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Carbon Pricing for the Malaysian Steel Industry: Incentivising Sustainable Growth

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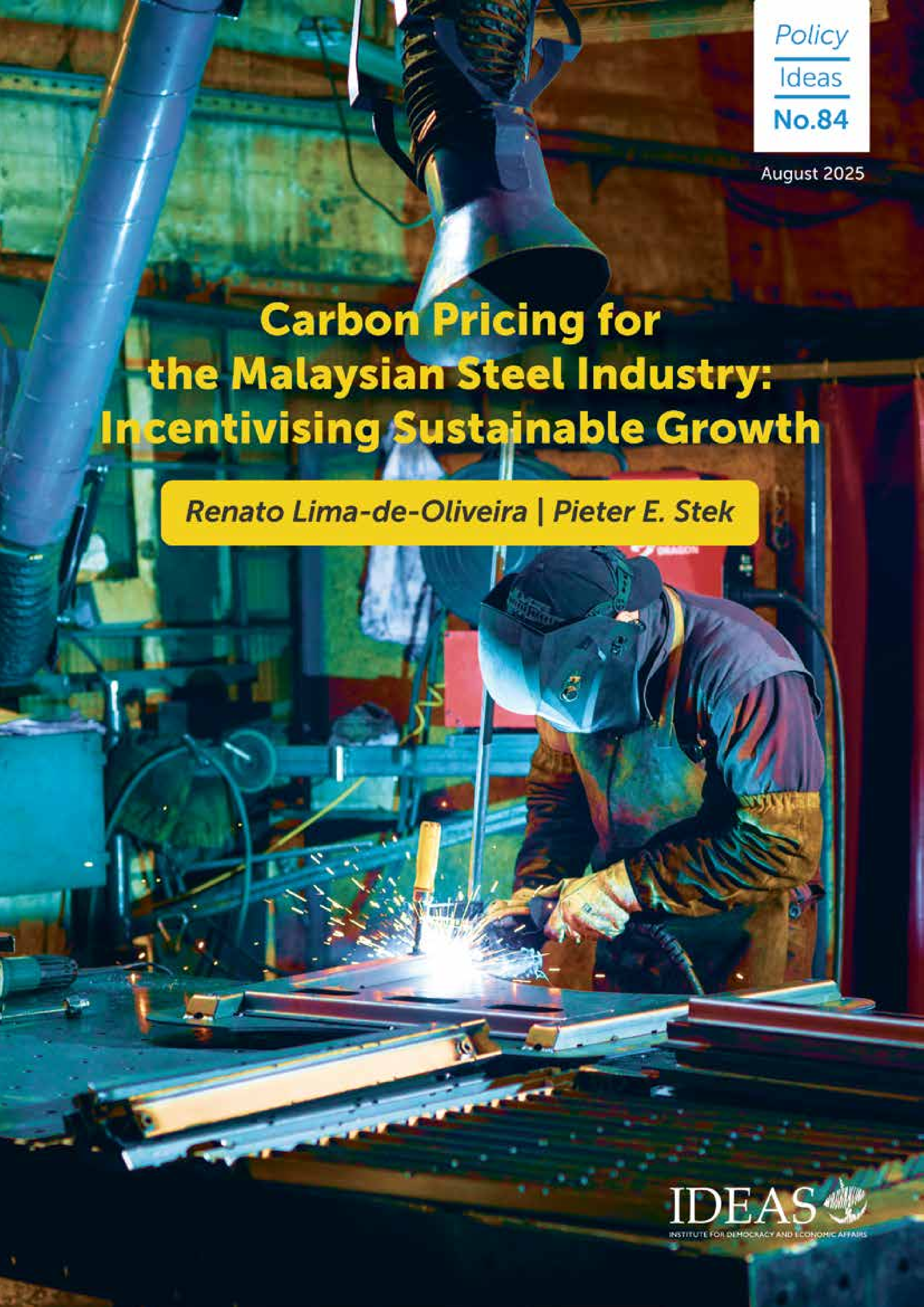

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Executive Summary

Malaysia's steel production is becoming more carbon emissions intensive despite Malaysia — and the world — facing an urgent need to decarbonise. A previous study published by IDEAS in 2024 highlighted how recent foreign investments in carbon intensive blast furnace production are taking Malaysia's steel sector backwards environmentally and in terms of value added. In the space of a decade, Malaysia shifted from being a low to above global average producer of steel emissions. Steel now accounts for a disproportionate and rising share of Malaysia's emissions, placing the country's net zero target at risk.

