Research Intelligence

Countdown to the CBAM

How prepared is Thailand for the introduction of the EU carbon tax?



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Introduction

The EU's Carbon Border Adjustment Mechanism, or CBAM, forms an important part of the bloc's efforts to meet its net zero commitments and more generally, to transition the region to a green economy. In this context and as the first move to collect import duties on carbon-intensive products, the policy has attracted considerable interest.

On 1 October, 2023, the enforcement of the CBAM will enter a 'transition period'. Initially, importers of goods in six product categories, namely cement, electricity, fertilizer, iron and steel, aluminium, and hydrogen, will be required to report the amount of goods being imported together with the quantity of carbon directly and indirectly associated with the production of these (i.e., their embedded emissions). The CBAM will be fully enforced from 1 January, 2026, at which point importers will need to purchase a CBAM certificate, the cost of which will be calculated based on an assessment of the quantity of imports and their embedded emissions.

Over the short term, because exports to the EU of the goods covered by the CBAM regulations do not represent a significant fraction of total sales, its introduction is expected to result in only limited impacts for Thai industry. Nevertheless, Thai manufacturers and exporters will still have to contend with problems arising from the measurement, verification and reporting of emissions, though this will be most pronounced for those exporting steel and aluminium goods since sales into the EU play a more important role for these than they do for other product categories. Moreover, because carbon emissions will represent an important source of costs for CBAM exports, Thai industry will need to respond by reducing its carbon intensity, and this will generate its own set of challenges. These problems can be expected to multiply as other countries or trading blocs introduce their own CBAM-type mechanisms. However, looked at from a different perspective, the need to confront and to surmount the difficulties posed by the introduction of the CBAM will help to force public sector bodies, private sector businesses, and the finance industry to adapt their operations and to accelerate the transition to a low-carbon economy and to move closer to meeting net zero commitments, which at present remains a distant prospect. Alongside this, the introduction of the CBAM will also help to catalyze the development of new low-carbon or carbon-reduction business opportunities.

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Greening the global economy

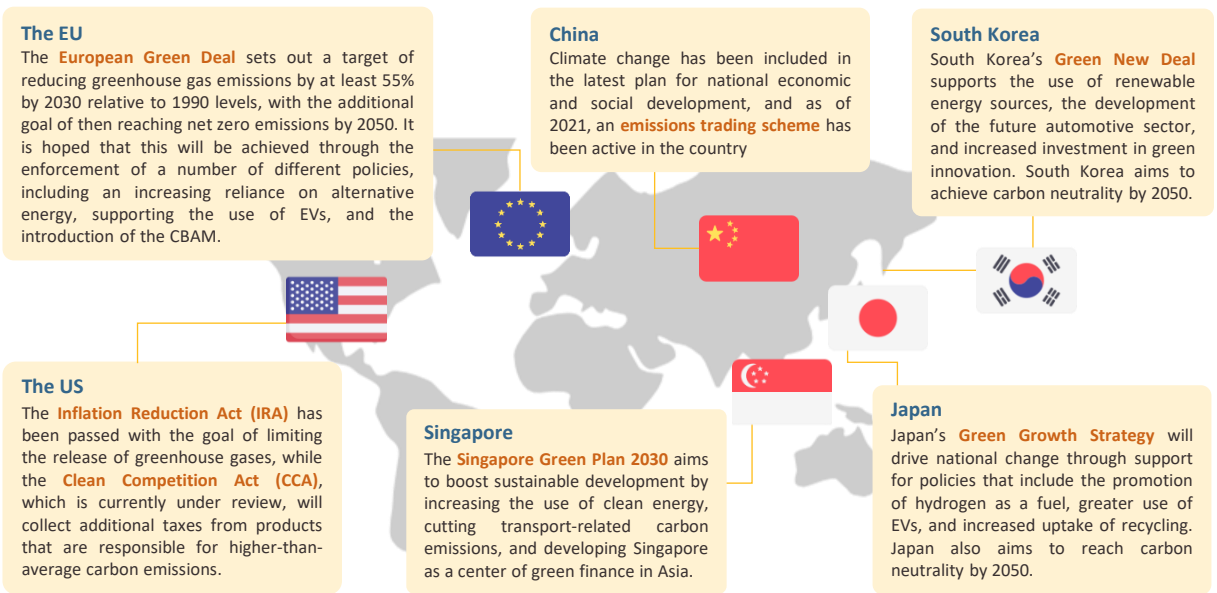
The threat of climate change poses grave dangers to the world, and indeed, the impacts of rising temperatures are already becoming increasingly evident around the globe. In the absence of effective mitigation strategies, the severity of these impacts will only worsen, and so policies currently being implemented worldwide aim to curtail the release of greenhouse gases (the primary cause of climate change) and to move economies towards carbon neutrality and net zero emissions.

The EU is widely regarded as a world leader in the area of climate change mitigation and adaptation, and the bloc has led the way by establishing a target of reaching net zero emissions by 2050. As part of this, in July 2021, the European Commission laid out its 'European Green Deal', which aims to cut net emissions of greenhouse gases by at least 55% by 2030 relative to the 1990 baseline (the so-called 'Fit for 55 Package'). The European Green Deal encompasses a range of different policies and measures[1/], the most important of which include the following:

- The development of the Emissions Trading System (ETS).
- Enforcing environmental or green taxes.
- Establishing a target of 40% of electricity coming from alternative energy sources by 2030.
- Banning the sale of new ICE-powered vehicles by 2035.
- Passing a law guaranteeing the sale of only deforestation-free products.
- Setting out a taxonomy of eco-friendly businesses.
- Developing and enforcing the Carbon Border Adjustment Mechanism (CBAM).

Figure 1:

Global Environmental Policy



Source: Krungsri Research

1/ https://www.setsustainability.com/libraries/1035/item/european-green-deal

On the other side of the Atlantic, the authorities in **the US** have been using legislative tools to push forward with national sustainable development. Most obvious among these has been the Inflation Reduction Act (IRA), which aims to cut emissions of greenhouse gases and to encourage consumers to switch to a greater reliance on clean energy. This is to be achieved through changes to the tax system, including the introduction of tax credits for businesses that switch to alternative energy and for consumers who purchase EVs. In addition, funds are being made available to assist with the purchase of rooftop solar installations[2/]. Beyond this, Congress is in the process of considering the Clean Competition Act (CCA). If passed, this will impose taxes on both domestically produced goods and imports that are responsible for greater-than-average carbon emissions, which as well as helping to reduce environmental impacts, will ensure that companies compete on a level playing field.

Asian nations have also been increasing their focus on environmental issues, and so governments across the region have been developing strategies to green their economies. In **China**, climate change was mentioned in a 5-year plan for the first time in the 14th National Economic and Social Development Plan (covering the years 2021 to 2025), and from 2021, an emissions trading scheme has been active in the country. It is hoped that this will help to cut emissions from the industrial sector. In 2022, the publication of new Green Bond Principles also set out the requirement that 100% of the use of proceeds (UoP) should be for green projects[3/]. **Singapore**'s Green Plan 2030 will drive national sustainable development by encouraging the use of clean energy, cutting the release of greenhouse gases from the transport sector, and establishing the country as a center of green finance in Asia[4/]. In **South Korea**, the Green New Deal is focused on increasing the share of renewables in the national energy mix, supporting the greening of the transport sector and developing the future automotive industry, and increasing investment in environmental innovation. South Korea hopes to reach carbon neutrality by 2050[5/]. **Japan**'s Green Growth Strategy aims to drive change through three main channels: (i) In the energy sector, the government will support the use of hydrogen and ammonia as energy sources; (ii) in industry and transport, support will underpin the use of EVs and the recycling of carbon; and (iii) in offices and households, the focus will be on greater use of recycled goods. Japan also hopes to reach carbon neutrality by 2050[6/].

However, it is clear that **Europe is the world leader when it comes to policies to address the threat of climate change**, and the EU has long been at the forefront of efforts to deal with these dangers. The bloc has thus initiated a number of policies that have then been taken up elsewhere, including the Emissions Trading System, setting out a taxonomy of sustainable activities, and now introducing the Carbon Border Adjustment Mechanism (CBAM), which will come into force in October 2023. Indeed, the CBAM will likely prove to have wide reaching consequences on world trade, and because the EU is an important export market for Thai manufacturers, Thailand will not be spared these impacts. Moreover, the EU's introduction of a border carbon tax can be expected to encourage other countries to do likewise, and this will then accelerate the rollout of environmentally friendly trade policies worldwide. This paper thus looks in detail at the CBAM, investigating the policy's history, its details, its enforcement, its likely impacts, and its shortcomings. The paper concludes with a look at the opportunities and challenges that the CBAM will bring about, for Thailand and for other countries.

2/ https://www.energy.gov/lpo/inflation-reduction-act-2022 and https://www.bot.or.th/th/research-and-publications-listing.html

3/ https://thaibizchina.com/article/dual-carbon/

4/ Patcha Thamrong-ajariyakun (2022) "Singapore: Towards a green and sustainable future" Retrieved from https://www.itd.or.th/itd-data-center/singapore-green-sdgs/

5/ https://tha.mofa.go.kr/th-th/brd/m_3129/view.do?seq=744835#:~:text=ในขณะที่เกาหลีใต้นั้น,นิวศ%20การจัดหาพลังงานคาร์บอน

6/ https://api.dtn.go.th/files/v3/63bbd0c9ef4140d9817e6047/download

What is the CBAM?

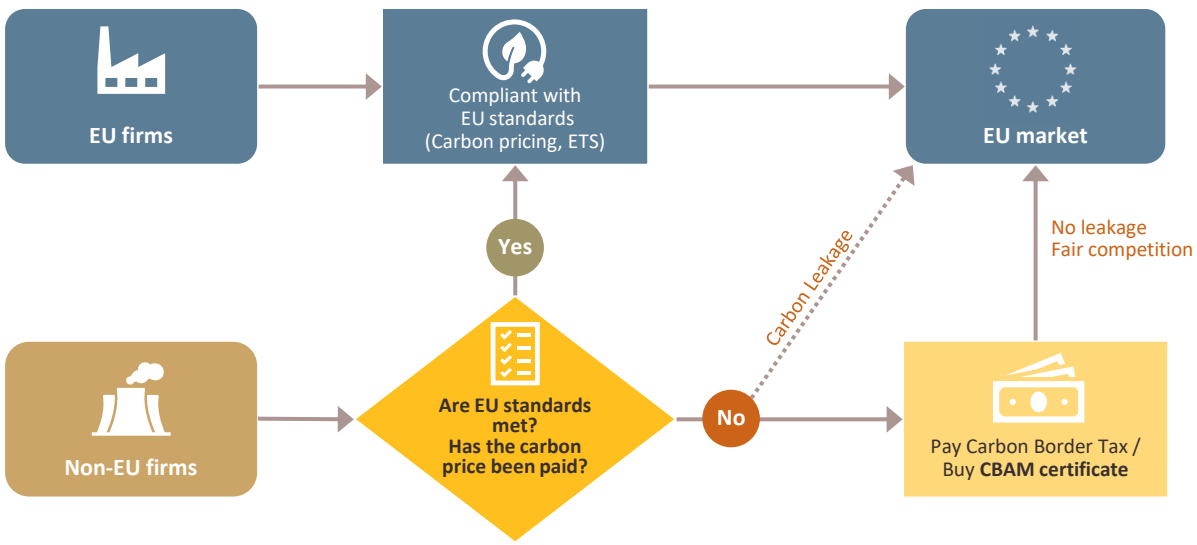
What is the CBAM?

Although the EU has steadily intensified its efforts to reduce carbon emissions originating within member states, it has been less successful in implementing measures to address its reliance on external sources of carbon. It has thus become necessary to confront problems arising from **'carbon leakage'**, that is, the tendency of EU-based manufacturers to respond to tightening carbon regulations by shifting production to countries that operate weaker regulatory environments, or to replace EU-produced goods with carbon-intensive imports sourced from non-EU economies.

These are the problems that the **Carbon Border Adjustment Mechanism (CBAM)** is designed to solve, which it does by effectively imposing import duties that are scaled to reflect the greenhouse gases associated with the production of those imports. EU authorities therefore hope that the CBAM will prove to be an effective mechanism for fully capturing and reflecting the carbon costs of imports. This is because once the scheme is fully operational, importers will be required to purchase CBAM Certificates that will be priced at a level that reflects the costs of producing similar goods in the EU together with the associated carbon emissions, and by accounting more fully for the latter, the EU will be better able to meet its climate change goals.

Figure 2:

How the CBAM Operates



Source: BCG Analysis[7/], Krungsri Research

7/ https://www.bcg.com/publications/2021/eu-carbon-border-tax

Background to the CBAM

Over recent years, a number of different EU bodies have engaged in discussions over how best to regulate carbon emissions, and this resulted in the European Commission initially presenting its proposals for the CBAM in July 2021. This was followed in June 2022 by proposals from the European Parliament and the European Council for their versions of the CBAM, with the three approaches differing over details with regard to the product categories to be targeted by the new regulations, how greenhouse gases were to be measured, the timeframe for the introduction of these measures, and the geographical area within which the CBAM was to be enforced. Of the three proposals, that put forward by the European Parliament was the most comprehensive.

