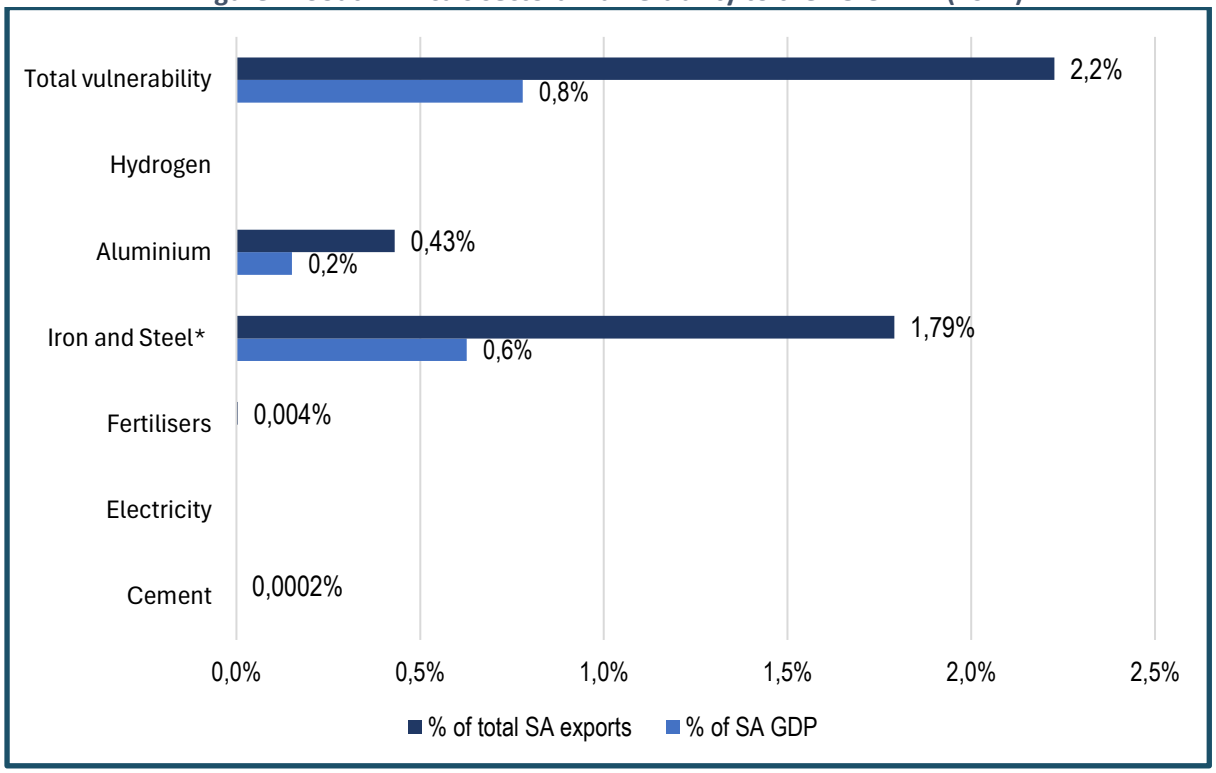
Building from the research that TIPS has done on global climate change policies and CBAM, two workshops in November 2023 were held with CBAM-affected industries, specifically the aluminium and iron and steel industries. The main aim of these workshops was to provide a platform to raise awareness about CBAM across the public and private sectors, understand the position and responses of the value chains to the CBAM, as well as co-create strategies and policy responses with key stakeholders in the value chains. Stakeholders who participated in the workshops included industry associations (and key players in the industries), government, and research institutions (including universities). This research, therefore, is heavily reliant on the inputs from these workshops, supplemented by TIPS research.

Research by TIPS shows South Africa is seen as one of the few countries with a high apparent vulnerability to the CBAM (Ramos, 2023). Figure 1 , extracted from the TIPS research, highlights South Africa's CBAM vulnerability based on the final list adopted in the CBAM legislation.

The EU is a major destination for South African goods, accounting for 21% of South Africa's total exports in 2022 (Trade Map, 2023). Based on the finalised list of goods covered by CBAM, as per the text adopted on 16 May 2023, a total of US$2.8 billion (about R52.4 billion) of South African exports (based on 2022 data) is at risk in the short-term, due to CBAM (Maimele, 2023b).

This is about 10.3% of South African exports to the EU, and about 2.2% of South African exports to the world, reflecting around 0.8% of South Africa's gross domestic product (GDP) (Maimele, 2023b). These numbers are set to increase as the CBAM is set to cover increased products and other jurisdictions introducing CBAM-like measures.

Figure 1: South Africa's sectoral vulnerability to the EU CBAM (2022)



Note: *Iron and steel include input materials (also known as precursors)and articles of iron and steel.
Source: Maimele, 2023.

CBAM puts the iron and steel and aluminium industries particularly in jeopardy, in addition to local logistical and energy challenges. Iron and steel exports face significant risk due to their high carbon intensity and high reliance to the EU market. The carbon intensity of South Africa's metals exports stands at about 5000 tonnes of carbon dioxide equivalent (tCO2e) per US$1 million, far exceeding other metal-exporting countries. India, Russia, and China have carbon intensities of 3500, 2200 and 2500 tCO2e per US$1 million, respectively (Montmasson-Clair, 2020).

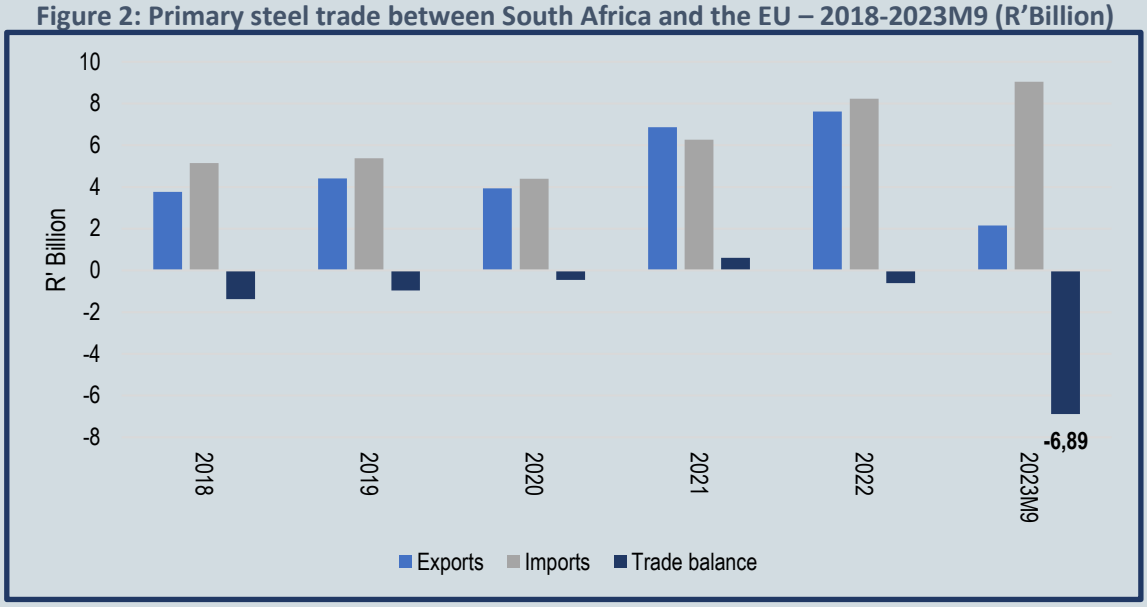
About US$2.2 billion worth of iron and steel exports, representing 2% of total South African exports are exposed by the mechanism. Such exports, including exports of iron ore will be highly impacted (Maimele, 2023b). Box 1 highlights the general state of the iron and steel industry in South Africa.

Box 1: Current state of the iron and steel industry in South Africa

In 2022, the South African iron and steel value chain employed 261 598 people directly. It contributed about 1.5% of the South African GDP in 2015 (Maimele, 2023b).

The value chain now faces producing under capacity, increasing steel imports, increasing competition of scrap metals for iron ore, and diminishing steel demand locally, in effect resulting in reduction of jobs at some key steel firms in South Africa, (AMSA, 2023; Makgetla, 2023; SAISI, 2023). ArcelorMittal South Africa (AMSA) may wind down their long steel operations at their Newcastle Works and Vereeniging Works (Boucher, 2024).

Figure 2: Primary steel trade between South Africa and the EU – 2018-2023M9 (R'Billion)



Source: SAISI, 2023.

South Africa in 2022 had primary production capacity of 6.5 million tonnes per annum of steel, but produced only 4.4 million tonnes. Among other issues, this has resulted in increased imports (particularly in automotive OEMs), due to the uncompetitiveness of iron and steel locally. In some instances, this has meant a shortage of steel to service local demand in the automotive OEMS (SAISI, 2023).