With the Malaysian government intending to introduce a carbon price for the iron and steel sector, this paper builds on the preceding study by examining the role of carbon pricing as a policy tool. It explores implementation options and identifies the specific carbon pricing that could meaningfully influence production decisions — including technology choices — and sector emissions.

The Key Discussion Points Are:

- **Malaysia's steel sector has shifted from a low to a high emissions profile.** Between 2014 and 2022, production moved from 100% electric arc furnace (EAF) to 70% blast furnace (BF), increasing Malaysia's weighted emissions intensity from approximately 0.4 to 1.7 tonnes of CO_2 per tonne of steel. Rising steel emissions are placing Malaysia's net zero aspirations at risk.

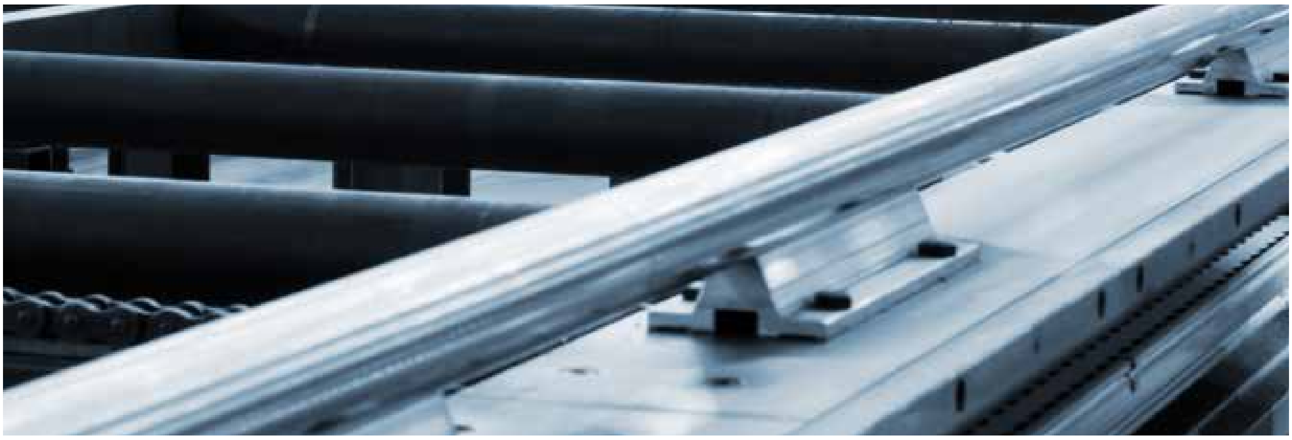
- **A carbon price of RM200 per tonne of CO_2 by 2030 is identified as the tipping point at which low-carbon steel production becomes commercially viable.** At this price, domestic steel production costs for BF producers would increase by about 11%—with the construction sector most affected, with a potential 3.5-4.6% increase in cost—though with other sectors, which use higher value-added steel, experiencing cost increases of around 1%.

- **Evolving trade dynamics make action necessary.** The imminent introduction of the EU's Carbon Border Adjustment Mechanism (CBAM) could trigger similar policies by other trade partners, and could erode the competitiveness of Malaysian steel exports. Without intervention, Malaysian steel risks becoming uncompetitive abroad because of its high emissions.

- **Policy design matters and will determine both feasibility and effectiveness.** A carbon tax may face greater political barriers, particularly given Malaysia's challenging environment for levying taxes. An emissions trading system (ETS) offers greater flexibility, provides clearer long-term signals for investment, and allows the private sector to adapt within a stable, rules-based framework.

- **Revenue recycling could help to balance economic and environmental goals.** At RM200 per tonne, a price that could be reached within 4 to 5 years, carbon pricing could raise around RM3 billion annually. Rather than relying on free permits, which risk weakening incentives and creating trade distortions, revenue could be collected and potentially recycled through targeted rebates for low-carbon steel and investment support for decarbonisation technologies. This approach helps firms adapt while maintaining fair treatment between domestic and imported products according to international trade practices.