Trilogue negotiations between the three bodies were completed in December 2022, and the CBAM will begin implementation at a transitional stage in October 2023[8/].

Table 1:

CBAM Proposals by the EU Institutions

Scope	European Commission (July 2021)	European Parliament (June 2022)	European Council (June 2022)	Final (as of May 16, 2023)
Sectoral scope 	Cement, fertilizers, iron and steel; aluminium and electricity (Review in 2025)	European Commission proposal + chemicals (including hydrogen) and Polymers (Intention to cover all sectors by 2030)	Same as European Commission	Cement, fertilizers, iron and steel, aluminium, electricity, and hydrogen
Geographic scope 	Exemption for countries with carbon market linked to EU-ETS (Iceland, Liechtenstein, Norway and Switzerland)	Same as European Commission, proposed that revenues from CBAM certificate are to be used for international climate finance in LDCs	Same as European Commission	Same as European Commission and intention to support LDCs
Emission scope 	Only direct emissions, indirect emissions to be considered later	Direct and indirect emissions	Same as European Commission	Direct emission (all) and Indirect emission (only for cement, fertilizers, and electricity)

Source: Presidential Climate Commission. (2023) and CBAM regulation in the Official Journal of the EU (May 16, 2023), Krungsri Research

Current status

Initially, the CBAM will apply to the **cement, electricity generating, fertilizer, iron and steel, aluminium, and hydrogen** industries, with the CBAM targeting the release of **embedded emissions** associated with the production of these goods. Embedded emissions are composed of (i) direct emissions connected to the manufacturing process (e.g., burning fuel to power machinery, or operating vehicles), and (ii) indirect emissions connected to the power used in industrial processes (e.g., for electricity), although indirect emissions will not be counted for imports of iron and steel, aluminium, and hydrogen. The CBAM will apply to all imports to the EU from non-EU countries, including Thailand, with the exception of those from countries that are in the EFTA (Iceland, Lichtenstein, Norway, and Switzerland).

8/ Presidential Climate Commission. (2023). "Carbon Border Adjustment Mechanisms and Implications for South Africa". Retrieved from https://pccommissionflow.imgix.net/uploads/images/PCC-Working-Paper-CBAM.pdf.

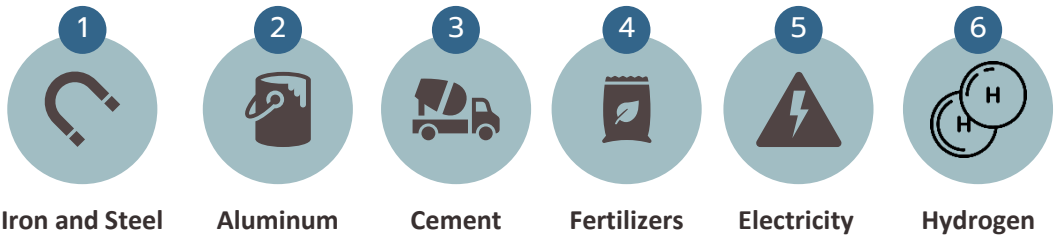
Enforcement of the CBAM

1) **Transition period (1 October, 2023 - 31 December, 2025)**: During the initial transition period, importers of goods covered by the CBAM will need to report their annual imports and the embedded emissions associated with these. The latter will need to be calculated according to the regulations laid out in the CBAM and then confirmed by an approved independent auditor or verifier[9/]. EU regulations specify that the initial reporting period will end on 31 January, 2024[10/], though throughout the whole of the transition period, **importers will not be required to purchase CBAM certificates.**

2) **Full implementation (1 January, 2026 onwards)**: Importers will be required to report their total imports and the embedded emissions associated with these, and then to purchase an appropriate CBAM certificate, the price of which will be set with reference to the weekly average auction price of EU ETS allowances[11/]. However, if importers are able to show that the production of these goods already incorporates their carbon costs, they will be able to set these against the price of the CBAM certificate.

Figure 3:

Industries Initially Targeted by the EU-CBAM



Source: European Commission

The CBAM regulations[12/] have been in force since their publication in the Official Journal of the EU on 16 May, 2023. However, the European Commission may announce additional CBAM requirements relating to the reporting of greenhouse gas emissions following discussions with the CBAM Committee, which is made up of experts from EU member states.

9/ The Thai government is currently negotiating with the EU over accrediting a number of independent auditors for the CBAM embedded emissions accounting process. These include the Centre of Excellence on enVironmental Strategy for GREEN business (VGREEN) at Kasetsart University, the Research Unit for Energy Economic & Ecological Management at Chiang Mai University, and the Center of Excellence for Eco-Energy (CEEE) at Thammasat University, as well as independent auditors from the public and private sector and from other educational institutions. For more details, please see: http://thaicarbonlabel.tgo.or.th/index.php?lang=TH&mod=ZG1WeWFXWnBaWEk9&action=Y0hKdlpIVmpkSE09

10/ https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en

11/ https://www.eex.com/en/market-data/environmentals/eu-ets-auctions

12/ REGULATION (EU) 2023/956 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 10 May 2023 establishing a carbon border adjustment mechanism. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R0956

Extending the CBAM beyond the EU: The US-CBAM

Other countries beyond the EU are also now developing similar policies to the CBAM as they look to better regulate the release of greenhouse gases. Thus, **in the US, the Senate introduced the Clean Competition Act (CCA) in June 2022, or what might be called the US-CBAM.** If passed, this would establish a carbon pricing mechanism that would apply to domestically produced goods as well as setting a carbon border adjustment mechanism to be used to adjust prices for energy-intensive imports.

At present, the CCA is still under review by the Senate, but if the bill becomes law, it would likely come into effect in 2026 and would initially apply to fertilizer, hydrogen, cement, iron and steel, fossil fuels, refinery products, petrochemicals, adipic acid, glass products, paper and pulp, and ethanol[13/]. The CCA will set out a mechanism for establishing carbon prices based on average emissions for different products. These will then be used as baselines within each industry, and imports that are responsible for emissions in excess of these will be charged duties at a proposed rate of around USD 55 per tonne of carbon. Significantly, this baseline will contract by 2.5% annually[14/], and so as the cost of carbon ratchets up, producers will be encouraged to gradually tighten their emissions. Under the CCA, importers will be required to report their greenhouse gas emissions, the weight of their imports, and the electricity consumption related to these to the Environmental Protection Agency.

Like the EU's CBAM, the US CCA is expected to exempt imports from least developed countries (LDCs).

Figure 4:

Industries Targeted by the US-CBAM



Source: Department of Trade Negotiations (DTN)

Comparing the EU and US mechanisms reveals a number of differences with regard to the industries that are targeted, but since both are focused on reducing carbon emissions, there is naturally significant overlap between the two. Overall, **the US-CBAM is broader than its EU equivalent, but importantly, while the EU measures impose a carbon tax on imports' total emissions, the US CCA will target only emissions in excess of the industry average.**

13/ https://www.dtn.go.th/th/content/page/index/id/11332

14/ Judy Chao. (2023). "Carbon tariff: U.S. rules of the game". Retrieved from https://www.infolink-group.com/energy-article/carbon-boarder-tax-how-the-us-plays-the-game#:~:text=In%20June%202022%2C%20the%20U.S.,recently%20completed%20its%20second%20reading.

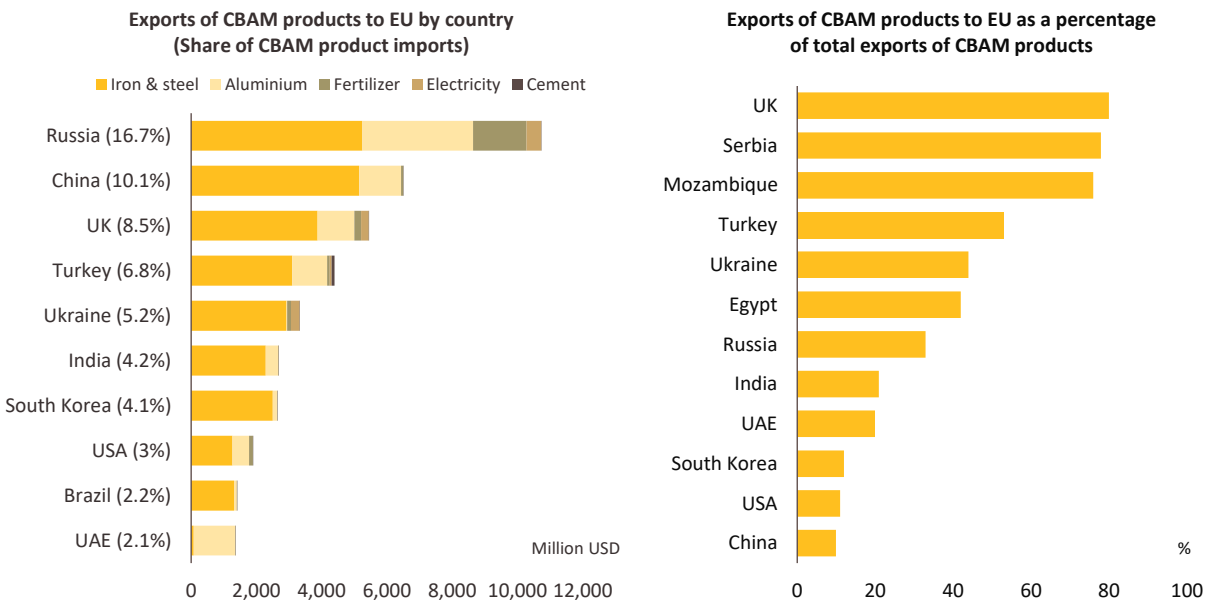
Potential impacts of the CBAM

Global-level impacts

While the EU clearly believes that introducing the CBAM will help to address problems with carbon leakage and so reduce overall greenhouse gas emissions, as well as institute a new source of income through the sale of CBAM certificates, some academics and researchers argue that the CBAM may distort international trade. Other criticisms of the CBAM focus on the fact that the mechanism will work to transfer responsibility for implementing mitigation strategies to developing countries, which are much less well placed to shoulder these responsibilities[15/]. This is mirrored in Dumitru et al (2021), who use a Computable General Equilibrium (CGE) model to analyze the global impacts of the CBAM, demonstrating that this will widen gaps in GDP and welfare provision between the developed and developing worlds[16/]. However, Beaufils et al (2023) show that the impacts of the CBAM will vary, with countries that are highly dependent on exports to the EU of carbon-intensive products being the most seriously affected. This group will include **Russia, the UK, Mozambique, Turkey, South Korea, India, and China**, and will most seriously affect many middle- and lower-income countries[17/].

Figure 5:

Impacts of the CBAM on the EU's Trade Partners



Source: Kardish et al. (2021)[18/] and Dumitru et al. (2021)

15/ He Xiaobei, Zhai Fan, Ma Jun. (2022). "The Global Impact of a Carbon Border Adjustment Mechanism: A Quantitative Assessment". Retrieved from https://www.bu.edu/gdp/files/2022/03/TF-WP-001-FIN.pdf

16/ Alexandra Dumitru, Barbara Kölbl, Maartje Wijffelaars. (2021). "The Carbon Border Adjustment Mechanism explained". Retrieved from https://www.rabobank.com/knowledge/d011297275-the-carbon-border-adjustment-mechanism-explained

17/ Beaufils, T., Ward, H., Jakob, M. et al. (2023). "Assessing different European Carbon Border Adjustment Mechanism implementations and their impact on trade partners". Commun Earth Environ 4, 131. Retrieved from https://doi.org/10.1038/s43247-023-00788-4

18/ Chris Kardish, Mattia Mäder, Mary Hellmich, and Maia Hall. (2021). "Which countries are most exposed to the EU's proposed carbon tariffs?". Retrieved from https://resourcetrade.earth/publications/which-countries-are-most-exposed-to-the-eus-proposed-carbon-tariffs

Over the years 2015 to 2019, Russia was the most important exporter to the EU of goods covered by the CBAM. Russia was followed in importance by China, the UK, and Turkey. From the EU's point of view, imports of iron and steel and aluminium were the most important of the CBAM products, though Russia is also the source of a significant proportion of the sizable amount of fertilizer imported into the EU. **Russia is thus expected to be the country most heavily affected by the CBAM**, though among other exporters to the EU, 80% of the UK's exports of CBAM goods are bound for the EU, while for Serbia and Mozambique, the equivalent figures are 78% and 76% respectively. Other major exporters to the EU for which exports of CBAM goods to the bloc account for more than 10% of sales include China, South Korea, and India. Overall, **Mozambique is expected to be among the countries most heavily impacted by the enforcement of the CBAM since the EU is a major market for its domestic aluminium industry**, and thus the country will need to shoulder higher export costs. However, the EU may offer financial assistance to LDCs struggling to reduce the carbon intensity of their industrial base[19/], and this would then help to take some of the sting out of measures similar to the CBAM if or when these are introduced by other countries (e.g., the US). The impacts on Mozambique may well therefore be somewhat less severe than they initially appear to be.