Overall imports of steel climbed from 4% of total steel sales in South Africa in 2003 to 16% in the first nine months of 2023 (Makgetla, 2023). In line with the overall increase, steel imports from the EU have risen, driven by local logistical and energy issues, as well as safeguarding measures introduced in the EU to protect and promote EU steel industries.

The safeguard measures include an import quota on steel, with a 25% tariff on quota exceeded by major traditional steel importers (EUROFER, 2019). This has in effect allowed EU steel exporters to increase their capacity and export capabilities.

The South African iron and steel industry faces daunting logistical and energy issues, leaving an opportunity for international infiltration. For example, Asian countries (such as China and Japan) have increased their exports of steel to the South African market. Chinese steel exports to South Africa, which began to increase post-covid-19, rose by 129% between 2019 and 2022 (Trade Map, 2024).

South African aluminium exports also face significant risk, but in the longer term. The focus on direct emissions in the initial phase of the CBAM, while still a problem for South Africa's export of aluminium products, does provide some reprieve in the short term to the value chain. In the longer term, the inclusion of indirect emissions, such as emissions from power or electricity usage, would be highly

problematic for the industry,. About US$530 million worth of aluminium exports, representing 1% of total South African exports are exposed by the mechanism (Maimele, 2023b). Aluminium products covered under CBAM exclude waste and scrap as well as table, kitchen, or other household articles. Box 2 highlights the state of the aluminium industry in South Africa.

Box 2: Current state of the aluminium industry in South Africa

The South African aluminium value chain directly contributed 0.7% to South Africa's GDP in 2019 and employed 11 600 people directly and 28 900 people indirectly in 2017 (Maimele, 2023b). Aluminium production in the country is dominated by primary production, despite South Africa not mining the bauxite ore from which aluminium is produced. Primary production of aluminium is highly energy intensive. It has remained relatively flat in South Africa since 2015, at approximately 700 000 tonnes per annum.

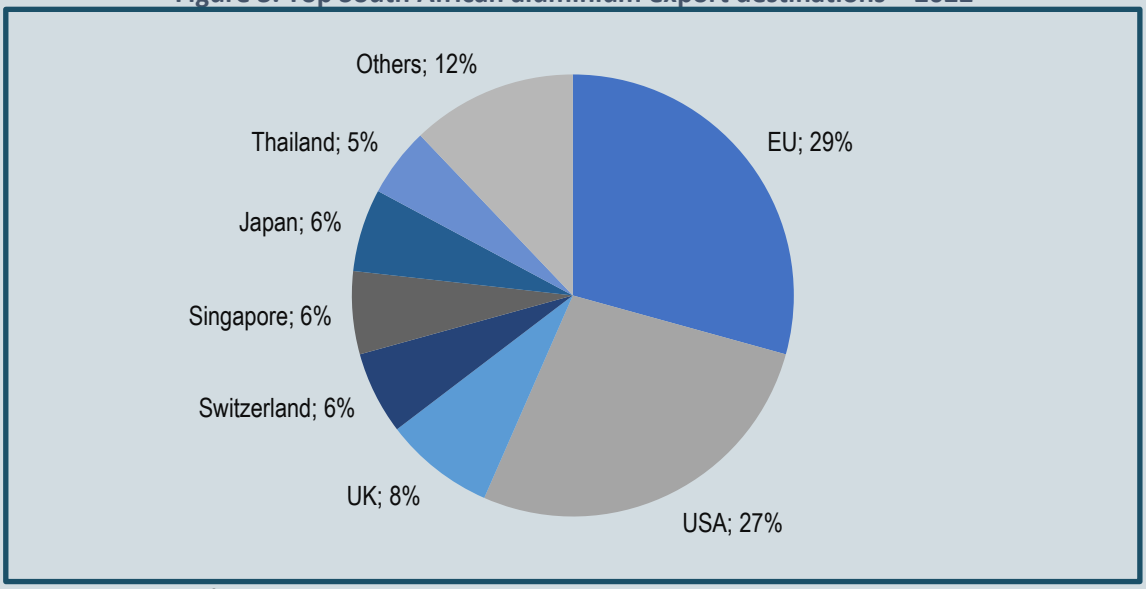
The secondary aluminium sector in South Africa is well established but relatively small, with at least 30 000 tonnes a year of production capacity (mainly from Zimco Metals, which produces around 50% of secondary aluminium, all from scrap aluminium).

The aluminium value chain in South Africa plays a huge role in the international market, and as shown in Figure 3 has diverse customers. Aluminium production is carbon-intensive as the sector is dependent on the South African electricity system, which is highly dependent on coal. Should CBAM requirements for the aluminium industry in South Africa be too strict, increasing market share in alternative markets, such as Asia and Africa, could be an option, although this will not be simple.

Despite the high reliance of the sector on South Africa's coal-based electricity, which falls under measurement of indirect emissions under CBAM, continual investment in the production process means South32's smelter is on a par with global standards and well positioned globally in terms of scope 1 emissions. Primary production benefits from a special pricing agreement with Eskom, ensuring its short-term profitability, but low-carbon power supply will be a requirement going forward (Monaisa & Montmasson-Clair, 2023).

Aluminium is not as badly affected as iron and steel, but it will not be untouched. The industry has an opportunity to look for new markets and examine localisation opportunities to cope with the stringent requirements of CBAM.

Figure 3. Top South African aluminium export destinations – 2022



Source: Adapted from AFSA, 2023. *Note:* Others include Brazil, China, India, Zambia, Mexico, Namibia, Botswana, and Hong Kong, China.

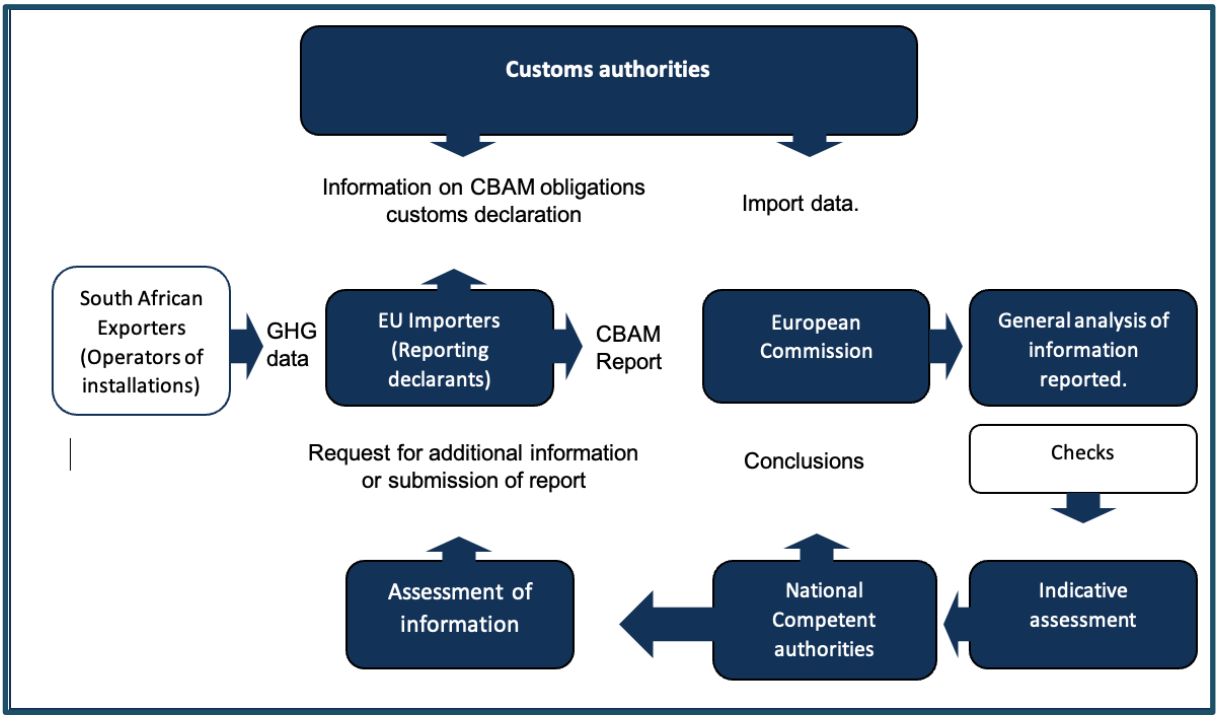
2. CBAM DURING THE TRANSITION PERIOD (1 OCTOBER 2023 – 31 DECEMBER 2025)

CBAM entered its transition period from 1 October 2023, and this will run until 31 December 2025. During the transition period, exporters to the EU will only report accurate GHG emissions embedded in the CBAM products (direct and indirect emissions) to the EU importers, also referred to as EU declarants, without paying any financial payments or adjustments. Then from 2026, payments or buying CBAM certificates will begin.

Figure 4 below is a schematic representation of the governance system of CBAM during the transition period, who is involved and how they interact. The European Commission (EC) will be the central governing body for CBAM during the transition period. The fundamental role of the commission will be to check the completeness and accuracy of the quarterly CBAM reports (See the timelines for submissions below).