- In conclusion, this paper **recommends a phased but rapid introduction of carbon pricing, targeting RM200 per tonne by 2030, implemented through an ETS framework designed around Malaysia's sectoral needs.** Without intervention, the emissions trajectory of Malaysia's steel sector will remain misaligned with national goals and expose the sector to growing risks.



1. Introduction

In October 2024, Prime Minister and Finance Minister, Anwar Ibrahim, told parliament that Malaysia would introduce a carbon tax for the iron, steel and energy sector (The Edge, 2024a). The announcement was not the first time that the government expressed its intention to introduce carbon pricing. Carbon pricing was also featured in the 12th Malaysia Plan 2021-2025 (12MP), and presented in Budget 2023 by then Finance Minister, Tengku Zafrul.

Malaysia's approach to start carbon pricing for the steel industry, instead of the energy sector, is somewhat unique. Carbon pricing schemes in countries like China and Indonesia have typically started with coal power plants, with steel being introduced during a later phase. The choice for the steel sector appears to be driven by several factors, including the EU's introduction of a Carbon Border Adjustment Mechanism (CBAM), essentially a carbon import tax, and the 2023 moratorium on new steel investment in Malaysia (The Sun Daily, 2023a). Introducing a carbon price can be seen as part of an exit strategy from the moratorium, which is due to lapse in August 2025.

The precise timeline and structure of a proposed carbon pricing scheme remain unclear, especially to the public. A carbon pricing policy has reportedly been under development since 2023 by the World Bank together with the government of Malaysia, but its findings have not been shared publicly (Bernama, 2023). Meanwhile, the Independent Steel Committee, convened by the Ministry of Investment, Trade and Industry (MITI), has made a set of recommendations for the sector, which have also not been publicly disclosed (Bernama, 2025).

The study is a follow-up to Policy IDEAS No. 79, titled: "Asserting Climate Change Leadership in ASEAN: Carbon Pricing for the Malaysian Steel Industry" (Lima-de-Oliveira et al., 2024). The aim of this study is to present an analysis of the current state of the Malaysian steel industry, and to provide insights into the economics of different steel making technologies under a carbon pricing scenario. This information forms the basis of a discussion of some of the policy options for Malaysia, also based on international experiences in implementing carbon pricing.

The report aims to address how Malaysia can use carbon pricing to not only reduce steel sector emissions, but to also encourage new investment in low-carbon steel-making technology. Carbon pricing and low-carbon technology investments will be critical to align the Malaysian steel industry with the country's net zero goals, as recently articulated in Malaysia's Long-Term Low Emission Development Strategies (LT-LEDS) document plan, launched in 2025.

Because the steel sector is Malaysia's pioneer industry for carbon pricing, it sets a precedent for other sectors. But it also presents a 'blank slate' to develop a carbon pricing framework that best meets the needs of the wider Malaysian economy.

Finally, efforts to decarbonise the steel industry should also be seen within a broader and still emerging green development policy agenda. Malaysia has recently passed a Carbon Capture, Utilisation, and Storage (CCUS) bill, and is due to present a Climate Change Bill. Malaysia has also joined the Climate Club in March (The Edge, 2025b). The Climate Club is an international initiative aimed at supporting countries in decarbonising their manufacturing sectors, and which supports the adoption of carbon pricing and an array of demand and supply measures to promote low-emissions steel and cement (IEA, 2025).

This report begins by providing a comprehensive overview of the current state of the Malaysian Steel Industry (section 2) and a broad-based analysis of the economics of low-emissions steel production in Malaysia, incorporating both technological, energy, Greenhouse Gas (GHG) emissions, downstream effects, and regional aspects (section 3). This leads to a discussion of the policy options available to the Malaysian government to incentivise low-carbon steel production through carbon pricing, as well as briefly touching on potential alternatives, such as carbon emission mandates (section 4). The conclusion (section 5) sums up the main findings of this report, which are:

- Malaysia could aim to gradually implement a substantial carbon price for the steel sector of around RM200 per tonne Carbon dioxide equivalent (CO_2e) by 2030 to encourage a shift in production toward low-emissions steel and high value-added steel production;
- an emissions trading scheme, rather than a carbon tax, could be the most effective way to reduce political opposition to carbon pricing, and to redirect funds towards other sustainability sectors;
- based on international experience, the design of emission trading schemes is highly diverse and dynamic, and therefore Malaysia could develop a scheme that not only effectively supports the decarbonisation of the steel sector, but also the development of other important sustainability sectors, for example, renewable energy and nature-based solutions.