In the case of Thailand, the EU is not a crucial market for exports of CBAM goods, and these account for only some 5% of sales. Thai exports of CBAM goods to the EU in fact have a similar profile to those of South Korea and India, that is, sales of iron and steel are the most important, followed by aluminium. The impacts of the CBAM on Thai industry will thus be limited, though a full analysis of this is given below.

In addition to the extent to which an industry relies on exports to the EU, other factors that will influence the impacts of the CBAM include the carbon intensity of manufacturing processes, the ability of importers to pass on higher costs to exporters, and the existence of and access to alternative markets for both importers and exporters. However, the costs associated with the CBAM could also be lessened if export-originating countries set a domestic price for carbon and introduce measures to tighten emissions.

Going forward, the move by the EU to introduce a CBAM has encouraged many other countries to consider developing their own equivalents. This is most evident in the US's CCA, though in the UK, the government is also consulting on measures to reduce carbon leakage, including through the introduction of a proposed UK-CBAM and of mandatory product standards (MPS), which will help to create a regulatory environment best suited for the reduction of carbon emissions from industry[20/]. Other countries involved in this process include Canada, which is now officially consulting on its CBAM[21/]. **What is sure to be a growing use of these measures will therefore have potentially significant impacts on global manufacturing and trade, and countries that are home to the least environmentally friendly industries will increasingly feel the pressure to bring these into line with emerging trends to green global production.**

19/ https://allafrica.com/stories/202211140007.html

20/ https://www.gov.uk/government/consultations/addressing-carbon-leakage-risk-to-support-decarbonisation

21/ https://ccsi.columbia.edu/content/event-highlights-carbon-border-adjustments-eu-us-and-beyond and https://www.canada.ca/en/department-finance/programs/consultations/2021/border-carbon-adjustments.html

Macro-level impacts in Thailand

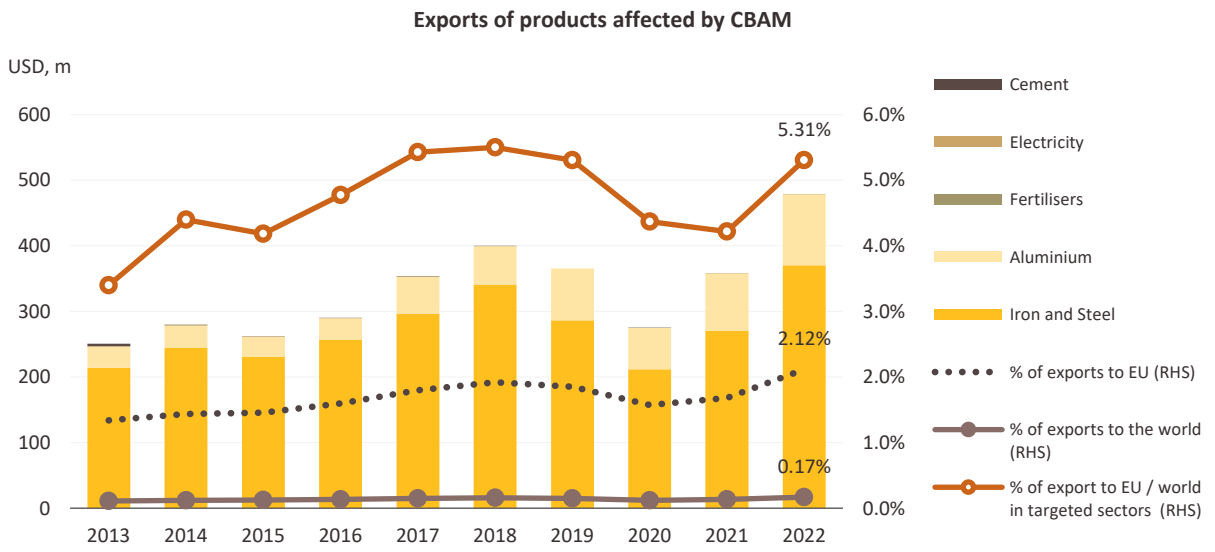
Although the initial enforcement of the CBAM, which begins in October 2023, will be restricted to a transition period during which importers will be required to report carbon emissions but not to purchase CBAM certificates, this will still impose additional costs on Thai manufacturers and exporters due to the required emissions checks and accompanying paperwork. In addition, over the long term, these costs will likely broaden, especially in the event that Thai players are not able to bring their production processes and operations into line with new global standards. The expected impacts of the CBAM on Thai industry are summarized below.

Negative impacts

1) **Higher export costs**: It is highly likely that the charges that the CBAM will put in place for the importing of high-emitting products will be passed on by importers to manufacturers and exporters, and so the mechanism will add to export costs for those selling into markets in the EU. These additional costs will come from both direct sources, that is for charges levied on excess emissions, and indirect sources, that is for measuring and reporting emissions and for paying for associated paperwork. Nevertheless, over the short term, the impacts of this on the Thai manufacturing sector are expected to be only slight because exports to the EU of goods covered by the CBAM regulations account for just 2.1% by value of all Thai exports to the bloc, and just 0.17% of all Thai exports in total. Among the CBAM goods exported to the EU, the most important for Thailand are iron and steel (1.5% of exports to the EU) and aluminium (0.4% of exports), while sales to EU customers of other CBAM goods are either very low or non-existent. Moreover, as a share of all exports from Thailand of CBAM goods, those going to the EU represent just 5.3% of the total, underlining the fact that at least for these product categories, the EU is not a major market. This thus puts Thailand in a very different position to countries such as the UK, Serbia, and Mozambique, which as described above, are much more exposed to the potential negative impacts of the CBAM.

Figure 6:

Exports of CBAM Goods to the EU

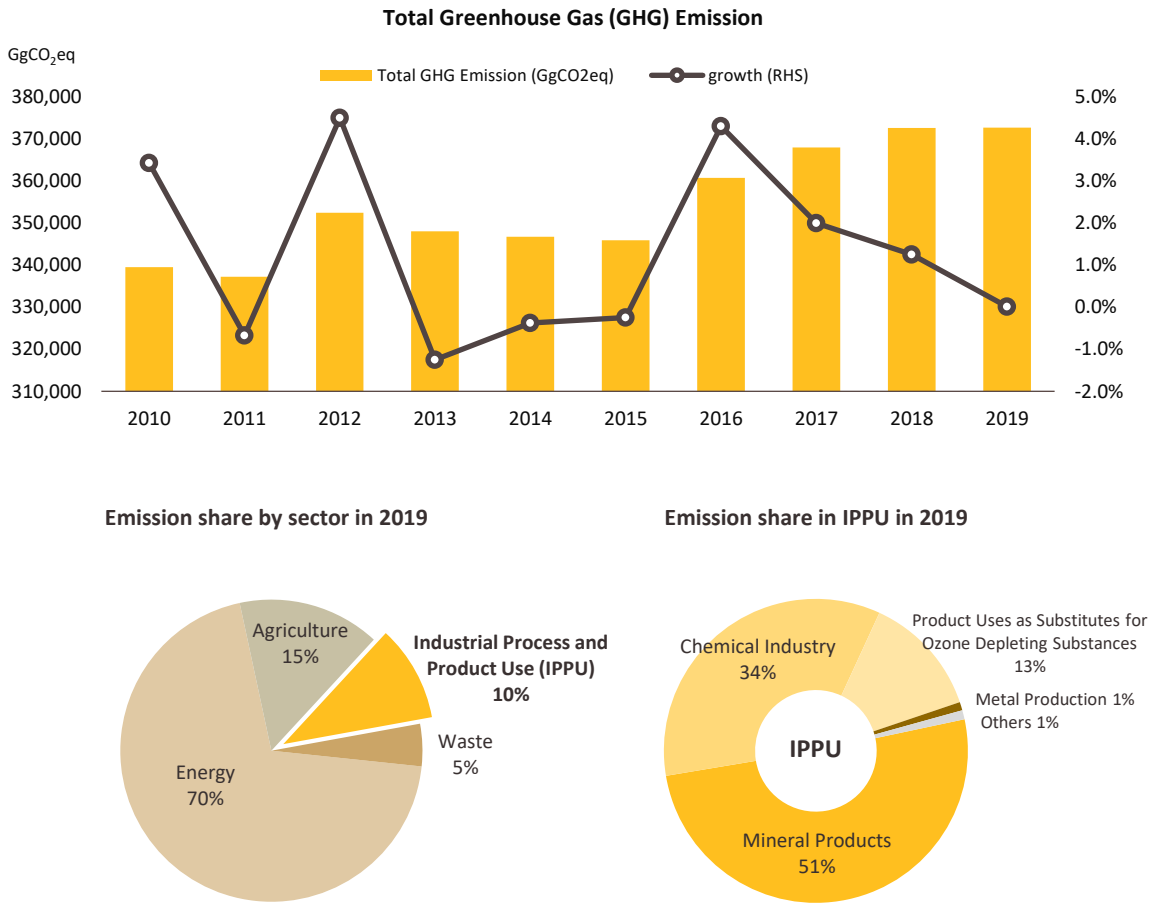


Note: Compiled data following CBAM sector classification in REGULATION (EU) 2023/956 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 10 May 2023 establishing a carbon border adjustment mechanism.
Source: International Trade Centre, Krungsri Research

While it is true that in the short term, the effects of the CBAM on Thai industry will be only slight, it is highly likely that over the longer term, other countries will introduce similar measures, and this will significantly amplify the impacts on Thai manufacturers and exporters. Beyond this, the data show that in Thailand, emissions of greenhouse gases accelerated rapidly over the period 2015-2019, which tends to indicate that if appropriate counter measures are not taken and emissions are not brought down again, CBAM-type policies may add sharply to manufacturers' costs. Indeed, emissions from industrial processes and product use (IPPU) represent around 10% of all Thailand's greenhouse gas emissions, with the most important industrial sources of greenhouse gases being mineral and chemical products. Moreover, it is possible that in the future, the EU's and the US's CBAM measures may be extended to include petrochemicals such as ethylene, which would mean that Thai exporters would potentially have to shoulder substantially higher overheads.

Figure 7:

Thai Greenhouse Gas Emissions



Source: ONEP, Krungsri Research

2) **Reduced competitiveness**: Although exports of CBAM goods to the EU do not represent a huge share of overall exports to the EU from Thailand, the value of these, and especially of iron and steel, aluminium, and downstream products, has been trending strongly upwards over the past decade. This naturally prompts the question of whether Thailand will be able to maintain this momentum or whether the Thai export sector will need to cede market share to its competitors, and especially to countries such as South Korea, China and India, which occupy a similar place to Thailand in the market but that may be better positioned to meet the challenges presented by the introduction of the CBAM.

Positive impacts

Despite the slightly gloomy picture painted above, the rollout of the CBAM does not mean that the future is uniformly negative and threatening, and indeed, these changes may well represent an opportunity for Thai industry and business to profit from the accelerating shift to net zero policies. The potential positive impacts of the EU's CBAM take two main forms, as described below.

1) **Accelerating the transition to a low-carbon economy**: Thailand has adopted the target of reaching carbon neutrality by 2050 and net zero emissions by 2065[22/]. However, the latter is 15 years behind the EU's target of hitting net zero by 2050 and so meeting the demands imposed by the CBAM will push Thailand to speed up its efforts to decarbonize, if it is to keep pace with its international competitors. As part of this, players at all stages of the manufacturing supply chains of goods affected by the CBAM will need to overhaul their operations as they look to cut the direct or indirect embedded emissions of greenhouse gases.

2) **Opening up new opportunities for trade and investment in green industries**: As stated above, environmental concerns are having an increasing influence on global trade, and indeed, the move to impose tighter environmental standards means that at times, the latter operate as non-tariff barriers to trade (NTBs). Nevertheless, if Thai players are quicker to adapt to this changing environment than competitors offering similar products on export markets, they will be well placed to expand their market share in both the EU and in other countries as and when they introduce their own CBAMs or other similar environmental measures. Beyond this, the CBAM regulations impose on exporters the need to have their greenhouse gas emissions measured and verified by approved auditors, and this will help to open the door to new business opportunities. These will include verifying emissions, offering sustainability consulting services, and facilitating reductions in the release of greenhouse gases. This might also include developing carbon capture and storage or carbon recycling technologies, as well as other green innovations.