The first report was due 31 January 2024. However, in January 2024, when EU declarants were submitting their first CBAM reports, the CBAM registry suffered technical issues, and the EC extended the submission of the first CBAM reports by 30 Days. This does not affect the 31 July 2024 extended deadline for rectifying submitted reports for the first two quarters of the transition (European Commission, 2024).

Figure 4: Governance and key CBAM actors and how they interact during the transition period



Source: Adapted from the European Commission, 2023b, 2023c.

The deadline to make corrections to submitted CBAM reports for the first two CBAM report submissions is 31 July 2024. This means that the first two quarters of the transition period (Q4 2023 and Q1 2024) will have a longer period to make corrections to the submitted reports. This comes after the EC acknowledged the difficulty in setting up Monitoring, Reporting and Verification systems in time during the transition.

During the transition period, the South African exporters to the EU will only be responsible for reporting Specific Embedded Emissions (SEE) of their goods exported to the EU. The data can be voluntarily verified by third-party verifiers, but this is not required during the transition period. As part of reporting the SEE, exporting firms must determine methodologies to calculate specific embedded emissions (i.e. setting system boundaries, relevant parameters, and methods, etc). For purchasing precursors, such as iron ore, firms will need to obtain emissions data from the supplier/s. These will also need to be reported to the EU declarants.

Exporting firms have to determine their CBAM reporting obligations (i.e. scope of goods, reporting period to use, based on the calendar year or financial year), parameters for reporting, and data on the domestic carbon price. See the appendix for examples of how the reporting could be done for both aluminium and steel products.

Table 1: Timelines for CBAM reports

REPORTING PERIOD	SUBMISSION DUE BY	MODIFICATION POSSIBLE UNTIL*
2023: OCTOBER – DECEMBER (Q4)	2024: JANUARY 31**	2024: JULY 31
2024: January – March (Q1)	2024: April 30	2024: July 31
2024: April – June (Q2)	2024: July 31	2024: August 30
2024: July – September (Q3)	2024: October 31	2024: November 30
2024: October – December (Q4)	2025: January 31	2025: February 28
2025: January – March (Q1)	2025: April 30	2025: May 31
2025: April – June (Q2)	2025: July 31	2025: August 31
2025: July – September (Q3)	2025: October 31	2025: November 30
2025: October – December (Q4)	2026: January 31	2026: February 28
Total of nine (9) quarters		

Source: European Commission, 2023b, 2023c.*Notes*: *After the modification deadline, reporting declarants may request reopening of the file before the national competent authority for eventual corrections. **The deadline for the first report was extended by 30 Days due to technical issues of the CBAM registry.

Monitoring methods

Monitoring and reporting will be paramount during the transition period. The European Commission (2023a, 2023b) noted three key methods to monitor GHG emissions embedded in products covered by CBAM. This section specifically focuses on relevant methods for iron and steel as well as aluminium products that firms outside the EU can rely on to develop monitoring methodologies. These methods should be used in conjunction with the system boundaries and relevant parameters as outlined above to monitor and report emissions.

Calculation-based methodology

The calculation-based methodology includes the standard method and the mass balance method. The standard method is the simplest method, which includes multiplying quantities of inputs in the production of the products covered by the CBAM with emissions factors estimated by the firm or using the estimates from the EC. The calculation-based methods are mostly used worldwide. For example, in South Africa, the standard method is used to estimate industrial GHG emissions.

The European Commission noted that, to monitor GHG emissions during the transition period, the standard calculation-based method is highly recommended. This method is also easier to use for calculation of SEE in the CBAM-covered products (European Commission, 2023b).

The mass-balance method calculates emissions based on the carbon content. This method is mostly used for complex goods. Typically, this method determines emissions as the sum difference between inputs and outputs. See examples in the appendix.

Measurement-based methodology

Measurement-based methodology includes the continuous emissions monitoring system. This method measures GHG emissions concentration directly in the stack (installation) or using extractive procedures. It includes a computerised GHG emissions monitoring system and is known to be expensive, which is why the European Commission (EC) is not recommending it.

Other

The above two methods are recommended (with the EC preferring the calculation-based method) when installations have some accounting/monitoring infrastructure and data in place. However, the CBAM legislation does provide an option for other methods to monitor GHG emissions emitted during the production processes of CBAM goods. These will have to be approved by the European Commission. Other methods include having a domestic CBAM-compatible monitoring system and use the default values which the European Commission published in December 2023.

Domestic CBAM-compatible monitoring systems

Firms can use a domestic CBAM-compatible monitoring system to account and report on GHG emissions for CBAM goods. For example, if a firm has already a more reliable monitoring system in place, the CBAM legislation does provide a window for the firms to use their existing monitoring systems. This system should pass certain minimum requirements, such as carbon pricing available where they operate as well as accuracy of the compulsory monitoring scheme, which should be verifiable by a third-party verifier.

In South Africa, a GHG emissions accounting system, called the South African Greenhouse Gas Emissions Reporting System (SAGERS), was introduced in 2019. SAGERS is a web-based platform or portal for the registering and submitting GHG emissions data (DFFE, 2017). This system calculates GHG emissions for the energy and industrial processes and product use sectors in South Africa, which include CBAM-covered industries. However, it monitors and reports GHG emissions at an industrial level, based on companies' submission of GHG emissions data. This is not in line with the requirements of CBAM, which are that GHG emissions be reported at a product level.

While SAGERS' main objectives mirror those of the CBAM registry (i.e. to promote transparency, and reporting of accurate emissions data) reporting methodologies and frequency of reporting are misaligned. SAGERS reporting methodology is industry level and annual. CBAM's reporting methodology is product level and done on a quarterly basis.

Therefore, a CBAM-compatible domestic system to allow reporting of specific embedded emissions of products in general, and not limited to CBAM products, is needed. The SAGERS can be reformed/adapted to start reporting GHG emissions at a product level (Section 4 shows how this can be done).

Another misalignment between SAGERS and CBAM is that verification of emissions data during the CBAM transition period is not compulsory. Independent verification of emissions data reported to SAGERS is encouraged, but to what extent verification is done is not known as the system is fairly new. From 2026, verification will be mandatory for CBAM, and third-party accredited verifiers will need to verify all reported GHG emissions data supplied to the EU declarants. The Department of Forestry, Fisheries and the Environment (DFFE) in adapting SAGERS, and it can also become accredited as a verifier of GHG emissions for CBAM. This will form part of the quality control responsibility of the

department in reporting accurate GHG emissions and in keeping with national commitments to fight climate change.

Default values

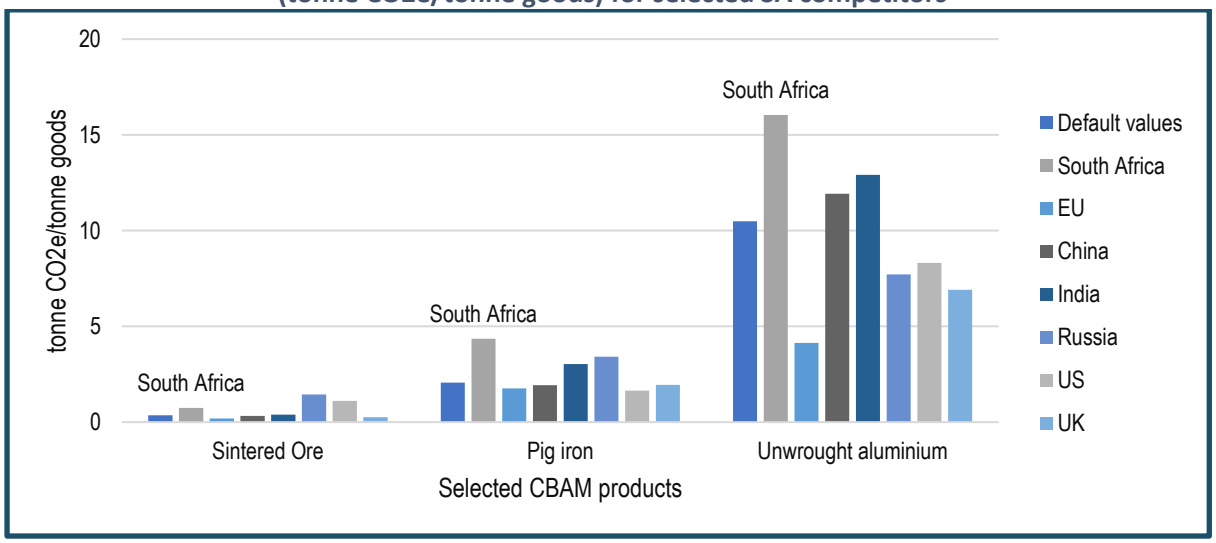
Another possible avenue for monitoring GHG emissions during the transition period is using default values estimated by the European Commission. Many exporters do not have mechanisms to account for and report GHG emissions during the short transition period the EU has allowed. As such, this method will be a typical option for many low- and middle-income countries.