Current State of the Malaysian Steel Industry

The Malaysian steel industry faces a number of significant imbalances in supply and demand, which are caused by a combination of domestic and international factors. At a global level, the steel industry has a persistent problem of excess production capacity, which is especially severe in Malaysia's domestic construction steel sector. Despite domestic overcapacity, Malaysia also imports significant steel volumes for its automotive and electronics sector. Malaysia has attracted significant foreign investment into new steel production capacity in recent years, worsening overcapacity concerns and raising the carbon intensity of steel production in contradiction with decarbonisation goals.[1]

Domestic steel production is concentrated in lower value-added construction steel, accounting for 83% of domestic production (SMM, 2025). Domestic steel producers face severe overcapacity, with the Malaysian Iron and Steel Industry Federation (MISIF) reporting that just 39% of capacity was utilised in 2024 (The Malaysian Reserve, 2024). Globally, the Organisation for Economic Co-Operation and Development (OECD) reports that capacity utilisation in the steel industry is at 77% (OECD, 2024), highlighting the scale of overcapacity globally, and the lack of competitiveness of the Malaysian steel sector in particular.

Global overcapacity has lowered steel prices and negatively impacted the financial sustainability of steel producers. However, it has not led to a reduction in overcapacity. While world steel demand is projected to decline, the OECD projects world steel production capacity to increase by 6% or 146 million tonnes during the 2025-2027 period. During the past 5 years, new steel production has been concentrated in Association of Southeast Asian Nations (ASEAN) (29.6 million tonnes), the Middle East (22.9 million tonnes), North Africa (15.5 million tonnes) and India (13.2 million tonnes). While steel production capacity in China has not increased during this period, both due to falling domestic demand and government policies, Chinese steel producers have made significant investments in new steel production capacity in ASEAN and Africa (OECD, 2024).

Despite overall domestic overcapacity, Malaysia imported 7.1 million tonnes of steel in 2023 — an amount that has remained relatively stable in recent years. Around 56% of imported steel are flat products, including higher-value-added hot-rolled and cold-rolled sheets and coil products which are primarily used in the automotive and electronics industries. High-value steel is mainly imported from Japan and South Korea, as well as from Taiwan and China. On a volume basis, ASEAN is the largest source of Malaysian steel imports (28%), followed by China (27%), Taiwan (13%), Japan and South Korea (11% each) (SMM, 2025).

1. For additional information and context, please see "Asserting Climate Change Leadership in ASEAN: Carbon Pricing for the Malaysian Steel Industry." Policy IDEAS, No. 79, April 2024, where the authors' go more in-depth into the industrial structure of Malaysia's steel sector and the observed changes over time.

That Malaysia is unable to meet domestic demand for high-value steel products is a source of trade friction. Since 2018, Malaysia has initiated anti-dumping investigations and related trade counter-measures against all its major steel import partners, including against Vietnam, Indonesia, Singapore and Türkiye (SMM, 2025).

Although difficult domestic market conditions have caused a number of Malaysian steel producers to close down, including Perwaja/Kinsteel, Antara Steel and Megasteel, they have not deterred new investments in steel production, notably by investors from China. Before the Malaysian government announced a moratorium on new steel production capacity in 2023, the South East Asia Iron and Steel Institute (SEASI) projected a 200% increase in Malaysian steel production capacity by 2030, with production capacity due to rise from 16.1 million tonnes per year in 2023 to 48.9 million tonnes per year in 2030 (Kallanish, 2023).

Increasing public infrastructure investments in Malaysia, notably in railway construction, as well as private investment in sectors like data centres and the semiconductors, are expected to increase domestic demand for steel in the near term. However, this demand is insufficient to significantly reduce excess domestic production capacity (The Edge, 2024c).