22/ Carbon neutrality refers to the point when the quantity of greenhouse gas emissions is equal to the quantity of greenhouse gas being removed from the atmosphere. This may be achieved through three means: (i) emissions reductions, for example by reducing consumption of fossil fuels; (ii) the removal of greenhouse gases from the atmosphere, for example by reforesting or by making use of carbon capture and storage facilities; and (iii) offsets, for example through carbon credits. This differs from net zero emissions in that this occurs when there is a balance between the quantity of greenhouse gases released into and reclaimed from the atmosphere. This thus excludes the use of offsets or carbon credits in the accounting process. Net zero also extends to include other greenhouse gases in addition to carbon dioxide (e.g., methane, nitrous oxide), and so reaching net zero is more challenging than reaching carbon neutrality (Thanisa Thawitchasri (2022). "Carbon neutrality and net zero emissions: What's the difference and why is this important?" Retrieved from https://www.pier.or.th/blog/2022/0301/)

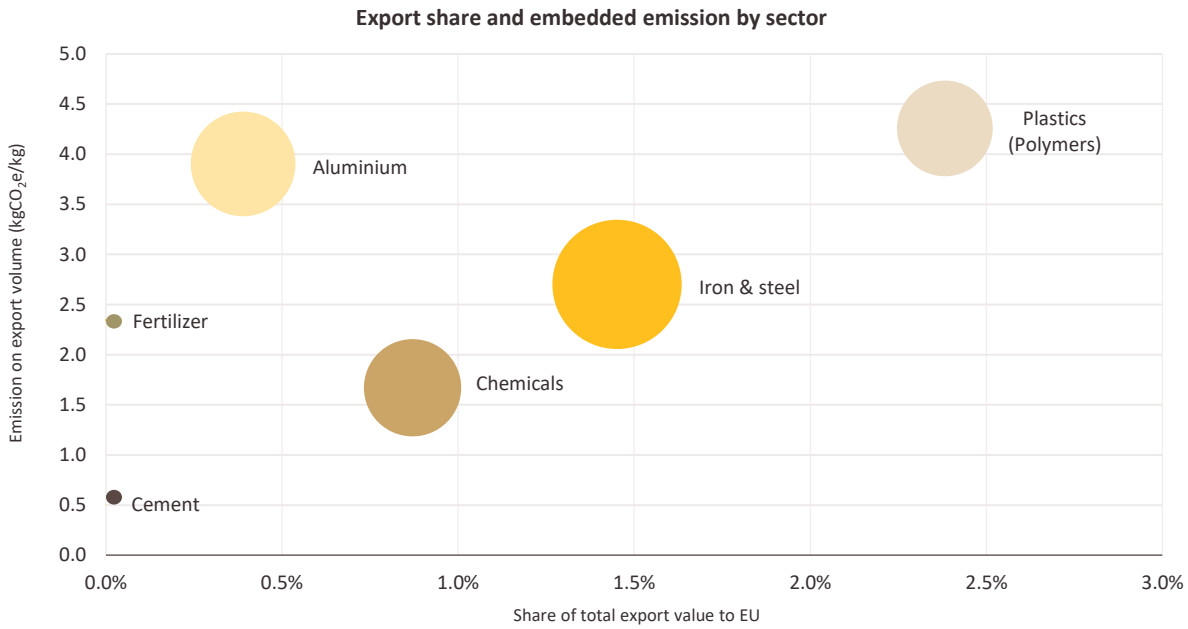
Industry-level impacts in Thailand

Clearly, the impacts of the CBAM will differ across the economy depending on a broad set of variables including the size of an industry's export sector, its reliance on exports to the EU, the structure of its manufacturing supply chains, and its carbon intensity and the quantity of greenhouse gas emissions for which it is responsible. In the following, a comparative analysis of these impacts is therefore given for industries targeted by the CBAM. It is hoped that this will present a clearer picture of how the introduction of the CBAM will affect these various industries.

The introduction of the **CBAM will have the most serious consequences for the iron and steel industry (including downstream steel products)**. This will be because compared to other CBAM goods, at 6.3% of sales, Thai iron and steel exports are more heavily dependent on markets in the EU. In addition, the industry is also very carbon intensive, and after plastics and aluminium production, it has the highest per unit emissions of greenhouse gases. **Next in line will be the aluminium industry**, which will be the second most seriously affected part of the Thai economy. Although the EU is a less important market for aluminium producers than it is for exporters of iron and steel goods, the industry is more carbon intensive and so the marginal costs associated with imports are likely to be higher. However, examination of the forward and backward linkage indices shows that the aluminium industry is less heavily integrated with other parts of the economy than is the iron and steel industry, which indicates that for the aluminium manufacturers, enforcing the CBAM will have fewer impacts on either upstream or downstream supply chains. Within Thailand, **other industries targeted by the CBAM will be largely unaffected** by its introduction because either exports to the EU are low and represent only a small proportion of overall sales (as is the case for cement and fertilizer) or there are no exports to the EU at all (as is the case for electricity and hydrogen production).

Figure 8:

Exports and Greenhouse Gas Emissions of CBAM Goods



Note: Bubble size represents exports to the EU as a percentage of exports to the World
Source: International Trade Centre, MOC, TGO, Krungsri Research

Despite the relatively mild impacts that are forecast, worries persist that in the future, any widening of the scope of the CBAM may have more far-reaching consequences for Thai industry, especially if the rules on imports are expanded to include chemicals and plastics. This was in fact suggested in discussions in the European Parliament but the proposal was later dropped. **The inclusion of plastic products and polymers in the CBAM measures would be particularly troubling for Thailand since compared to iron and steel, exports of these to the EU are more substantial, and accounts for a larger proportion of total sales to the bloc. These goods are also strongly associated with a high level of direct and indirect greenhouse gas emissions**, and so the industry is keeping a close eye on developments.

Table 2:

Sectoral impacts of the CBAM

	Current EU-CBAM				Potential EU-CBAM / US-CBAM			
	Iron & steel	Aluminum	Cement	Fertilizer	Chemicals	Plastics (Polymer)	Pulp & paper	Glass
Export share of total export value to EU (%)	1.45%	0.39%	0.00%	0.00%	0.87%	2.38%	0.27%	0.22%
Export to EU / export to the world (%)	6.27%	4.12%	0.00%	0.00%	3.56%	3.45%	2.95%	5.75%
Export volume in 2022 (ton)	139,417	21,023	0.05	8.87	177,602	209,392	40,313	38,526
Numbers of entrepreneurs (firms)	1,474	284	74	1,028	870	5,628	1,842	245
Emission on exports (tCO_2e)[23/]	2.70	3.90	0.51	2.34	1.67	4.26	2.10	1.51
Additional cost (THB/ton)[24/]	9,158.23	13,226.30	1,718.50	7,946.51	5,658.78	14,427.27	7,115.94	5,116.12
Downstream risk – forward linkage index[25/]	4.90	3.21	1.00	3.05	7.12	4.52	2.33	1.00
Upstream risk – backward linkage index[26/]	1.53	1.01	0.91	1.17	1.03	1.12	1.07	1.11
Construction	●	●	●		●	●	●	●
Automotive	●	●			●	●	●	●
Electronics	●	●			●	●	●	●
Agriculture and Food				●	●	●	●	
Mining and Quarrying	●	●	●		●	●	●	●

Note: The electricity and hydrogen sectors are absent as Thailand does not export these products to the EU, ● reflects linkage between CBAM sectors and other key sectors
Source: ITC, MOC, TGO, DBD, NESDC, European Energy Exchange, BCG, Krungsri Research

Details on the industries expected to be most heavily affected by the CBAM, the likely consequences of this, and ways in which they might reduce their greenhouse gas emissions are detailed below.

23/ Calculated from exports (tonnes) x emission factor (tCO2e/tonne) for each product, and then as a weighted average for the industry as a whole.

24/ Calculated from emissions (tCO_2e) x CBAM price (weekly average of ETS auction = EUR 91.56/tCO_2e as of April 23, source: https://www.eex.com/en/market-data/environmentals/eu-ets-auctions) x exchange rate calculated at an average of THB 37: EUR 1.

25/ If the index has a high value, this indicates that this segment is heavily integrated with downstream production, and so any shock (e.g., from higher costs) is likely to have major impacts on downstream industries.

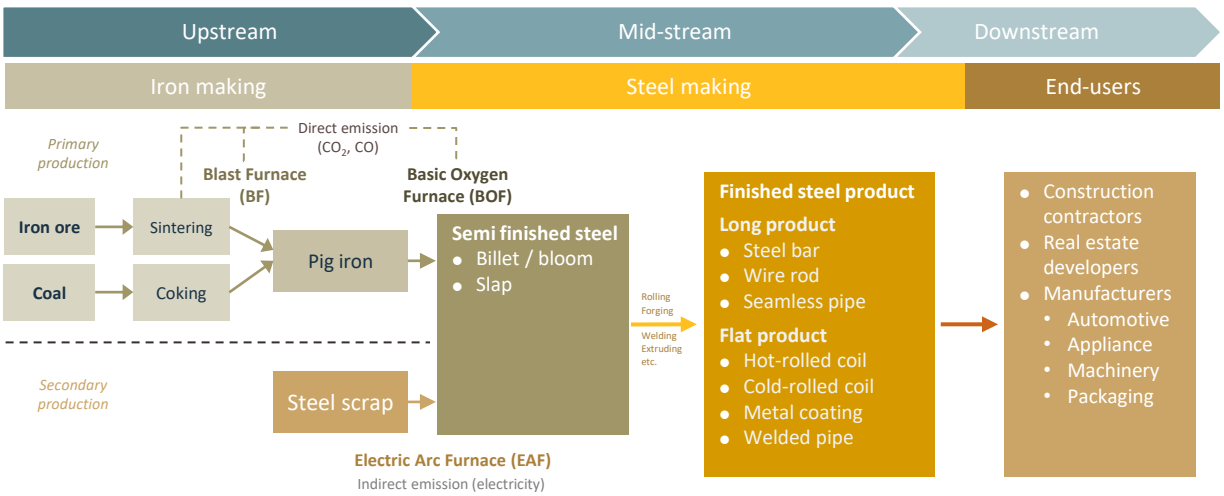
26/ If the index has a high value, this indicates that this segment is heavily integrated with upstream production, and so any shock (e.g., from a decline in exports) is likely to have major impacts on upstream industries.

Iron and steel

The iron and steel industry is a major consumer of energy, with upstream production of pig iron or iron inputs generally relying on one of two methods. (i) Primary production involves the processing and melting of iron ore in blast furnaces, which is then transformed into pig iron in basic oxygen furnaces. Each of these stages entails the release of significant quantities of carbon, and typically, primary processing of iron ore is responsible for the release of 2.3 tonnes of carbon for every 1 tonne of iron that is produced[27]. However, this type of processing is not carried out in Thailand. (ii) Secondary production involves the smelting of scrap and the direct rolling of steel in electric arc furnaces, which also leads to the indirect release of a large quantity of greenhouse gases. Midstream parts of the iron industry convert iron into steel, outputting semi-finished steel products, which then passes through additional downstream processes to be turned into finished products such as sheet steel or steel bar.

Figure 9:

The Release of Greenhouse Gases across the Iron and Steel Supply Chain



Source: Bellona[28], EIA, Krungsri Research

In addition to raw iron and steel, the goods covered by the CBAM include products made from these (e.g., nails, nuts and bolts, containers, packaging, etc.) and for Thai exporters, these comprise the most important category of goods sold into the EU; in 2022, 69,000 tonnes of these were shipped from Thailand to buyers in Europe. These were followed in importance by rolled stainless steel products, of which 26,000 tonnes were sold to the bloc. In terms of the greenhouse gas emissions connected to lifecycle production and use (i.e., a product's emission factor), galvanized steel (used to prevent rusting) is the worst offender, and so it is evident that a high proportion of the steel products exported to the EU from Thailand carry with them heavy per-unit carbon costs.

Table 3:

Emission Factors for Iron and Steel Products

Product	Emission Factor ($kgCO_2e/kg$)
Sinter iron	0.3493
Cast iron	1.6382
Pig iron	1.5143
Galvanized steel sheet	2.7073

Source: TGO

27/ Cosbey, Aaron and Mehling, Michael and Marcu, Andrei. (2021). "Border Carbon Adjustments in the EU: Sectoral Deep Dive". Retrieved from SSRN: https://ssrn.com/abstract=3817779 or http://dx.doi.org/10.2139/ssrn.3817779

28/ https://bellona.org/news/fossil-fuels/2019-03-is-steel-ste

However, efforts are underway to shift businesses towards green steelmaking and thus to reduce the greenhouse gas emissions of the iron and steel industry. One example of this is the development of hydrogen-based steelmaking, which should be commercially feasible by 2030[29/], and indeed the Chief Executive Officer and founder of Singapore's Meranti Steel, a driving force in the move to sustainable steel production, estimates that global demand for green steel will reach 41 million tonnes by 2025 and 235 million tonnes by 2040. Likewise, demand for low-polluting products is forecast to jump from 1% of total demand for flat steel products to 26%[30/]. This type of transformation of the market may be possible over the long term, but in the short term, manufacturers will need to cut direct emissions of greenhouse gases from primary production processes through the use of carbon capture and storage technologies (CCS), while problems with excessive indirect emissions can be addressed through increased energy efficiency and the switch to renewable sources of energy.