Although default values will be used mostly during the transition period, (European Commission, 2023d), during the first three quarterly reports (Q4 of 2023 and Q1 and Q2 of 2024), declarants may report embedded emission based on default values made available and published by the European Commission without quantitative limit. However, from Q3 of 2024 and until the end of 2025, declarants can still report emissions based on estimations, but only for complex goods and with a limit of 20% of the total embedded emissions.

Then from 2026 onwards, another set of default values will apply. Those values will be set at the average emission intensity of each exporting country, increased by a proportionately designed mark-up. Those default values will be determined through an implementing act planned for adoption in 2025. The default values are based on world averages during the transition period, weighted by production volumes. In South Africa, the default values during the transition period are lower than the actual embedded emissions in CBAM products, giving South African firms an advantage in the short term. See Figure 5.

For instance, take a simulation of the financial impact of CBAM on South African steel products, made by Worthington (2024). Worthington took as an example South African hot flat-rolled stainless steel, which has an emission intensity of 6.86 tons of CO2 per tonne of product as per the EC JRC technical report, with a differential of roughly 3.8 compared with the EU's lower emission intensity of 3.07 tonnes. Based on these emissions embedded in hot-rolled stainless-steel products, Worthington estimates that the South African flat-rolled stainless-steel products will have a CBAM border charge of around 13% more than the EU products, should actual GHG emissions be used. In a nutshell South African exports will be less competitive in the EU market, despite the opportunity of using default values during the transition which are lower than the national estimates by the EC.

Figure 5: Total emissions embedded in selected iron and steel and aluminium products (tonne CO2e/tonne goods) for selected SA competitors



Source: Author's calculations, based on European Commission, 2023a, 2023d. *Note:* Default values are based on the EC defaults, and Countries and EU's estimates are based on the EC JRC technical report.

Figure 5 shows how much lower emission intensity is for the EU than South Africa. South Africa's embedded emission estimates for selected CBAM products, default values (which are weighted average from the EC JCR technical report), the EU's emissions and selected competitor's emissions. The default values provide lower estimations, but South Africa still has higher carbon intensities embedded in CBAM products.

Generally, the South African emissions embedded in CBAM products, especially iron and steel, and aluminium products, are higher than the EU's, higher than the default values, and higher than most competitors (European Commission, 2023a, 2023d; Worthington, 2024).

Therefore, using local infrastructure in reporting GHG emissions at a product level seems like a viable option for South African firms in the longer term – instead of relying on EU estimates. Section 4 advocates reform/adaptation of the current local system (SAGERS) to start reporting and monitoring GHG emissions at a product level. This will unlock both local capabilities and access to international markets.

Penalties

During the transition period, failure to report or incorrect reporting of specific embedded emissions will result in penalties. EU importers that fail to comply during the transition will pay a penalty of between €10 and €50 per tonne of unreported and incorrectly reported emissions, and the penalty will increase in accordance with the European index of consumer prices. Also, if more than two incomplete or incorrect reports or no reports have been submitted in more than six months a higher penalty will apply, and importers will likely pass these penalties on to the exporting firms.

3. ISSUES AT HAND – SOUTH AFRICA'S READINESS TO COMPLY WITH CBAM DURING THE TRANSITION PERIOD

Two workshops were held in November 2023 with the aluminium and iron and steel to identify and deliberate issues these two industries are facing during the transition period of complying with CBAM. Key stakeholders included industry associations and key players in the industries, government, and research institutions, including universities. Issues raised ranged from lack of awareness of CBAM, local industrial challenges (some linked to CBAM), misaligned accounting systems, and the possibility of displacing exports amid the expected rising costs to access markets. These issues illustrate the extent of South Africa's readiness to comply with CBAM during the transition period.

This section is highly reliant on the inputs from the two workshops held in November 2023 (Maimele, et al., 2023; Maimele, Ramos, & Robb, 2023).

3.1. Lack of CBAM awareness in industry and government

Based on the workshops held in November 2023, both the iron and steel and the aluminium industry players in South Africa, including government departments, are not well aware of the mechanism. They are not aware when the mechanism will come into effect, and what is expected from the mechanism. In many industry cases, firms in South Africa exporting to the EU have not had any formal communique from the EU declarants, i.e. importers, about reporting GHG emissions embedded in their products – although this may have changed at the beginning of 2024 as the first CBAM report was due end of February 2024. The lack of awareness of the mechanism is said to be the result of a rushed application of CBAM by the EU. Requirements are changing too quickly, leading to technical-legalese information overload for industries.

Also, it was noted during the workshops that the mechanism is a unilateral measure without engagements with affected parties. Generally, a lack of understanding of climate change and decarbonisation exists in both government departments and affected industries in South Africa. Domestically, industries have complained of there being no single point of authority or contact with the South African government on CBAM matters, making the issue less of a priority, despite the law already having been implemented.

Also detracting from awareness is the limited time and capacity available to fully understand and prepare for CBAM. Industry understanding of how serious a threat CBAM may be to South African exporters is inadequate – as a result, responding to CBAM is not budgeted for, and is not top of agendas in board meetings. Compounding the awareness problem, the "legalese" of CBAM regulations makes them exceedingly difficult to interpret and translate into the practical actions that industry needs to achieve. In addition, CBAM timelines are too short for such a major paradigm shift, and the unilateral imposition of CBAM is unhelpful and creates conflict and confusion. Another key concern is that it remains unclear how firms are meant to account for indirect emissions that result from imports from the EU. It is noted that, while emissions can be easily tracked throughout local production processes, accounting for indirect emissions is much more complicated and burdensome.

The lack of awareness of CBAM will result in a negative effect on industries in South Africa. These effects include the South African industries being late in terms of compliance, penalised for not being compliant, incorrect reporting of GHG emissions during the transition period, and as a result business profitability impacted negatively.

3.2. Domestic industrial challenges – Logistical, energy and coordination issues

South African manufacturers are faced with many challenges domestically. Manufacturers are already in a "survival mode," trying to balance between surviving and solving domestic manufacturing issues, including irregular electricity supply from power utility Eskom and state-owned freight rail company Transnet. In 2022 for example, it was estimated that "loadshedding" or schedule power rationing[1] reduced the output of the largest steel producer in South Africa (AMSA) by R95 million. Escalating problems at Transnet proved even more costly (Makgetla, 2023). AMSA, according to Makgetla (2023) argued that in 2022 it lost R600 million in sales because of transport delays. In addition, its freight costs rose by R500 million as it shifted to road carriers.

Despite the logistical and energy problems they face locally, industrial players have flagged issues of coordination. Many are panicking about the need to respond to CBAM, and, often there is a lot of confusion, and, again, the lack of single point of authority to clarify issues of CBAM locally is unhelpful. During the workshops, lack of coordination within the manufacturing industry as a whole in responding to CBAM has been noted as an immediate issue, applying both to large corporates and SMMEs. The problem is worsened by the lack of coordination between government and industry, and government stands accused of not responding to CBAM adequately.

It was claimed in workshops that there are no government engagements on CBAM issues, despite South Africa being a front runner on CBAM during the 2023 United Nations Climate Change Conference (COP28). Also, there is a lack of clear ownership and leadership in responding to CBAM,

[1] Loadshedding in 2023 is estimated to have cost the South African economy about R1.23 trillion, resulting in R77 billion in loss of tax, equating to about 5% of total South African tax revenue, which could result in the loss of 860 000 jobs (Jacobs, 2022; NEASA, 2023).

both by government and business. Also adding to the lack of a coordinated response is the divide between political and business decision-making processes. Coordination is lacking between government and industry on oncoming challenges - on CBAM and other issues.

Domestic problems have become a barrier to solving the emerging problems of CBAM. While logistical and energy challenges need more attention, so do the internal issues of coordination. A coordinated and collective response to the challenge of CBAM is necessary. Overall, enabling institutions are required to deal with the broader challenges related to the South African energy system to open opportunities in the green space.

3.3. Misaligned GHG accounting infrastructure – CBAM and SAGERS not compatible

South African industry stakeholders during the workshops held in November 2023 said that they have neither the means nor the time to account and report emissions before the end of January 2024, let alone establish infrastructure before the end of the transition period. This is mainly because of local technical challenges in measuring, reporting, and verifying emissions data as well as the misalignment of CBAM and the global accounting and reporting GHG protocols.

The technical challenges are driven by a lack of clarity on what needs to be measured (confusion around indirect emissions), and how this needs to be done (frequency of reporting and methodologies). Technically, South Africa does have a GHG emission accounting system in place, called SAGERS as noted in section 2, and the differences between SAGERS and the CBAM methodology are detailed there.