Therefore, the first major challenge for the steel industry in Malaysia has been the low utilisation of existing plants, which has led to some closures over the years. Nonetheless, the country has received significant new investments in production capacity—primarily of the higher-emissions-intensity BF type. This is discussed in more detail below, but one key takeaway is that these new investments have added another dimension to the problem of overcapacity: a higher emissions intensity per unit of steel produced.

Alliance Steel and Eastern Steel, the most significant majority foreign-owned steel investments in Malaysia both use BF technology and together emitted an estimated 12.8 million tonnes of CO_2e in 2024, based on publicly accessible satellite data (Climate TRACE, 2024a). The emissions from these two plants alone are equivalent to approximately one-third of Malaysia's total manufacturing emissions. Based on satellite data, Alliance Steel and Eastern Steel were respectively the sixth and seventh highest emitters in the country in 2024, just below major coal power plants at Kapar, Jimah and Jimah East (Climate TRACE, 2024b).

The additional BF production has also impacted Malaysia's overall carbon emissions in a significant way. Malaysia reported 37 million tonnes CO_2e emitted by the manufacturing sector (IPPU) in its first Biannual Transparency Report (BTR) submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in 2024, with data for 2021 (NRES, 2024). Within the timeframe of analysis (2005-2021), iron and steel production showed an increase of 16.12% compound annual growth rate (CAGR) and is now reported to account for 40% of the country's IPPU emissions (14.9 million tonnes CO_2e). The trend is worrying as it has been much higher than cement (which decreased by 2.04%) and semiconductor production (which increased by 4.9% and is only 4.6% of total IPPU emissions).[2] Real-time satellite data, as provided by Climate TRACE discussed above, suggests that official updates with data after 2021 may show further absolute growth of emissions from the steel sector.

While the emissions from the new BF plants have raised environmental concerns, the operations appear to be financially successful. For the financial year ended July 31, 2023, Eastern Steel recorded relatively healthy revenue of RM2.24 billion with an after tax profit of RM163.06 million, equivalent to a net margin of 7.2% (The Sun Daily, 2023b). In general, local producers of billets and steel bars have struggled to remain profitable in recent years, while producers of pipes, hot-rolled and cold-rolled flat products, as well as aluminium producers, have generally turned a profit, with margins ranging from 0.28% to 13.3% (The Edge, 2025b).

In addition to making it more difficult for Malaysia to achieve its net zero goals, the buildup of high-emissions steel capacity risks reducing the country's export competitiveness, especially as other nations begin implementing carbon border adjustment mechanisms (CBAMs) — the first of which will come from the European Union. Furthermore, new US tariffs on steel and aluminum imports (and additional tariffs on Chinese imports), have raised concerns about Malaysian producers losing access to key export markets, or facing increasing competition due to trade diversion. Although Malaysian iron and steel exports to the EU and US are relatively small, accounting for 5% and 7% respectively (UN Comtrade, 2024), new tariffs could influence steel trade patterns (The Edge, 2025c).

Given sustained global overcapacity concerns and international commitments to achieving global climate change goals, a policy of attracting large-scale, high-emissions steel investments is clearly not a viable long-term strategy for the sector. Instead, the New Industrial Master Plan (NIMP) 2030 for the metals sector proposes to "accelerate the adoption of technology to move towards higher value-added products" while also highlighting the need for "regulations and compliance to environmental related standards that aid in transitioning towards a low carbon economy." (MITI, 2023)

While NIMP 2030 does not provide specific guidance on how to achieve these goals, encouraging a transition towards low-carbon steel production technologies is clearly necessary to achieve NIMP 2030's dual environmental and economic aims. In a carbon-constrained world, manufacturing the same commodity with lower carbon technologies can be a source of competitiveness and a desirable industrial upgrading path. In the next section the economics of low-carbon steel production in Malaysia are discussed.

2. See "Table SIC4.3: Sectoral Summary for Industrial Processes and Product Use (IPPU) Sector in 2021" (p. 83).

Economics of Low-Carbon Steel in Malaysia

With steel production accounting for approximately 7% of worldwide GHG emissions (EC, 2022), low-carbon steel production is seen as an important enabler of the global transition towards net zero. Like chemicals and cement, the steel industry is seen as a hard-to-abate sector due to its high energy intensity, long capital investment horizons, widespread use of fossil fuels, and the economic and technological challenges involved in transitioning to new production methods (UNCC TEC, 2024). Influencing the GHG emissions of steel production are the production method itself, such as the reducing agent being used (direct emissions), as well as a production site's source of energy (indirect emissions).