Aluminium

In its initial production, aluminium is the most energy hungry of all non-ferrous metals due to the large quantities of electricity that this process consumes (this is thus an indirect source of greenhouse gases). As with iron, there are two methods for manufacturing aluminium. (i) Aluminium can be produced from bauxite, which is smelted to produce alumina powder, and an electrical process is then used to transform this into aluminium. However, because Thailand has no bauxite mines, this process is not employed domestically. (ii) aluminium may also be made from scrap, and because this uses only 5% of the electricity of producing aluminium from bauxite[31/], this is a popular route to take. The emission factor for the second technique is thus significantly lower than for the first, and so producing aluminium from scrap will have an important role to play in reducing industry emissions.

Table 4:

Emission Factors for Aluminium Goods

Product	Emission Factor ($kgCO_2e/kg$)
Aluminium Primary	12.2359
Aluminium Secondary from new scrap	0.4329
Aluminium Secondary from old scrap	1.4682
Aluminium sheet, semi-finished sheet product	3.2231
Aluminium alloy (AlMg3)	6.3369

Source: TGO

In 2022, the most important category of aluminium exports from Thailand to the EU was aluminium foil, a midstream product for which sales totaled 9,900 tonnes. This was followed in importance by 'other' downstream aluminium products (2,400 tonnes). Nevertheless, when the CBAM is first enforced, although it will apply to downstream aluminium goods, indirect emissions will not be counted when calculating the total embedded emissions of aluminium, iron, and steel products. Over the short term, costs will therefore not rise substantially.

Over the longer term, a transition to the production of 'green aluminium' will play an important part in reducing the industry's release of greenhouse gases. This is because green aluminium is produced from alternative energy (often from hydroelectric power) and so the manufacturing process typically produces less than 4 tonnes of carbon for every 1 tonne of aluminium, or less than a quarter of the average 16.6 tonnes of carbon released per tonne of aluminium when standard production processes are used. Moreover, output is rising, and this is expected to jump by 10% in 2023 alone. Among other beneficiaries of this will be the auto industry since aluminium is widely used in the manufacture of auto parts (e.g., for the production of bumpers) and so using green aluminium will help to reduce the carbon intensity of downstream goods such as this[32/].

29/ https://www.toolmakers.co/green-steel-การผลิตเครื่องมือและ/

30/ https://news.isit.or.th:8080/isit/2023/04/10/ความต้องการ-green-steel-เพิ่มขึ้น/

31/ Full report on the status of the non-ferrous metals and aluminium industry, carried out under the project for the development of an in-depth data analysis center for the metals industry, 2014.

32/ https://www.reuters.com/business/autos-transportation/bumper-green-aluminium-output-is-good-news-carmakers-climate-2022-12-17/

Plastics

Although at present, plastic products have not been included within the scope of the CBAM rules, this was in fact proposed by the European Parliament, and because plastics are both the most important of the potential CBAM goods exported from Thailand to Europe and the most carbon intensive, any move to expand the mechanism to cover these would have substantial consequences for Thai industry. The impacts of such a move would be amplified by the fact that the plastic industry is tightly linked to many other parts of the economy, including the manufacture of packaging, construction materials, automobiles, electronics, electrical goods, and medical devices. Some of the plastics that are most widely used include polyethylene (PE)[33/], which is used in the manufacture of products such as bags, bottles, buckets, and film, and polyvinyl chloride (PVC), which is used in construction and domestic settings (e.g., for water pipes and connections, and cabling).

Plastics production begins with the refining of crude oil or the distillation of natural gas, and the outcome of these processes is then separated into basic chemicals including ethylene, propylene, styrene and phenol. These are used as precursors in the production of plastic resins. Following this, the plastic products themselves are manufactured by melting plastic pellets and then using processes such as blowing, injection molding, pressing, rolling, and so on to form the plastic into the desired shape. Almost all of the greenhouse gases associated with the production of plastics is released as carbon dioxide that comes from the fossil fuel-derived power used to isolate the basic chemicals. Embodied emissions are thus mostly direct, though plastic production also consumes a significant amount of electricity and this is therefore a sizeable additional source of indirect emissions.

A consideration of the emission factor of different plastics shows that among those most widely used in Thailand, polycarbonates used in the auto and medical devices industries and high-density polyethylene (HDPE) have the highest per unit greenhouse gas emissions. In 2022, a major share of Thai exports to the EU of plastics came from sales of high- and low-density polyethylene (HDPE and LDPE) and of plastic bags and packaging also manufactured from polyethylene. Thai manufacturers and exporters are thus exposed to a significant risk that in the future, the high carbon emissions that these products are responsible for will translate into higher costs.

Table 5:

Emission Factors for Plastic Products

Product	Emission Factor ($kgCO_2e/kg$)
High Density Polyethylene (HDPE)	**6.7071**
Low Density Polyethylene (LDPE)	2.6258
Polypropylene (PP)	1.8814
Ploy vinyl Chloride (PVC)	2.1331
Polyethylene terephthalate (PET)	2.8854
Polycarbonate	**7.7760**

Source: TGO

A number of different routes may be taken to reduce emissions from the production of plastics, including the use of catalysts to cut the amount of energy used in the manufacturing process, and taking advantage of carbon capture, utilization, and storage (CCUS) technologies. In addition, it will be possible to cut carbon emissions by substituting regular plastics with alternatives, including recycled plastics manufactured from waste products and bioplastics made from natural products. The latter includes renewable resources and agricultural products (e.g., cellulose fiber, collagen, flour, and bean proteins), and because bioplastics are biodegradable, they are regarded as more environmentally friendly than regular oil-based plastics. These also offer the advantage of being able to be used in roles as varied as food packaging and medical applications (e.g., as artificial skin)[34/].

33/ High-density polyethylene (HDPE) is not transparent, whereas low-density polyethylene (LDPE) is.

34/ https://www.bio-eco.co.th/bioplastics/ and https://packingdd.com/blogs/news/พลาสติกชีวภาพ-คืออะไร-ทำไมถึงมีความสำคัญต่อนวัตกรรม

Exports from Thailand to the EU of other goods covered by the CBAM regulations (i.e., cement and fertilizer) are very limited and so the associated greenhouse gas emissions are likewise negligible. In the case of cement, emissions come mainly from heating limestone to produce clinker and so emission reduction efforts are focused on replacing clinker and promoting the use of hydraulic cement in place of Portland cement. For fertilizers, greenhouse gases are produced mainly during the splitting of hydrogen from methane, which is then combined with atmospheric nitrogen to produce ammonia (i.e., nitrogen fertilizer). However, Thailand is an importer of fertilizer and with only minimal exports, the environmental consequences of Thai production are very limited.

Table 6 below summarizes details on the primary activities of industries targeted by the CBAM, how these are responsible for greenhouse gas emissions, and how these emissions may be reduced.

Table 6:

Reducing Greenhouse Gases from CBAM Industries

	Activity	Source of GHGs	Possibilities for Reducing GHGs
Iron and steel 	Primary production from iron ore (not found in Thailand) uses more energy than secondary production from scrap, though the latter is still electricity intensive. Emissions of GHGs are thus mostly indirect. Thailand's most important exports to the EU are of galvanized steel, the production of which is very energy intensive.	• On-site burning of fossil fuels (e.g., natural gas, LPG, bunker fuel, diesel, etc.) • Burning of fossil fuels for transport. • The release of carbon from flux, which contains a large quantity of carbonate or graphite. • Carbon dioxide used in the production processes. • Electricity used in the production of steel.	• Growth in green steelmaking, e.g., using hydrogen in the production process. • Using renewables in the production process. • Improving production efficiencies and using CCS technologies to capture carbon from the primary production processes.
Aluminium 	Electricity-intensive production means that indirect GHG emissions are greater than direct emissions. Thai businesses engage in only secondary production from scrap, and exports to the EU are mostly of midstream (e.g., foil) and downstream products.	• On-site burning of fossil fuels (e.g., natural gas, LPG, bunker fuel, diesel, etc.) • Burning of fossil fuels for transport. • Carbon dioxide used in the production process. • Electricity used in the production process.	• Using hydroelectric power or recycled inputs to produce green aluminium. • Using new technology to cut GHG emissions and produce oxygen as a byproduct (i.e., using inert anode smelting technology[35/]).
Cement 	Cement production is energy intensive and is responsible for the release of large amounts of GHGs. This is because cement is made by heating limestone to produce lime, which then goes through additional chemical processes resulting in clinker. In addition, there are few alternatives to cement since materials such as wood, steel, and glass have very different qualities.	• On-site burning of fossil fuels (e.g., natural gas, LPG, bunker fuel, diesel, alternative fuels, cracker bottom, etc.) • Burning of fossil fuels for transport. • The calcination reaction by which limestone is converted into lime. • Electricity used in the production process.	• Using alternatives to clinker, e.g., calcium-based products, fly ash, pozzolans, or slag, or reducing the proportion of clinker, i.e., using hydraulic cement in place of Portland cement. Regulations on the production of hydraulic cement are covered under TIS 2594-2556. • Utilizing carbon capture and storage technologies.
Fertilizer 	Thailand is heavily reliant on imports of fertilizer since domestic production is limited (this includes production of ammonia and ammonia sulphate) and so exports to the EU are minimal. However, fertilizer production involves the release of large quantities of GHGs, and of the three major ingredients in fertilizer (nitrogen, phosphorus and potassium), nitrogen production is the most GHG intensive.	• Emissions come principally from separating hydrogen atoms from methane using high-pressure steam (methane steam reforming) that then combines with atmospheric nitrogen to form ammonia. Emissions come both from the energy used in the process and the CO2 produced as a byproduct. • GHGs are produced from urea, lime, and dolomite, and from soil sources.	• The capture and storage of carbon that is released when hydrogen is split from carbon atoms to react with nitrogen to create ammonia fertilizer, and switching to renewable-energy powered electrolysis.
Plastics (polymers) 	The plastics industry is an important source of exports to the EU, and this represents potentially the largest share of CBAM goods. Plastics are also the most carbon intensive of these. The plastics industry is strongly linked to other parts of the economy, including the packaging industry, construction, auto assembly, and the production of electronics, electrical appliances, and medical devices. In Thailand, the most widely used plastics are polyethylene (PE) and polyvinylchloride(PVC).	• CO_2 accounts for almost all GHG emissions from the production of plastic, most of which comes from the consumption of fossil fuels during the production of basic chemicals (e.g., ethylene, propylene, styrene, and phenol). GHG emissions are thus mostly direct. • Electricity used in the production process.	• Use of catalysts may reduce the amount of energy consumed in production processes. • Carbon capture, use and storage (CCUS). • Recycling plastics from waste. • Using bioplastics made from natural or renewable sources (i.e., agricultural sources such as corn, sugarcane, cassava and cellulose).

Source: TGO, Cosbey et al. (2021), OIE, Krungsri Research

35/ https://packaging.oie.go.th/new/admin_control_new/html-demo/file_technology/8405319726.pdf

How prepared is Thailand for the rapidly approaching introduction of the CBAM?

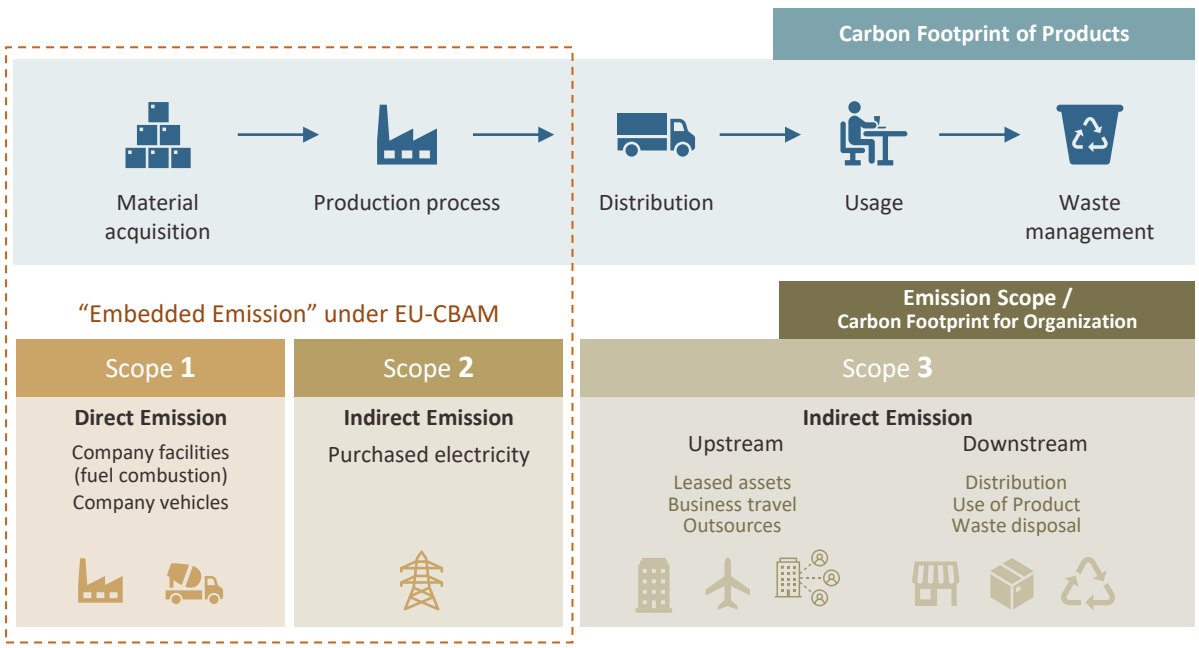
Having looked at the likely impacts of the CBAM, it is natural to then ask **'How prepared is Thai industry for this?'**, though any answer to this question must take into account not just the impacts of the EU's CBAM but also the likely future introduction of similar mechanisms by other countries. Consideration of the structure of the CBAM shows that the costs that will arise from it will be strongly influenced by how players respond to three particular challenges.