The unpreparedness of South African industries in complying to CBAM is also driven by the misalignment of CBAM and the global GHG protocols, which guides SAGERS. Industries all over the world have been using these protocols to monitor and report GHG emissions across industries, as has South Africa. The introduction of the new and different GHG emissions accounting and reporting legislation by CBAM creates confusion in the accounting and reporting of GHG emissions globally. For example, the global protocols differentiate between three types of accounting of GHG emissions. These include Scope 1, 2 and 3 emissions, while the CBAM legislation differentiates between only two types, indirect and direct emissions. These different typologies and scopes in reporting creates confusions in the international space, and locally in South Africa.

Additionally, the European Commission has not clarified how indirect emissions will need to be accounted for under CBAM. As noted in the workshops this has created much uncertainty for South Africa's affected industries. CBAM legislation (in its final text) does not differentiate between Scope 2 and 3, while later publications related to the mechanism do differentiate between Scope 2 and 3.

The final CBAM text does highlight that only scope 2 emissions – emissions from electricity usage – will need to be accounted for. It is uncertain whether Scope 3 emissions – emissions from transportation and distribution – will be included, although emissions from input materials and/or precursors will need to be accounted for.

The inconsistency of the CBAM legislation with global GHG protocols and the local GHG infrastructure (SAGERS) has made the law unpredictable. South African firms have had to work on a range of assumptions about emissions reporting and reduction measures that may turn out to be incorrect in the case of CBAM. A notable concern raised during the workshops is the lack of clarity on reporting mechanisms with indirect emission tracking and pricing. Although emissions can be easily tracked

throughout local production processes it becomes much more complicated, complex, and burdensome when accounting for indirect emissions.

Other issues pertain to the monitoring, reporting and verification infrastructure, and how to secure storage of data and transfer of emissions data to prevent data manipulation. These, as has been noted in the workshops, will arise as South African firms start to adapt to the legislation. Also, there is a lack of global standards to guide industries on reporting GHG emissions at a product and production process level (which could be the reason for the misalignment in policies affecting countries globally).

The confusion, presented by the misalignment of CBAM with global GHG protocols and the local GHG accounting infrastructure (SAGERS), present cascading issues for the local industries in complying to CBAM. The misalignment means that South African exporters cannot demonstrate to clients that they are making progress on compliance. Also, firms cannot demonstrate that they are setting out a viable glide path on reduction in emissions more generally. This will soon result in the loss of precious time required to respond effectively, activate enabling institutions, and mobilise key stakeholders and capabilities. This in turn will result in loss of business and access to markets. While Section 2 does provide clarity on the misalignment, a detailed evaluation is urgently needed on alignment with EU methods and what capabilities are required – and whether South Africa has these capabilities or will end up paying for expensive EU-based consultants.

3.4. Displacement of exports amid increasing cost of accessing markets

The introduction of CBAM as a stand-alone feature in the global discourse of mitigating climate change has created a great deal of tensions and fragmentation within the international trade space. CBAM as a carbon tax will also increase exports prices to the EU. This in effect will drive the displacement of international trade, specifically trade of CBAM-covered goods. Western economies have started to turn inwards to protect their local economies through protectionist measures as global trading systems have fragmented (Maimele, 2023a).

CBAM exacerbates the need for countries to start protecting their own industries in the absence of a functioning multilateral trade system, i.e., the disfunction of the World Trade Organization (WTO). Already, CBAM-like measures are being proposed in policy discussion circles. For example, the United Kingdom (UK), United States (US), Japan, Australia, and China are looking to introduce or adapt to carbon border taxes to offset the costs of CBAM to their local industries. This in effect, will promote further fragmentation of the global economy, undermining the role of the WTO and other multilateral institutions and thus displacing exports of CBAM-covered goods.

While, the fragmentation of global trade is driven by the cost of exports, during the transition period firms exporting goods covered under CBAM to the EU do not have to pay any taxes. Payments will start from 2026. However, during the transition period, failure to report or incorrect reporting of specific embedded emissions will result in penalties, as detailed in Section 2.

The cost of doing business during the CBAM transition period will undoubtedly increase. When CBAM proper kicks in, CBAM certificates will have to be bought, in other words firms will start paying carbon taxes. This will make South African exports costlier and generally uncompetitive.

What will also increase costs from 2026 is the requirement that firms verify their accounted/reported GHG emissions. Exporting firms will bear the cost. In South Africa, a lack of third-party verifiers will result in even greater expense if capacity is not built locally as firms will primarily have to use international verifiers. This will quickly lead to the creation of a domestic industry, cutting costs but

not eliminating them. It was noted in the workshops that industries currently rely heavily on extremely costly international carbon auditors for their accounting and reporting of GHG emissions.

In additional, domestic infrastructural issues need to be fixed to avoid additional unnecessary costs that might affect overseas exports, considering the acceleration of green solutions globally. These issues include attending to the bottlenecks in the grid and allowing room to implement domestic policies. While CBAM has not been budgeted for, the cost of investing in new/clean technologies is extremely high. This will make firms start to restructure their business models and this will have socio-economic impacts, affecting profitability, earnings, and jobs.

4. OPTIONS FOR RESPONDING TO CBAM DURING THE TRANSITION PERIOD

To mitigate the potential harm, as a cross-cutting intervention a CBAM awareness drive to educate those responsible for affected value chains in South Africa about the potential impact and how to respond to CBAM and broader border carbon adjustments during the transition period need to be introduced. The primary audience should be the affected industries and government.

In parallel, affected firms, supported by government, should begin to adapt infrastructure to CBAM and CBAM-like measures. As highlighted in Figure 6, four possible avenues in addition to the awareness drive and adapting infrastructure could be explored during the transition period. These could include, diplomatic, economic, fiscal and trade avenues. These avenues differ by the timeframes of their interventions, but are a good start for complying with CBAM and mitigating potential impacts during the transition period.

Adapting infrastructure to CBAM and CBAM-like measures could include creating an integrated GHG accounting system domestically (starting with a GHG emission accounting methodology during the transition period) that covers all carbon-intensive industries in South Africa. This solution could be based on the South African Greenhouse Gas Emissions Reporting System (SAGERS). At the same time, there is a need to create capacity for domestic verifiers during the transition period, allowing small players opportunities to solve climate change in the longer term.

Diplomatic avenue: The diplomatic avenue includes engagements with the EU and the WTO for concessions. The South African government should start by submitting a formal complaint to the EU and explore disputing the CBAM at the WTO. The current dispute system at the WTO is not working to its full capacity, however, the dispute route might not be effective in the short term (Lester, 2022).

Fiscal policy avenue: This includes starting to reform the South Africa's domestic carbon tax to reflect global carbon pricing by 2030. This will be critical to ensure that the country's carbon-intensive products reflect at least the EU carbon price. Increasing the South African carbon price will stimulate heavy emitters to reform their business models and operations, as well as reduce the exposure to the CBAM by retaining funds locally that would be paid to the EU, and recycling carbon taxes for decarbonisation of hard-to-abate sectors, such as iron and steel and aluminium.

Economic policy avenue: Boosting green industrialisation of affected value chains should be investigated. This avenue examines how businesses can start exploring changing technologies in their production processes to avoid expected surges in the cost of exporting to the EU market. At the same time, South African policymakers must have a strategy to mitigate the socio-economic costs of technological change. Also, local demand for green products in the affected CBAM industries must be stimulated, such as through a localisation policy for scrap metals, as the product has become a globally scarce commodity.

Trade policy avenue (Finding new markets): Should affected South African firms not receive concessions to have uninterrupted access the EU market and other markets introducing border carbon adjustments, finding new markets should be another short-term solution.

These avenues are expanded below from collated suggestions of the government-industry-researchers workshops on iron and steel and aluminium value chains, held in November 2023.

4.1. CBAM awareness drive

Awareness among key stakeholders must be raised, including government and affected industries, through among others, roadshows, workshops allowing in-depth knowledge sharing, and opinion pieces in the news media as soon as possible. The awareness drive must aim to achieve clarity and coherence of meaning about CBAM and border carbon adjustments. Before that, an extensive understanding of CBAM requirements needs to be undertaken, and an institutional body on climate change and trade, including government and industries, must be established. Alternatively, existing bodies such as research institutions, the Presidential Climate Commission (PCC) and industry associations, should be used.

This will also need to be supported by a Single Point of Authority (SPA) to be established within a relevant government department in responding to CBAM that coordinates actions within affected industries, across affected industries and between industry and government. This should preferably be situated in the Department of Trade, Industry and Competition (the dtic). Additionally, the establishment of the SPA and the institutional body must be empowered to act, and this should increase coordination within industry and between industry, labour, and government.

4.2. Adapting to CBAM – Creating a centralised domestic CBAM-compatible MRV system

In parallel to the awareness drive, affected firms along with government and research institutions should create a centralised domestic CBAM-compatible Monitoring, Reporting, and Verification (MRV) system. The CBAM is here to stay and jurisdictions around the world are starting to adapt to the mechanism. Other jurisdictions, such as the UK and US, are introducing similar mechanisms to offsets envisioned costs, and other jurisdictions are adapting their infrastructure to align them with the EU reporting methodologies of GHG emissions for carbon-intensive goods. China, for example, in February 2024 launched a test of their China CBAM (Al-driven) digital platform (Digiacarbon, 2024) to adapt to CBAM during the transition period.