Although many different factors influence the cost of steel production, the cost competitiveness of low-emissions steel production primarily depends on two factors: the price of carbon emissions and the cost of renewable energy used to power steel production. In a situation whereby renewable energy supply is abundant and cheap, and carbon emissions are expensive due to direct taxation or other market mechanisms, low-emissions steel production becomes economically competitive when compared to 'grey' steel production using technologies such as BF.

In the absence of these conditions, low-carbon steel production can be commercially viable through stronger government interventions, such as limits on total embodied carbon, subsidies, or if buyers are willing to pay a premium (IEA, 2025). This willingness-to-pay can be driven by a government mandate, public procurement rules, or by private actors who attach value to low GHG emission products, as is the case for some data centre developers (Amazon, 2024).

Currently, Malaysia has announced its intention to introduce a carbon tax for iron, steel and energy as a response to the European Union's CBAM carbon import tax (The Edge, 2024a). Under CBAM, imported products are taxed based on their embedded GHG emissions at the price of the EU's domestic GHG emissions market (ETS). However, carbon taxes already paid abroad can be deducted. Therefore, if Malaysia's domestic carbon price is similar to that of the EU, Malaysian products are not subject to any additional CBAM charges when imported into the EU. Domestic Malaysian carbon pricing also means that related revenue can be captured by Malaysia, instead of by the EU.

Given the explicit mention of CBAM by policy makers in reference to carbon pricing in Malaysia, Malaysia's approach to carbon pricing can be expected to follow the GHG emission accounting methods of CBAM, which include direct (scope 1) and indirect emissions (scope 2 and 3), including the emissions from direct inputs such as steel billets, as well as purchased electricity (EC, 2023).[3]

3. Note that emissions offset using market mechanisms such as RECs are not allowed under CBAM.

Based on these two key parameters, the cost of GHG emissions and of renewable energy, the cost of steel production using different technologies is analysed.

The remainder of this section is divided into three parts. First, an overview of different steel producing technologies is provided (including low-carbon production technologies), which is followed by a discussion of regional differences within Malaysia with regards to renewable energy and carbon pricing. Next, a simplified analysis of the effect of carbon pricing on different steel production technologies is presented.

Technological Options to Reduce Carbon Emissions From Steel

To gain a deeper understanding of the cost competitiveness of low-emissions steel production, it is useful to delve into the main steel production technologies currently in use, as well as the most promising low-carbon steel technologies that are currently available, or which are expected to be available in the near future. This section provides a high level overview of different technologies, and serves as background for the economic analysis presented in the final section.

There are a number of different technologies to produce steel, all of which have different properties in terms of their feedstock (scrap steel, iron ore, hydrogen), energy sources (coal, natural gas, electricity) and GHG emissions profile. The marginal cost of steel production for each technology depends on the cost of these inputs and emissions, while the price of steel products depends on current demand and the product's specific physical properties.

Viewed from the perspective of producing low-carbon steel, two clear steps would need to be taken:

- BF production capacity would have to be phased-out, because the technology does not provide an economically viable pathway towards significant GHG emission reductions (Nicholas and Basirat, 2024; Transition Asia, 2024), unless there is a dramatic cost reduction in deploying carbon capture and storage (CCS) equipment.

- At the same time, Malaysia would need to significantly expand its low-carbon electricity supply to meet the energy needs of alternative steel production technologies.

As the steel sector transitions, some technologies can be adapted. For example, Direct Reduced Iron (DRI) technology could initially use natural gas as its reducing agent, and later hydrogen — a transition also envisioned in the Middle East. In a similar way, EAF can use electricity generated from a mix which includes fossil fuels (as currently in Malaysia), and later switch to renewable energy when it becomes available.

A more detailed analysis of current and emerging steel production technologies is provided below, in Table 1 based on global sources. In the sequence, we contextualise this information to Malaysia.