Challenge 1: Measuring carbon emissions

The most important variable influencing the costs arising from the introduction of the CBAM is the extent of embedded greenhouse gas emissions associated with particular products because this will determine the cost of CBAM certificates. Thailand has already begun work on the development of systems for the measurement of greenhouse gas emissions, and these may now be adapted for use in measuring CBAM embedded emissions. This includes the **'carbon footprint of product' (CFP) mark**, which has been designed to reflect an assessment of a product's complete lifecycle emissions, from sourcing inputs and raw materials, through production, distribution and use, to end of lifecycle disposal. This will then help to communicate to consumers that particular products are (or are not) environmentally friendly. Manufacturers are able to request certification from the Thailand Greenhouse Gas Management Organization (TGO), though producers are responsible for calculating the carbon footprint of products, which they may do themselves or they may contract out to a consultant. These assessments are then subject to verification by certified individuals or organizations and, following this, confirmation and certification by the TGO[36/].

Figure 10:

Assessing CFPs and Embedded Emissions



Source: TGO, Circularise[37/], Krungsri Research

36/ For more details, please see http://thaicarbonlabel.tgo.or.th/index.php?lang=TH&mod=Y0hKdlpIVmpkSE5mY0hKdlkyVnpjdz09
37/ https://www.circularise.com/blogs/scope-1-2-3-emissions-explained

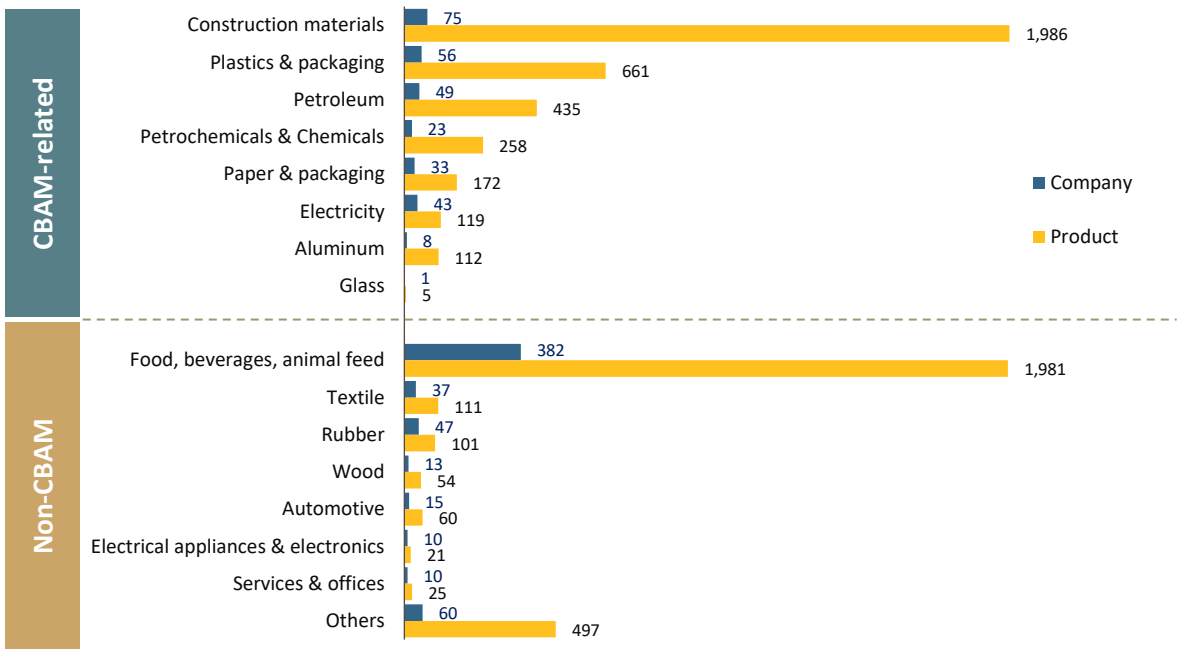
It is important at this stage to be clear about **how far the CFP and the CBAM's definitions of embedded emissions overlap**, and comparing how these two procedures assess the greenhouse gas emissions associated with particular products, clear differences emerge. Thus, CBAM embedded emissions measure only those direct and indirect (i.e., from electricity use) emissions that result from the production process itself[38/], and so the total lifecycle assessment of greenhouse gas emissions required under the CFP is much wider than the CBAM assessment of embedded emissions.

The CFP doubtless marks a positive start for Thailand since in addition to preparing the way for measuring and verifying carbon emissions, the CFP has also been included in the list of recognized marks in the Thai Rating of Energy and Environmental Sustainability (TREES), a green building assessment, and in the Thai Green Card list, which is used to measure products' environmental friendliness and which is gaining popularity among consumers. However, the costs of measuring and verifying emissions and then of registering with the CFP are significant[39/], and worse, registration is valid for only two years, at which point the verification and registration process needs to be repeated. This may be one reason why registrations are at present somewhat limited.

As of 13 June, 2023, a total of 7,122 products produced by 820 companies had been registered for the CFP mark, though of this total, only 2,872 products from 268 companies still had an active registration. With 1,986 products, construction materials (including steel and cement) were the most heavily represented in the historical total, followed by food and drink products. Interestingly, **comparing on the one hand goods that are currently or that are likely to be covered by the CBAM regulations and, on the other those that are outside the scope of the regulations, the former are more heavily represented in CFP registrations than the latter. This is especially the case for construction materials, plastics, chemicals, petroleum products, and petrochemicals.** Nevertheless, as a share of all businesses active in particular industries, those registered with the CFP represent only a very small fraction of the total. At 4.8%, this share is highest for producers of construction materials, falling to 2.7% for producers of aluminium, and around just 1.0% for manufacturers of plastics. It is therefore reasonable to conclude that many manufacturers are not yet prepared for official testing and verification of their greenhouse gas emissions.

Figure 11:

Companies and Products Registered for the CFP Mark



Source: TGO, Krungsri Research

38/ "Embedded emissions mean direct emissions released during the production of goods and indirect emissions from the production of electricity that is consumed during the production processes" (REGULATION (EU) 2023/956 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL)

39/ Registering one product with the CFP costs THB 8,500, with this rising to THB 110,000 for those registering 101 or more products. (http://thaicarbonlabel.tgo.or.th/admin/uploadfiles/files/ts_7e7d2db8ca.pdf)

In addition to differences between how the Thai and EU systems measure emissions, an additional issue involves the **standards, systems and personnel involved in verification processes**. The EU has specified that independent auditors verifying greenhouse gas emissions must be registered either with the EU ETS or with the national accreditation bodies of individual member states**. The Thailand Greenhouse Gas Management Organization (TGO) and the Thai Industrial Standards Institute (TSI) are jointly developing Thailand's measurement and verification systems in line with the standards established by the EU**, and it is hoped that this will result in the creation of a digital platform that can be used to calculate embedded emissions as defined by the CBAM. Alongside this, personnel with expertise in measuring and verifying emissions are also being trained in how to follow these standards, and in the near future, there is likely to be significant demand for these skills. The development of these native Thai systems for measurement, reporting and verification will help to reduce the costs faced by exporters, with the additional advantage that rather than divert funds to overseas organizations, any such expenditure will remain within Thai borders.

Challenge 2: Using domestic carbon pricing to reduce the costs connected with the CBAM

The CBAM regulations specify that if an importer can show that the cost of goods brought into the EU already includes payments relating to the release of carbon during the production process, these can be set against the fee for the CBAM certificate that importers need to buy. Thus, if the originating country has introduced an effective carbon pricing mechanism that operates in line with the EU principles, this can help to cut costs arising from the introduction of the CBAM.

At present, Thailand's market for carbon credits takes the form of the **Thailand Voluntary Emission Reduction Program (or T-VER)**, though this remains somewhat small. Carbon prices thus averaged just THB 108/tonne of CO_2 in 2022, and relative to the total approved issuance of carbon credits, sales are still low. This is partly a result of the fact that participation in the market remains voluntary and so the incentives encouraging businesses to participate are weak. In addition, understanding of how carbon markets work and what benefits they offer is not yet widespread, while the costs of registering with the T-VER and of requesting carbon credits, as well as of measuring, assessing, and verifying emissions can be substantial[40/]. Nevertheless, given the need to reach carbon neutrality, **the Thai market for carbon credits has potential for rapid growth on both its demand and supply sides**, and when the market has improved in terms of both quantity and quality, this may help to reduce the costs faced by Thai exporters when purchasing CBAM certificates. In light of these clear potential benefits, agencies involved in the development of these areas should accelerate negotiations with the EU to bring the T-VER program, or other domestic carbon pricing mechanisms in the future, into line with the requirements imposed by the CBAM.

40/ For further details, please see https://ghgreduction.tgo.or.th/th/tver-step/tver-fee.html

Box 1 Thailand's voluntary carbon pricing mechanism

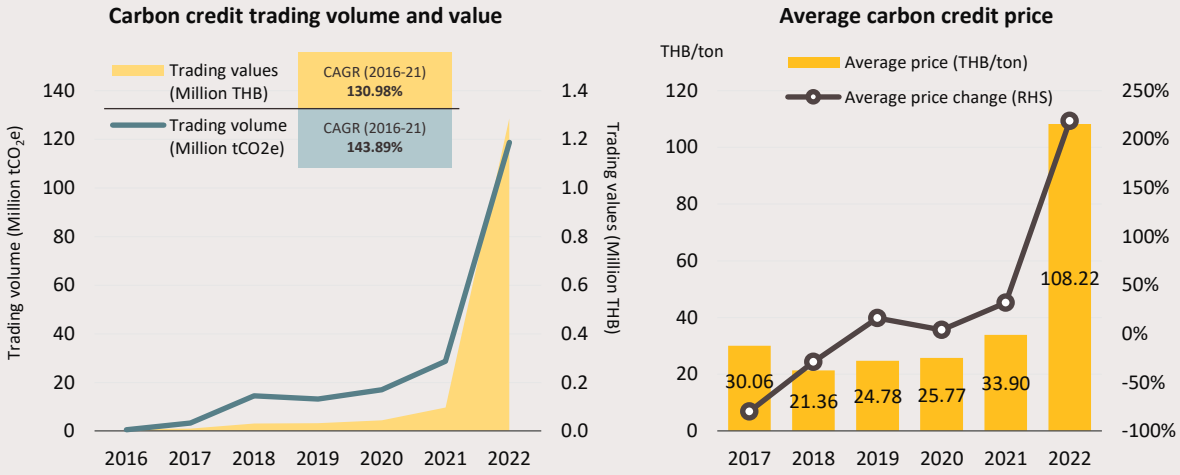
Carbon pricing attempts to set a price for the release of carbon, which may be achieved through policies such as carbon taxes or by establishing markets for the buying and selling of emissions. For example: (i) emission trading schemes (ETSs), which may be set up by governments to establish a ceiling for the maximum permissible total emissions of greenhouse gases and then provide for the trading in permits to release carbon (so-called 'cap and trade' systems)[41/]; or (ii) carbon credit schemes, which are voluntary market mechanisms that regulate reductions in or sequestration of greenhouse emissions through certified processes[42/].

In the Thai context, efforts to develop carbon pricing mechanisms are focused on the **Thailand Voluntary Emission Reduction Program (T-VER)**, which was established in 2014 and is run by the TGO. As of 15 June, 2023, it is estimated that the T-VER has cut emissions of greenhouse gases by 15.8 million tonnes of CO_2 equivalent ($MtCO_2e$) thanks to offsets against 295 projects, most of which involve the development of sources of alternative energy. Unfortunately, these reductions represent just 5.6% of net emissions[43/] and if progress continues at this pace, the goal of carbon neutrality will remain a distant prospect.

At present, trading in carbon credits[44/] represents only a small proportion of the cuts in carbon emissions or increases in sequestration, and so in 2022, while 4.7 $MtCO_2e$ of carbon credits were awarded, just some 1.2 $MtCO_2e$ (or around a quarter) was traded. However, both the volume and value of carbon credits traded within the T-VER are increasing rapidly relative to initial levels, with these up by an average of respectively 144% and 131% annually over the years 2016-2022.