South Africa's CBAM-incompatible digital platform (SAGERS) can be the basis for a domestic CBAM-compatible MRV system. This is, however, is a longer-term solution. Now, the main aim should be building a South African integrated accounting methodology to supplement SAGERS. This should be supported by a South Africa benchmarking study on emission methodologies against EU and other jurisdictions. In the later stages, capacity for third-party verifiers/auditors, learning from international parties already doing auditing of GHG emission reporting, can be created.

Developing the methodology for GHG emissions reporting in South Africa was suggested by the key stakeholders from the workshops as the first thing to be done in preparing to comply with CBAM. This methodology is expected to build back from the International Organization for Standardization (ISO) 14067 global standards on GHG emission reporting, and global protocols on GHG emissions reporting and accounting, as well as what the DFFE has already done in GHG emission reporting/accounting methodologies (i.e. SAGERS).

This methodology will be used to streamline the reporting for CBAM but also for all industries that need to account for GHG emissions at a product level in South Africa. It can foster an integrated accounting system that can be used for any global climate change policy seeking reporting of GHG emissions at product and production levels.

Before development and agreement on the South African accounting methodology, understanding the requirements of CBAM and possibly other developing CBAM-like measures is necessary. Key stakeholders identified to understand such are the DFFE, the South African Bureau of Standards, and the Council for Scientific and Industrial Research. Once the methodology has been agreed upon, industries will have to be capacitated and trained on it.

4.3. Improve coordination for diplomacy

At the same time as every affected stakeholder is being informed about CBAM requirements and how to respond, and the coordination arm is established and well empowered, the diplomatic route can also be exercised. This diplomatic route will include developing a negotiation strategy – a coordinated response that the South African government and industries can create through the established institutional bodies outlined in the diagram below to global climate change and trade policies. The main aim of the strategy and the coordinated response should be to enhance multilateral discussions where South Africa can negotiate with the EU and other important trading partners about measures like CBAM and generally on issues of climate change and trade.

The negotiation strategy should support the ongoing attempt by the South African government to negotiate with the EU for more time. Along the same lines, through engagements with the EU, clarity can be obtained on reporting/verification of emissions data as well as support sought for capacity-building and other technical assistance for South African exporters in adapting to CBAM.

The negotiation strategy will need to include WTO and EU negotiations on getting concessions for implementing CBAM during the transition period. This strategy could be developed by the Department of International Relations and Cooperation (DIRCO), the dtic, the Presidency, the Department of Mineral Resources and Energy (DMRE), DFFE and National Treasury (NT). The PCC and TIPS could support the development of this strategy. The main aim should be to submit a formal complaint to the EU and the WTO as the first step, and the government could lobby for concessions because of historical emissions and classification of South Africa as a developing country.

Similarly, South Africa should mount a coordinated response to the challenge of climate change and trade – not only CBAM. There should be clarity about which government departments/agencies and which private sector bodies are going to lead and coordinate the response to climate change and trade issues at the diplomatic level. Negotiating for trade concessions under the new green/climate change and trade policies is expected to be protracted – it is likely to take a decade for some concessions to be agreed on. This is based on having considered the current pace of negotiations at the WTO (Elms, 2024). The negotiation strategy needs to be supplemented by training. Considering the dysfunction of the WTO and the possibility of a long period of negotiating with the EU, it was noted during the workshops that a mitigation strategy should be developed in case the negotiations fail.

4.4. Align domestic carbon pricing with global carbon pricing with recycling mechanisms

The current South African domestic carbon tax is at R190 per tonne of carbon dioxide equivalent (tCO2e) or about US$10/tCO2e as of January 2024 (Worthington, 2024). This is expected to reach US$30/tCO2e by 2030 and US$120/tCO2e beyond 2050 (Steenkamp, 2022). Given the EU carbon price of about US$79/tCO2e (considering the volatility of the carbon price based on the EU ETS scheme as of January 2024), the South African domestic carbon price is low by global and EU standards (Worthington, 2024).

Against this backdrop, the National Treasury could start looking into reforming and South Africa's carbon tax to reflect global carbon pricing with recycling mechanisms. This would mean increasing the domestic carbon tax to be within the global carbon price corridor of US$50-100/tCO2e by 2030. This would be critical to ensure that the country's carbon-intensive products reflect at least the EU price of carbon (Maimele, 2023b). The increase would need to be handled in a way that would not affect production for the local market, especially for iron and steel and aluminium products.

Increasing the South African carbon price would also stimulate heavy emitters to reform their business models and operations, as well as reduce the exposure to the CBAM. While increasing the domestic carbon tax would have a similar impact to the CBAM on local companies, it would enable South Africa to retain the proceeds of carbon pricing. Domestic carbon revenue would stay in South Africa instead of flowing to the EU in carbon tax (Maimele, 2023b). This revenue could be recycled to incentivise the decarbonisation of industries locally, prioritising the highly impacted sectors, such as the iron and steel and aluminium industries.

While local industries would still incur financial losses due to the CBAM, a percentage of the carbon tax could also be avoided by buying carbon offsets. Demand for carbon offsets would rise, which would increase the incentive to produce more carbon offsets at the project level, presenting opportunities in the SMME space.

4.5. Greening local value chains/changing production technologies to unlock green opportunities

Greening local carbon-intensive value chains is a longer-term exercise, but one that needs to start during the CBAM transition period to unlock opportunities. As a start, critical infrastructural problems – such as municipal systems and frameworks to enable embedded private generation to wheel into the grid – must be solved as quickly and decisively as possible.

There should be technological change in production processes to achieve much-needed decarbonisation in carbon-intensive value chains. However, this was noted during the workshops to be extremely expensive in the short term. Maimele (2023b); Montmasson-Clair et al. (2023); Steuart (2023) and Monaisa & Montmasson-Clair (2023), provide technology options for decarbonising the iron steel and aluminium sectors and how this can help enable green opportunities. As was evident from the workshops, an environmentally friendly electricity supply that is efficient and predictable would decrease local costs and increase localisation opportunities alongside limiting emissions for exports. It was also noted that repairing and bolstering local energy, transport, and water infrastructure would maintain high-quality production of CBAM-covered goods.

Additionally, in the longer term, a shift to bolstering local demand for green products in both steel and aluminium sectors is needed and this includes localisation of scrap. Underpinning these should be clear local policy direction. Policies need to be developed to protect local industries from the rising threats arising from global climate change/green-trade policies. Key policies that argue for bolstering

localisation are the Integrated Resource Plan from the DMRE and industrial policy master plans, among others.

On top of the current problem with the steel master plan, i.e. the AMSA announcement closure of its two plants, it was noted that green/clean aspects are missing from the master plan. While the South African aluminium industry does have a roadmap, the roadmap also was seen as needing review. A master plan was said to be necessary to foster localisation in the aluminium industry in South Africa. The drafting of an aluminium master plan is envisioned to include a Just transition Pathway/framework for the aluminium industry.