Table 1. Schematic Comparison of Steel Production Routes (emissions, costs, and readiness)

Technology / Route	Emissions (tCO_2 per t steel)	Production Cost (USD per t steel)	Readiness
BF-BOF (Conventional)	~2.0–2.3 (typical)	~$390 (global avg)	Mature & dominant (>70% share)
Natural Gas DRI + EAF	~1.4	~$455 (depends on gas pricing)	Mature (especially MENA)
Scrap EAF (Recycling)	~0.3–0.7 (depending on power mix)	~$415 (varies with scrap)	Mature (21% global share)
H_2 DRI + EAF (Green H_2)	~0.1 (near-zero, using renewables)	~$650 (first plant expected in Sweden in 2025)	Demo stage; first commercial by 2025–2030
BF-BOF + CCS	~0.2–0.5 (with ~60–90% CO_2 capture)	~$500–600 (est.) – high due to CCS implementation costs	Pilot stage; no full commercial

Sources: IEA (2023, 95) and De Boer et al. (2024, 13).

Blast Furnace (BF)

BF accounted for 72% of Malaysian steel production in 2022, a rapid increase from zero BF production in 2014 (Liew, 2024). BF production uses mainly iron ore and coal and its direct and indirect emissions are approximately 2.2 tonnes CO_2e per tonne of steel output (IEEFA, 2022). Due to the use of coal, it is not possible to achieve near-zero emission BF steel production, even if it is coupled with a CCS system. While CCS may allow BF GHG emissions to be reduced, its high cost and low efficacy make it uneconomical compared to other existing low-carbon steel production technologies (Adams, 2022; Nicholas, 2025; Witecka et al., 2024).

Electric Arc Furnace (EAF)

Scrap-EAF used to account for all of Malaysia's domestic steel production in 2014, but has rapidly declined since then. EAF production uses mainly scrap steel and electricity as input, and its direct emissions are approximately 0.1 tonnes CO_2e per tonne of steel output (Witecka et al., 2024). Indirect emissions depend on the carbon intensity of the electricity used. EAF can be done at a relatively small volume and with relatively low capital expenditure. Capex as a share of the levelised cost of steel (LCOS) is approximately 3% for EAF, and around 7% for BF and 8% for DRI (Hasanbeigi et al., 2024; Jackson and Huleatt, 2025). As a result, barriers to entry for EAF production tend to be lower. LCOS is the cost per unit steel at which a particular steel plant will break even over its entire lifetime. A similar approach is widely used for measuring generation costs in renewable energy (the Levelized Cost of Electricity, LCOE).

Natural Gas Direct Reduced Iron Electric Arc Furnace (NG-DRI-EAF)

Malaysia currently does not have NG-DRI-EAF steel production, but plans are underway to develop such a facility in Sabah with support from a Singapore-based investor (Petronas, 2025; The Edge, 2024d). NG-DRI uses mainly iron ore, natural gas and electricity as inputs, and its direct emissions are approximately 1.0 tonnes CO_2e per tonne of steel output (IEEFA, 2022). Indirect emissions depend on the carbon intensity of the electricity used for the EAF. If natural gas is used, total emissions are around 1.4 tonnes CO_2e per tonne of steel output.

Globally, NG-DRI is primarily used in the Middle East, a region with abundant natural gas supply (Nurdiawati et al., 2025). Given the Middle East's large potential for solar power, DRI-EAF facilities could in future use hydrogen instead of natural gas as the iron ore reducing agent (Astoria et.al., 2022).

Hydrogen Direct Reduced Iron Electric Arc Furnace (H_2-DRI-EAF)

H_2-DRI technology is currently on the cusp of entering commercial production, with several projects due to be commissioned in Europe, Australia, Oman and China between now and 2030 (Basirat, 2024). H_2-DRI-EAF uses hydrogen, high-grade iron ore and electricity as its main inputs. Depending on the source of hydrogen, emissions from H_2-DRI-EAF steel production can be near-zero.

Within the context of low-carbon steel production in Malaysia, hydrogen can be generated using renewable electricity, where it also serves as an energy carrier for storage ("green" H_2). Hydrogen can also be produced from natural gas, with emissions being reduced through CCS ("blue" H_2) or by using methane pyrolysis ("turquoise" H_2), although emissions are significantly higher than those of green hydrogen, of which direct GHG emissions are effectively zero (Husain Patel et al., 2024). Naturally occurring hydrogen deposits ("white" H_2) and hydrogen generated using nuclear power ("pink" H_2) are also potential sources of hydrogen for low-carbon steel production. However, they are not currently available in Malaysia.