Figure 12:

The T-VER Market for Carbon Credits



Source: TGO, Krungsri Research

41/ Thailand's voluntary pilot project for trading in carbon permits is run by the TGO. For more details see http://carbonmarket.tgo.or.th/index.php?lang=TH&mod=Y29uY2VwdF92ZXRz

42/ Carbon credits or reductions in greenhouse gas emissions below the business-as-usual case that can be traded in the market need to be certified, for example by the Clean Development Mechanism (CDM), the Gold Standard (GS), the Verified Carbon Standard (VCS), or the Thailand Voluntary Emission Reduction Program (T-VER).

43/ As of 2019, net emissions of greenhouse gases were equal to 280.7 $MtCO_2e$ (https://climate.onep.go.th/th/topic/database/ghg-inventory/#1629282850097-8b14e636-4ba4)

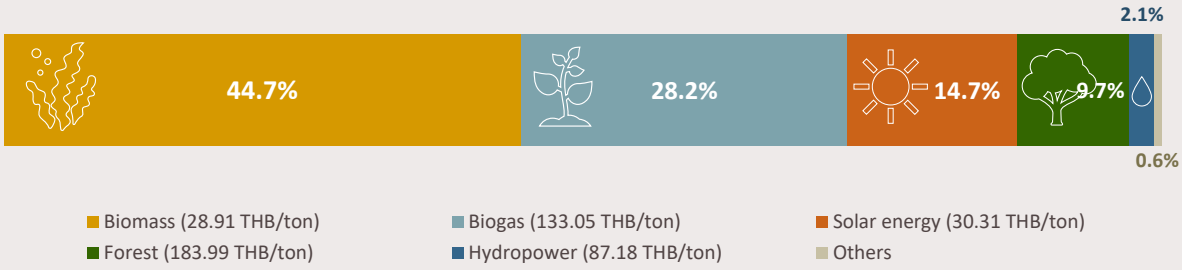
44/ This can be done in two ways: (i) directly made agreements between buyers and sellers to trade that do not occur on the open market (i.e., over-the-counter, or OTC sales), which is the main way of carrying out T-VER trades; and (ii) through a trading platform, which first became available in the 2023 financial year.

Box 1 Thailand's voluntary carbon pricing mechanism (continued)

Likewise, prices for carbon credits jumped to an average of THB 108/tCO_2 in 2022, more than three-times higher than a year earlier. The most valuable credits came from projects connected to reforestation, which realized an average price of THB 184/tCO_2 and a maximum of THB 2,000/tCO_2. The greatest volume of trades in carbon credits were for renewable energy projects (e.g., for biomass, biogas, and solar power), but apart from biomass projects, the sale price of these other carbon credits remained low.

Figure 13:

Volume and Value of Carbon Credit Sales, by Project Type



Source: TGO, Krungsri Research

Nevertheless, the Thai carbon credit market has significant potential for future growth. For example, the Thailand Carbon Neutral Network (TCNN)[45/] now has 431 member organizations, and stakeholders are committed to reaching carbon neutrality. Thus, one goal of the TCNN is to expand and promote Thailand's carbon credit market. In addition, the Thai Renewable Energy Association (also called RE100 Thailand Club[46/]) gathers together energy providers, energy users, and manufacturers with the goal of accelerating the transition to 100% use of renewable energy[47/].

45/ http://tcnn.tgo.or.th/index.php?lang=TH&mod=YUc5dFpRPT0

46/ https://re100th.org/#

47/ As part of the drive to meet the RE100 goals, companies have been given the opportunity to apply for a 'Renewable Energy Certificate' (REC), which recognizes the right of an organization to produce and use renewable energy. This is issued only by approved organizations. Like carbon credits, RECs can be traded, though the goal of RECs is to reduce the release of scope 2 greenhouse gases, whereas carbon credits aim to cut emissions of scope 1, 2 and 3 gases (the Electricity Generating Authority of Thailand and the Thailand Greenhouse Gas Management Organization. See https://egc.egat.co.th/rec-คืออะไร/)

Challenge 3: Transitioning to a low-carbon economy

In addition to short-term efforts to cut the costs required to meet the CBAM standards by improving measurement and verification systems and developing domestic carbon pricing mechanisms, as described above, over the longer term, it will be more important to cut greenhouse gas emissions connected to economic activity. This will then accelerate the transition to a low-carbon economy, which would necessarily be the most efficient way of cutting embedded emissions.

The next issue to address is therefore considering where Thailand currently stands with regard to the goal of becoming a low-carbon economy. Thailand's 'Long-Term Low Greenhouse Gas Emission Development Strategy (Amended Version)', produced by the Office of Natural Resources and Environmental Policy and Planning (part of the Ministry of Natural Resources and Environment) was submitted to the United Nations Framework Convention on Climate Change (UNFCCC)[48/] in 2022. This estimates that to reach net zero emissions, Thailand's emissions should be no more than 120 $MtCO_2e$ by 2065, which allowing for sequestration by forests would result in zero net emissions. Unfortunately, as of 2019, Thailand's total emissions came to 373 $MtCO_2e$, or more than triple the target and because the country remains so far from achieving its goals, efforts in that direction will doubtless need to be accelerated. However, as things stand, **Thailand lacks the explicit regulatory framework required to drive the transition to a low-carbon economy**, though efforts have been made to draft a climate change bill. If the latter is passed in the near future, this would certainly help to increase pressure across all parts of the economy, pushing stakeholders to step up their efforts to control carbon emissions and to jointly bring the net zero goal much closer to fruition[49/].

Given the tendency of different sectors to generate different levels of greenhouse gas emissions, Thailand's long-term strategy for addressing these issues focuses on cutting emissions from industries affected by the CBAM directly, that is, the energy sector and carbon-intensive industrial processes. This strategy therefore involves **exploiting alternative energy sources, greater use of EVs, and intensified research and development of related technologies, such as carbon capture and storage, and these measures will then help to reduce both direct and indirect emissions, as the CBAM intends**. In addition, measures unique to particular industries are also being pursued, so for example, cement producers are developing alternatives to clinker. However, such alternatives have yet to emerge in the iron and steel and aluminium industries, partly because in these areas, emissions largely originate from the electricity and fossil fuels used in production, and these are already accounted for in the energy sector.

Table 7:

Strategies for Cutting Greenhouse Gas Emissions from Industry and from the Energy Sector

Sector	Measures
Energy use Responsible for 70% of GHGs, largely from electricity generation and transport	Improving energy efficiency Using new technology, e.g., CCS/CCUS Greater use of electric vehicles Greater reliance on renewable power for heating and electricity generation
Industrial processes and product use Responsible for 10% of GHG emissions	Using alternatives to clinker Using replacements for CFCs and HCFCs in cooling applications that have a low global warming potential (GWP) Better management of industrial wastewater, for example, using this to generate methane, which can be captured and used

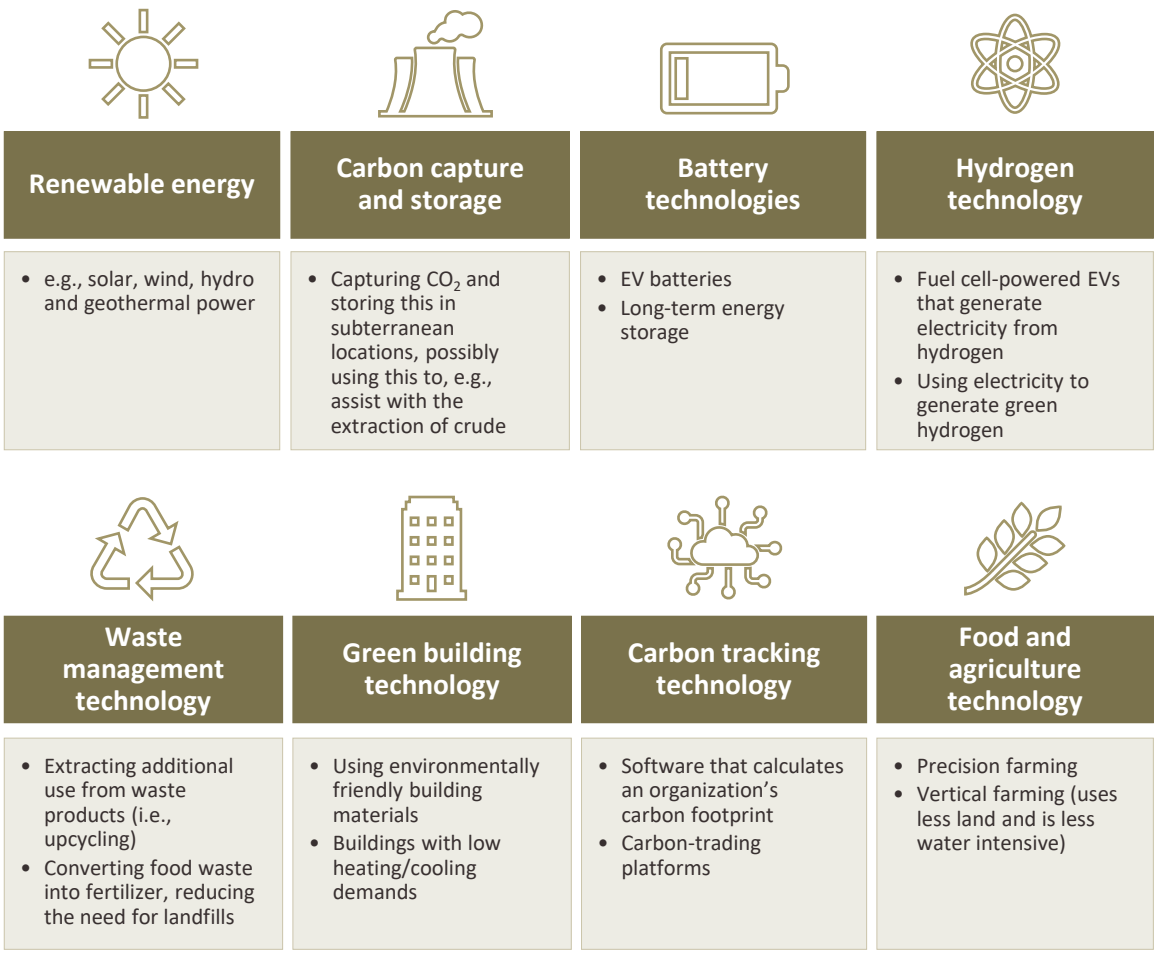
Source: TGO, ONEP, Krungsri Research

48/ Thailand submitted its targets and long-term strategies under the United Nations Framework Convention on Climate Change (UNFCCC).
49/ https://www.greenpeace.org/thailand/story/17760/climate-emergency-thai-climate-change-law/

Thailand's strong focus on cutting carbon emissions through action involving the energy sector carries with it a significant reliance on technology, and although low-carbon or 'green' technologies are showing increased potential to assist in reducing greenhouse gas emissions, greater research and development is needed before these will achieve widespread adoption. Moreover, the costs associated with many of these innovations (e.g., CCS and hydrogen-based power) remain significant, although with regard to the former, PTT Exploration and Production began researching the feasibility of using CCS in Thailand in 2021, and the company estimates that it will be possible to begin commercial CCS operations in the Arthit gas field in 2026[50/].

Figure 14:

Major Green Technologies



Source: The Structure, Greenly[51/], Krungsri Research

50/ https://www.pttep.com/th/Sustainability/Carbon-Capture-And-Storage.aspx
51/ https://greenly.earth/en-us/blog/ecology-news/everything-you-need-to-know-about-green-technology-in-2022

Stakeholder responsibilities for driving the transition to a low carbon future

While it is certainly true that the private sector will have a central role to play in determining the success or otherwise of the transition to the low-carbon economy, many other stakeholders will also play their part in supporting this process and in ensuring that the transformation of the economy is as smooth and painless as possible. It is interesting to note that in 2022, the United Nations Global Compact–Accenture CEO Study sought the opinions of more than 2,600 executives in 128 countries[52/], and the survey revealed that 52% of CEOs saw the government as having the greatest influence over issues relating to sustainability. Moreover, 21% of CEOs surveyed believed that the banking sector also had an important role to play in this area, with the proportion up from just 6% in 2021. This survey therefore underlines the importance of stakeholders such as the public sector and the financial industry in helping to bring about these changes.

Among these, **the government** will have a central influence in setting the direction of change, in facilitating this change, and in ensuring that industry follows its lead. In this regard, one of the Thai government's most important strategies has been the 30@30 policy, which aims to ensure that by 2030, 30% of autos coming off Thai production lines are zero emission vehicles (ZEVs). To help bring this about and to encourage increased domestic production and use of EVs, the government has made changes to the tax system and provided other assistance to industry. Because EV production is linked with many other parts of the economy, it is also hoped that an increase in the former will help to accelerate the green transformation in other parts of the economy. With regard to industry overall, the Board of Investment (BOI) rolled out its 'Smart and Sustainable Industry' policy at the start of 2023. This has the goal of encouraging the private sector to increase investment in industrial sustainability[53/], for example through increased energy efficiency, greater use of alternative energy, reduced industrial impacts on the environment, and more rapid adoption of international sustainability standards[54/]. In the first quarter of 2023, the policy attracted 60 applications with a combined value of THB 3.33 billion. This reflects the widespread acceptance of these measures, and providing funding by the government now represents a valuable opportunity for increasing the sustainability of the Thai manufacturing sector[55/].