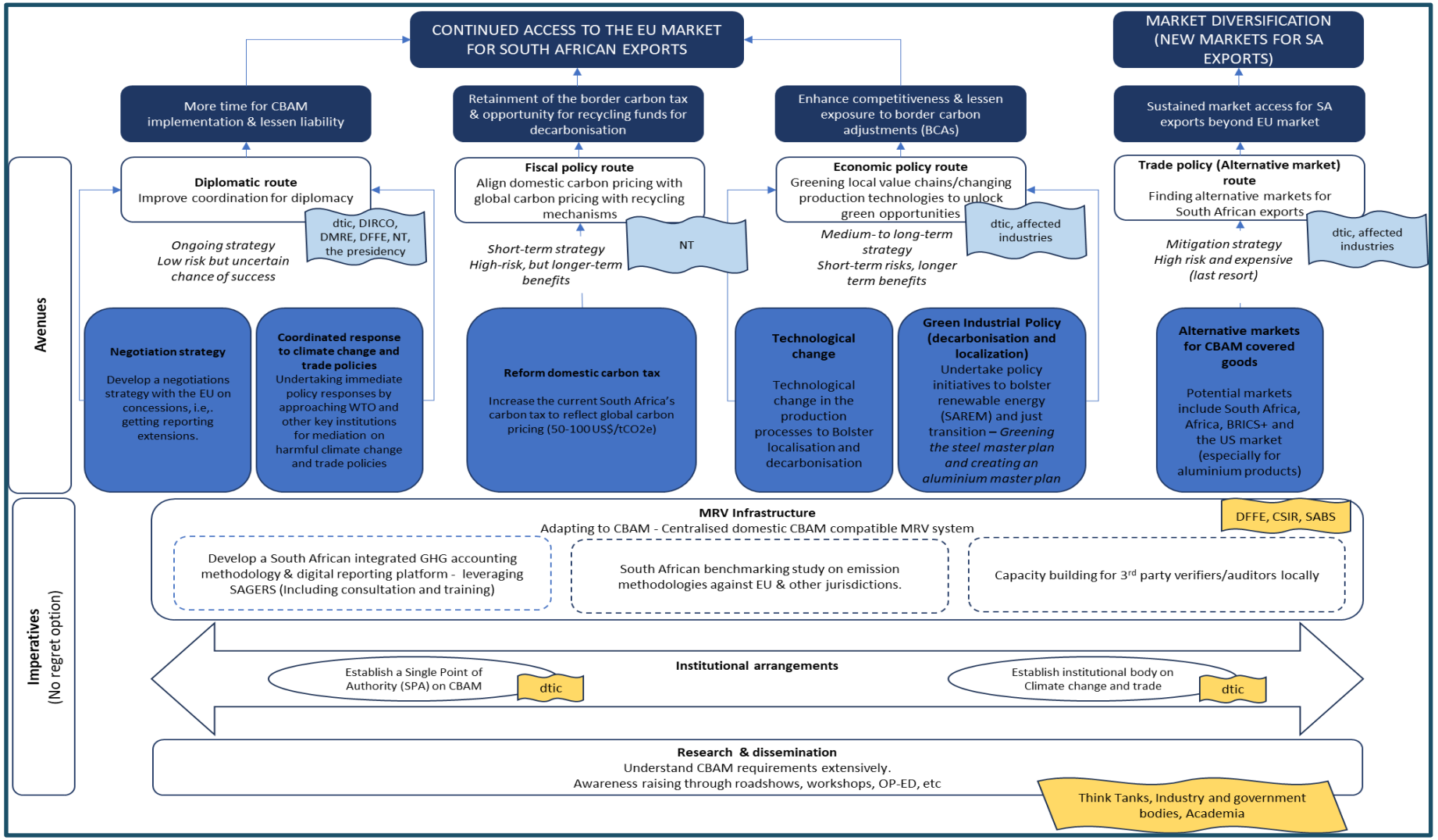
After the CBAM transition period, it was noted during the workshops, independent power-producing capabilities must be developed both on and offsite to promote decarbonisation and to offset carbon-intensive energy from Eskom. Continuous engagement is called for with the EU to acquire concessions (i.e. exemptions) for developing countries and to provide time to adjust and adhere to EU CBAM requirements. Also, a funding mechanism for localisation and decarbonisation should be established, either through industry-based grants or government support programs.

4.6. Finding alternative markets for South African exports

Should all interventions fail, key stakeholders from the workshops noted, seeking alternative markets for South African exports is the last resort. This was seen as an expensive and time-consuming exercise. However, should South African exports become too expensive and uncompetitive to enter the EU market, South Africa's biggest trading partner, alternative markets will have to be sought.

Alternative markets include the South African market, African market, BRICS+ market and the US market (especially for aluminium products). In South Africa, noting all the problems the industries face, such as constrained domestic demand, infrastructural issues, escalating imports, etc the South African market and the African market remain largely untapped for South African steel and aluminium. The start of implementation of the preferential trading of South Africa with Africa, under the African Continental Free Trade Area (AfCFTA), in January 2024 will help unlock opportunities in these affected CBAM sectors (Republic of South Africa, 2024).

Figure 6: Options for South Africa to respond to CBAM during the transition period



Source: Author's compilation

5. CONCLUSION

South African industries and the South African government are not ready to comply with the EU CBAM during the transition period. Time is short for both government and industries to adjust to the change. This comes as industries in South Africa are unaware of CBAM, the pace of change is accelerating, and the EU is imposing laws on the Global South. However, with climate change impacts increasingly being felt, the Global South (including South Africa) needs to transition relatively quickly. Doing so has broader climate benefits as well as economic gains from the global shift taking place.

As CBAM and border carbon adjustments are being imposed on the Global South, South African firms along with firms in emerging economies will have to incur a wider range of costs related to compliance, a higher cost of doing business, reduced market access, and heavy investments in green technologies to comply with/implement CBAM during the transition period. While climate action is warranted, pushing the climate responsibility onto the Global South is a huge concern. Implementation and understanding the reporting requirements of CBAM needs more time. CBAM is a complex paradigm shift. The Global South should be accorded space and time to transition, and rules should not be unilaterally imposed by the Global North.

Not being allowed more time to comply with carbon border taxes will result in negative socio-economic consequences such as firm closures and/or downsizing and associated job losses as well as loss of investment for South Africa and the countries of the Global South.

Vulnerabilities include South African industries being late in complying with CBAM or incorrectly reporting or not reporting GHG emissions during the transition period. Business profitability will be reduced, mainly due to penalties to be passed down by EU importers to firms exporting to the EU to pay during the transition period due to non-compliance.

Increasing distribution costs for exporters, resulting in production and administration costs increasing significantly. Companies would require notable investments to offset administrative costs of monitoring and reporting GHG emissions. Smaller companies without emissions tracking systems in place will be hard hit.

Increasing project and investment management in the longer term as industries will have to invest in long-term projects and review the viability of exporting to Europe.

In the extreme, there will be job losses and firm closures due to loss of market access/competitiveness, and loss of investment – both from foreign domestic investment and domestic capital. There will also be a breakdown of trust between government and business, further adding to the deterioration in important relationships between politicians/policymakers and business. Overall, the increased administrative burden in measuring and reporting GHG emissions will result in high administrative costs, coming on top of the inability to conform to EU reporting standards and declining market share based on high emissions reports.

As time is of utmost importance, implementation of CBAM during the transition period has become a hurdle to South African exporters, manufacturers, government and affected industries in general. It is, therefore, paramount to start acting collaboratively on these issues. Government, affected industries, labour unions and researchers need to work together to find solutions on CBAM. While more time is needed to implement CBAM in South Africa, there is also a need to engage the EU on the issues highlighted above about CBAM to negotiate for more time. More time is what South Africa needs to transition at a pace that is not harmful to the South African socio-economic setup.

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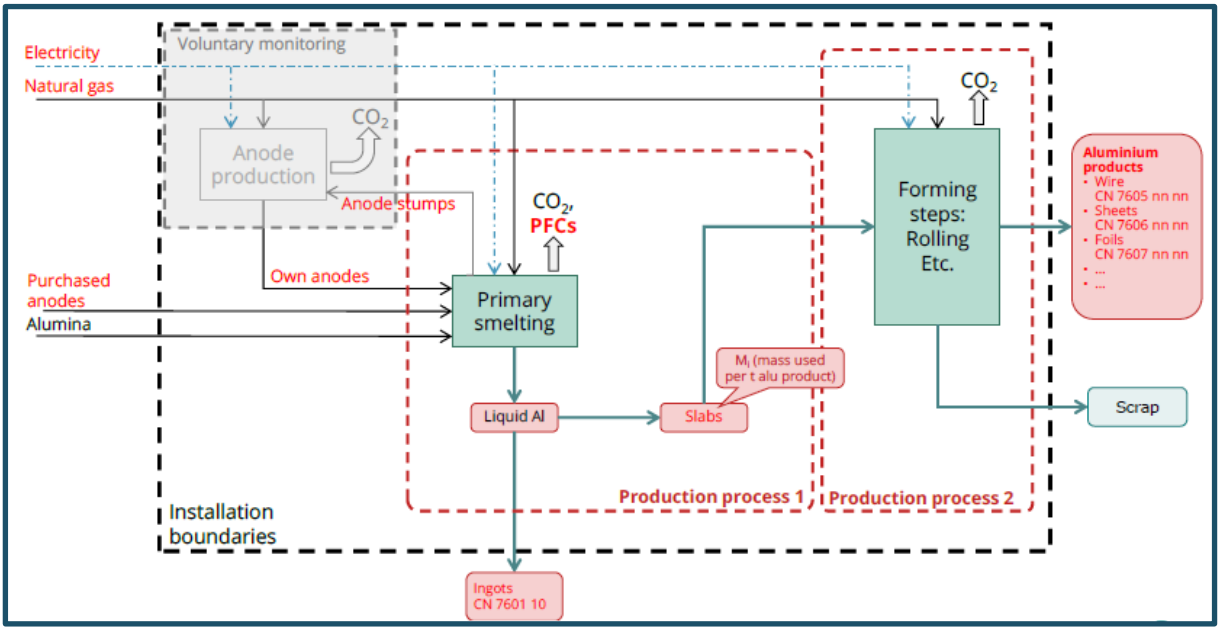
APPENDIX

Table 2. Non-exhaustive CBAM checklist for iron and steel and aluminium sectors – for the transition period

Checklist for Exporters (Operation installers)	
Monitoring, Reporting and Verification (MRV)	Firms only have to monitor and report GHG emissions. Verification is not required, but is encouraged. Post the transition period, verification will be mandatory.
Pay carbon border tax on your exports	Firms are not required to pay any tax during the transition period. Payments will start from 2026.
Reporting frequency	GHG emissions must be reported quarterly, and reports are due one month from the previous quarter (the first report is due end of January 2024 for Q4 of 2023).
GHG emissions accounted and reported	Both direct and indirect emissions
Domestic carbon tax	Report domestic carbon tax to be paid in your jurisdiction.
Exported goods covered (looking at Iron and steel and aluminium)	**Iron and Steel** **72** - All Iron and Steel product except for selected ferro alloys, and all iron and steel waste and scrap (**Direct CO2**) **2601 12 00** - Agglomerated iron ores and concentrates, other than roasted iron pyrites (**Direct and indirect CO2**) **7301** - All articles of iron and steel, except for a selected articles of iron and steel (**Direct CO2**) **Aluminium** All CN code 76 excluding scrap (7602) and tables etc (7615) (Direct and Indirect CO2 and direct perfluorocarbons (CF4 and C2F6))
Monitoring	Firms must determine Specific Embedded Emissions (SEE) (i.e. setting system boundaries, relevant parameters, and methods, etc.). In buying precursors, such as iron ore, firms will need to obtain emissions data from the supplier/s.
Reporting	Firms are required to determine their CBAM reporting obligations (i.e., scope of goods, reporting period to use, parameters for reporting, data on domestic carbon price).