52/ Jointly organized by UN Global Compact and Accenture in 2022. For more details, please see http://ebook.globalcompact-th.com/books/vsbf/#p=7

53/ Incentives available to investors include: (i) waivers on import duties on plant and machinery that will increase production efficiency; and (ii) waiving taxes for 3 years to a value of 50% of the investment, excluding purchases of land and working capital. However, the minimum investment is set at THB 1 million, though for SMEs this is reduced to THB 500,000. (https://www.boi.go.th/th/smart_sustainable)

54/ Examples of international sustainability standards include accreditation by Good Agriculture Practices (GAP), the Forest Stewardship Council (FSC), the Program for the Endorsement of Forest Certification Scheme (PEFCs), and the ISO 22000 food safety standards.

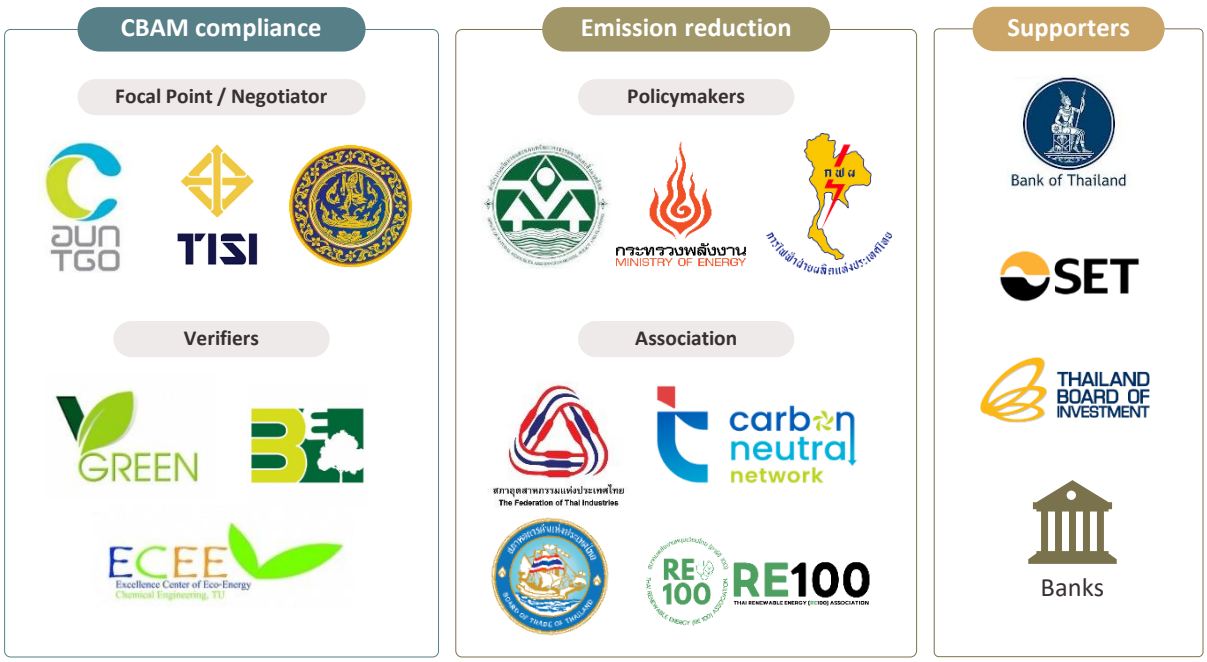
55/ https://www.bangkokbiznews.com/environment/1069788

Because the transition to the green economy will carry with it a heavy price tag, a crucial role will be played by **sustainable finance**, since this will help to allocate capital efficiently. In Thailand, the issuance of sustainability bonds has undergone rapid growth, and as of the first quarter of 2023, these had a value of THB 550 billion, up around five-fold from their 2020 value of THB 110 billion. The majority of these are for financing related to projects that aim to cut greenhouse gas emissions[56/]. However, the development of the market for green finance involves both opportunities and threats. With regard to the former, this development will help to boost demand for green finance products, though with regard to the latter, it can be difficult to distinguish between worthwhile projects and those that represent less good value. To help address these problems, the Thailand Taxonomy has been created. This has the goal of establishing standards for classifying economic activities that are connected with the environment and for assessing their sustainability and environmental impacts.

Given, as described above, the problems arising from the implementation of the CBAM, the roles played by stakeholders in transitioning to the green economy, and the interconnections between these and how this will play out in determining how successful the country will be in meeting the challenges posed by the enforcement of the CBAM, it is clear that stakeholders will need to work hard to coordinate their efforts. However, if they are successful in this, this will then reduce the severity of the impacts associated with the new EU policies, and may even help to turn a crisis into an opportunity.

Figure 15:

Stakeholders in the CBAM Process



Source: Krungsri Research

56/ https://thaipublica.org/2023/06/pier-research-climate-adaptation-financing/

Box 2 Thailand Taxonomy

The Thailand Taxonomy offers standardized definitions of economic activities, and then orders these according to their environmental impacts. This thus comprises a unified framework for assessing where activities fall on a single scale with regard to the environment, and its use will help to produce consistent judgments of these and to reduce the risk of greenwashing. Within the taxonomy, activities are split into three levels (i.e., it uses a traffic-light system[58/]) that reflect the extent of an activity's environmental friendliness.

Table 8:

Thailand Taxonomy Traffic-Light System

Green list	Environmentally friendly business activities	Activities that are in alignment with climate change goals. These are thus currently associated with zero or close to zero net greenhouse gas emissions.
Amber list	Business activities that are undergoing a process of transformation	Activities that at present have not yet reached (or are not close to reaching) net zero but that are reducing their greenhouse gas emissions. These are thus having a positive impact on reducing the severity of the problem, though more work needs to be done.
Red list	Activities that are not environmentally friendly	Activities that cannot be considered conducive to meeting net zero greenhouse gas emission targets and so fall outside the scope of the definitions for amber and green activities.

Source: Money and Banking, BOT

The initial development of the Thailand Taxonomy is now complete and available for use with the energy and transport sectors since these are the main source of greenhouse gas emissions in Thailand. In the future, the taxonomy will be extended to include other activities and parts of the economy, including industry, agriculture, and water management (processing, waste management and quality improvement)[59/].

The Thailand Taxonomy will provide benefits to many parts of the economy, and businesses will be able to use it to help with planning for their green transformation. The finance sector will also utilize the Thailand Taxonomy to guide the development of the green financial products and services that will be needed as the economy decarbonizes, and to better evaluate risk connected to green debt instruments. Alongside this, though, using the Taxonomy will also present its own set of challenges, in particular those relating to gathering information on environmental impacts, since to ensure that this is in agreement with the established standards, data collection needs to be both detailed and transparent. Commercial operations will likely thus need to improve their processes on assessing environmental impacts, but while this may add to costs over the short term, these improvements will help to bring businesses closer into line with the CBAM requirements. However, it should be remembered that the taxonomies of individual countries may not align, and the EU's taxonomy embodies tighter environmental regulations than does its Thai equivalent. This is partly because the two have been created for use in somewhat different contexts, most clearly in the much greater reliance of the Thai economy on more polluting heavy industry. Businesses will therefore need to stay alert to these issues.

57/ https://www.sec.or.th/TH/Template3/Articles/2566/210166.pdf
58/ https://moneyandbanking.co.th/2023/18096/
59/ https://www2.deloitte.com/th/en/pages/about-deloitte/articles/thailand-taxonomy-th.html

Krungsri Research view: Challenges confront opportunities on the path to the green transformation

The EU's announcement of the introduction of the CBAM is further evidence of the rising international will to seriously confront climate change and to begin the transition to a low-carbon society. Although Thailand has set a target of reaching net zero emissions that is 15 years behind that of the EU, the country cannot avoid the need to adjust to this changing reality and to follow the lead set by countries at the forefront of the movement to manage problems with carbon emissions. As stated above, initially, the CBAM will come into effect for a transition period lasting somewhat longer than 2 years, but following this, the regulations will then be fully enforced. The impacts on Thai industry that can be expected over these two periods are described below.

- **In the transition period** (October 2023-December 2025), although it will not be necessary for manufacturers and exporters to purchase CBAM certificates, they will still face rising costs due to the need to report the greenhouse gas emissions connected to the manufacture of their exports. This will most seriously affect producers of iron, steel and aluminium, since these are the most important of the CBAM goods exported to the EU. Unfortunately, at present, Thai manufacturers, and especially MSMEs, are not well prepared to meet these challenges and to effectively measure and report their carbon emissions, and this lack of preparedness is reflected in the only low levels of participation in carbon labeling schemes. At the same time, Thailand's ability to measure, report and verify emissions (MRV) is also underdeveloped and additional work is needed to bring this into line with the CBAM requirements and to prepare for future expansion in demand. The latter might include developing appropriate online platforms, increasing the knowledge and awareness of exporters, training assessors to verify carbon emissions, and cutting the costs of MRV systems since this may be a factor affecting businesses, most obviously MSMEs.

- **Once the EU-CBAM is fully enforced** (i.e., from 2026 onwards), exporters and other businesses connected to the export process should already be familiar with the measuring, reporting and verification processes. At this point, the major challenge facing Thai players will instead be meeting the additional costs arising from the need to purchase CBAM certificates to balance any additional carbon emissions connected to imports to the EU beyond that which is permitted. These challenges can be split into two main groups.

    - The embedded emissions of Thai exports remain high since at present, reductions in overall greenhouse gas emissions remain a very long way off the goal of reaching carbon neutrality. In addition, unlike the EU, the Thai economy is still weighted towards industries and industrial processes that are energy and emissions intensive.

    - The impacts of the CBAM will be amplified by: (i) any future expansion in the scope of the regulations beyond the six industries initially targeted; and (ii) the EU-CBAM triggering a domino effect by which other countries are encouraged to introduce similar measures, possibly led by nations on the opposite side of the Atlantic, namely the US and Canada.

Although in the eyes of the EU, these new measures may play the role of the hero in the drama of reaching net zero, given the likely impacts of the CBAM on their domestic industry and the wider economy, other countries could be forgiven for wondering if instead they would do better to regard the policy as the villain of the piece. The resolution of this question will, though, depend on the context in which individual countries find themselves, and for Thailand, the CBAM may in fact play a role in opening up new opportunities.

- **Opportunities in the private sector**: The introduction of the CBAM will help to build awareness of the importance of environmental issues across the private sector, and this will then help to accelerate the transition by Thai businesses to a low carbon future and therefore of meeting the country's net zero goals. Meeting the requirements of the CBAM will also likely widen the use of carbon pricing mechanisms in originating countries, including for example carbon credit markets, which are used by businesses as a tool for cutting the costs associated with decarbonizing. These may in fact help to kill two birds with one stone: firstly by generating income from the sale of carbon credits, and secondly by providing confirmation in export markets that emissions reduction targets have been met. Moreover, the growth of the green economy will help to expand opportunities for new businesses, such as those connected with measuring and verifying carbon emissions and offering sustainability consulting services. This will also open up new investment possibilities connected to the development of green technology.
- **Opportunities for the public sector**: The enforcement of the CBAM will push policymakers to speed up their efforts to build a regulatory environment that will mirror international standards and encourage a fall in greenhouse gas emissions. This will include developing and extending carbon credit markets, the Thailand Taxonomy, and systems for measuring and verifying carbon emissions, while legislators will also be encouraged to pass a climate change law. As these measures come into effect, Thailand will move ever-closer towards the long-term goal of transitioning to a green economy.
- **Opportunities for the finance sector**: The financial sector will have a crucial role to play in softening the impacts of green policies such as the CBAM, on industries that are competing to cut greenhouse gas emissions and to win the race to carbon neutrality and the transition to a green economy. As part of this and to cover the necessary spending on technology, businesses will need access to sufficient capital reserves, and so thanks to its role as a financial intermediary, the finance sector, and especially banks, will occupy a central place in helping countries meet their net zero commitments. In this greener future, companies that will see major opportunities for growth but that will also therefore require additional capital will include those specializing in green technology, e.g., renewable energy, carbon capture and storage, battery technology, hydrogen power, green building, and the platforms needed to help with the measurement, calculation and trade in carbon.

In conclusion, although a superficial assessment of the CBAM might conclude that this will only generate problems and difficulties for manufacturers and exporters, a deeper look at these issues shows clearly that the introduction of these measures signals the start of a more serious attempt to push forward with the move to a green economy. This is no easy task, and so it is perhaps inevitable that this will bring with it both challenges and opportunities, but with effort and intelligence, the business and finance sectors will be able to maximize the latter and minimize the former.

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