Timeline for the transition period	1 October 2023 – 31 December 2025
Reporting year	Calendar year or firm fiscal year
Emission data	Start collecting emissions data from 1st Oct 2023.
Correction of report	Up to two (2) months to correct quarterly CBAM report. But within the first two quarters of the transition period (Q4 2023 and Q1 2024) a longer period will be allowed to make corrections to the reports, and the deadline for the corrected reports of Q4 2023 and Q1 2024 is 31 July 2024. This comes after acknowledging the difficulty of setting up MRV systems in time.
Penalty	€10 and €50 per tonne of unreported emissions.

Figure 7: Aluminium monitoring system – Boundaries and relevant parameters



Source: European Commission, 2023b

Table 3. Aluminium reporting (example) – Reporting of goods exported (inputs and outputs), in/direct CO2 and SEE

Production:	**Ingots and liquid aluminium (total)**	tonnes (t) **200 000**
	Ingots (Sale):	80 000
	Primary aluminium (Unwrought aluminium) into process 2	120 000
	Aluminium products (Process 2)	
	Tubes (7608)	60 000
	Plates, etc (CN 7606)	45 000
	Foils (CN 7607)	8 000
	Total Aluminium products (process 2)	**113 000**
Inputs:	Alumina	380 000
	Electrodes (sum self-produced and purchased, minus stumps)	69 000
	Natural gas	14 180

Direct emissions (CO2e)	tonnes (t)
From electrodes (using factor 3,664 t CO2 / t C):	252 816
From natural gas (NCV = 48 GJ/t, EF=56,1 t CO2 / TJ):	32 902
From PFCs (using overvoltage or slope methods as highlighted in the guiding docs)	25 282
Total Process 1 (primary aluminium)	**311 000**
Total process 2 (final aluminium products), emissions from natural gas	5 283
Total direct emissions of the installation	**316 283**

Indirect emissions	**Electricity Consumed (MWh)**	**EF (tCO2/MWh)**	**Emissions (tCO2)**
Process 1 (Primary production)	3 000 000	0,80	2 400 000
Process 2 (final products)	105 000	0,80	84 000
Total Indirect emissions			**2 484 000**

EF is based on 80% dependent of coal plants

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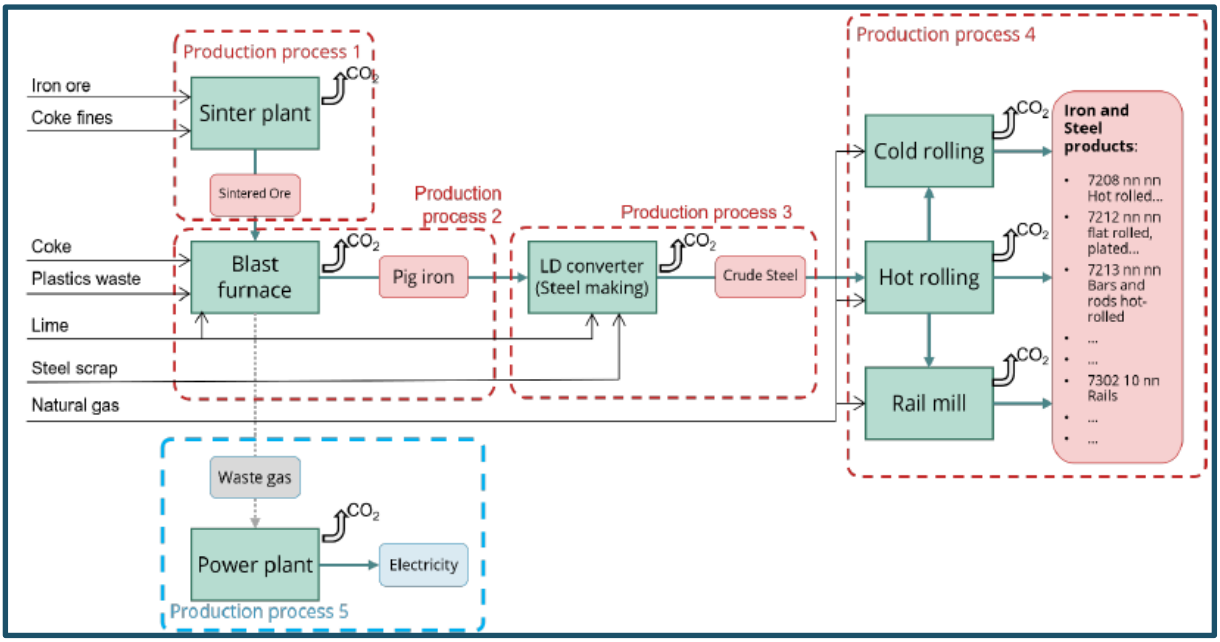
What the Report could look like - Aluminium

	Production levels		Process total emissions		Mass (Mi) of precursor	Specific Embedded Emission (SEE) Direct	SEE Indirect
Process 1 (unwrought aluminium – ingots and slabs)							
	Product		**Direct**	**Indirect**		**Direct**	**Indirect**
	Ingots	80 000					
	Slabs	120 000					
	Total	**200 000**	**311 000**	**2 400 000**		1,555	12,00
Process 2 (Final aluminium products)							
Precursors	Slabs	120 000			1,061946903	1,555	12,00
Aluminium products		113 000	5 283	84 000		0,046752212	0,743362832
Total embedded emissions of final aluminium products						**1,602**	**12,74**

Source: Adapted from the European Commission, 2023b)

Figure 8: Iron and steel monitoring system – Boundaries and relevant parameters



Source: European Commission, 2023b

Table 4: Iron and steel reporting (example) – Reporting of goods exported (inputs and outputs), in/direct CO2 and SEE

Inputs	Activity data (AD) (tonnes)	Carbon Content (CC)	Biomass fraction	Emissions (t CO2)	Comments
Coke fines	50 000	88%		161 216,0	
Iron ore	5 600 000	0,023%		4 719,2	
Coke fines	2 200 000	88%		7 093 504,0	
Plastic waste	70 000	68,4%	16%	147 363,1	Biomass fraction = 28 052 tCO2
Scrap (external)	800 000	0,210%		6 155,5	
Scrap (internal)	200 000	0,180%		1 319,0	
Lime calcined	280 000	0,273%		2 800,8	
Natural gas	170 000	75%		467 160,0	
Other inputs	40 000	10%		14 656,0	
Sum					**7 898 893,7**

Outputs				
Steel	4 800 000	0,180%	31 657	
Slags	1 000 000	0,030%	1 099	
Sum			**32 756**	
Total direct emissions of the installation			**7 866 137,5**	
Emission factor (t CO2/ t C)	3,664			

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	AD (TJ)	Emission Factor (Natural gas)		
Waste gas export	-12 800	56,1	478 959,36	Considers a correction factor of 0,667
Total attributed direct emissions of the production process for crude steel products			**7 387 178,2**	

Input	AD (MWh)	Emission Factor (tCO2/MWh)	Total indirect emissions	
Electricity from the grid	414 711	0,628		**General case: Use of default values.** Average emission factor of the country of origin, or based on IEA data
Electricity from waste gas combustion	1 244 133	0,576		
Total electricity consumption	**1 658 844**	**0,602**	**998 624**	

Total amount of goods produced (steel products)	4 800 000	t/year
Total direct emissions of the production process for steel products	7 387 178	tCO2/year
Total indirect emissions of the installation	998 624	tCO2/year
Specific direct embedded emissions	1,539	tCO2/t steel product
Specific indirect embedded emissions	0,208	tCO2/t steel product
Specific total embedded emissions	**1,747**	**tCO2/t steel product**

Source: Adapted from the European Commission, 2023b