Molten Oxide Electrolysis (MOE)

MOE technology is currently in an experimental phase, but it could lead to a more cost-effective pathway for producing steel from iron ore using only electricity, thus without the intermediate step of producing hydrogen (Crownhart, 2022). MOE could be ready for large scale industrial deployment around 2035-2040 and could be less expensive than H_2-DRI-EAF using green hydrogen (Witecka et al., 2024). However, in terms of capital expenditure (per tonne of steel), MOE is likely higher than H_2-DRI-EAF (Shahabuddinet. al., 2023). The US-headquartered Boston Metals opened its first commercial operation in Brazil, one of the world's largest iron ore producers, and it deploys MOE to recover critical metals from mining waste.

Regional Differences: Peninsula, Sarawak and Sabah

From the perspective of electricity and carbon pricing, Malaysia is effectively divided into three separate zones: Peninsula Malaysia, Sarawak and Sabah. Each region has a separate electricity grid, and Sarawak and the Federal Government (with regards to Peninsula Malaysia), have both adopted some separate legislation concerning carbon pricing and CCS. Grid interconnections between Sarawak and the Peninsula have been proposed since the 1990s, but have not yet materialised. Sabah and Sarawak, which share a land border, will have limited grid interconnectivity (275 kV) starting in 2025 (Sarawak Energy, 2024).

There is significant variation in carbon intensity between the grids of the Peninsula (0.774), Sabah (0.525) and Sarawak (0.199 kg CO_2e/kWh) based on 2022 data, as well as differences in electricity prices — with Sarawak having the lowest tariff (ST, 2024). As a result, carbon pricing could incentivise low-carbon steel investment in Sarawak.

While Malaysia has a common internal market for goods and services between its three regions, differences in electricity and (potentially) carbon prices could influence the future development of the steel industry. Sarawak has adopted its own carbon levy under the Environment (Reduction of Greenhouse Gasses Emission) Ordinance, 2023 (Sarawak, 2023), which means GHG emissions in Sarawak could be subject to both federal and state pricing. The ordinance is part of a broader push by Sarawak to claim greater autonomy from the Federal Government (Stek, 2024; Yeoh, 2024). Sarawak in particular, which has already made a significant push in developing renewable energy, green hydrogen and carbon pricing, could benefit from a policy promoting low-carbon steel.

Peninsula Malaysia could be the region most affected by carbon pricing. Malaysia's main BF facilities are located on the Peninsula, along with much of its chemicals and manufacturing industry. The carbon intensity of Peninsula Malaysia's energy grid is also relatively high due to coal power generation, whereas the emissions factor of Sarawak is much lower due to large-scale hydropower (ST, 2024). This could make it more difficult for steel producers in Peninsula Malaysia to source renewable energy. Alternatively, this new industrial demand could be one catalyst for renewable energy developers to speed up investments in the Peninsula.

The imposition of carbon pricing could also act as an incentive for the export of renewable electricity from Sarawak to the Peninsula, providing a further incentive for expediting grid interconnectivity between Sarawak and the Peninsula. Grid interconnectivity could potentially lead to a national electricity market, and together with a national carbon pricing regime, could eliminate the main regional differences in the cost of steel production.

Economic Analysis

This report's economic analysis of steel production in Malaysia suggests that a relatively low carbon price of 50-200 RM/tonne would neutralise the current price advantage of BF production over EAF and DRI-EAF. In fact, at around 100 RM/tonne based on current projected hydrogen and RE prices for 2030, H_2-DRI-EAF steel production would become economically viable in Malaysia.

While RM200 may seem like a high carbon pricing level, it is lower than current prices on the EU ETS, which is used for CBAM (approximately €70, RM336) or the current cost of CCS at Kasawari (US$65, RM293). However, it is approximately four times the price of the Kuamut nature-based carbon project, whose credits trade on Bursa Malaysia for RM50 per tonne.

The economic analysis is based on simplified operating cost models of steel production, which take into account the cost of basic inputs such as iron ore, scrap, electricity, natural gas, hydrogen and carbon emissions, while assuming that other costs remain constant. A rough estimate for capital expenditure is also made. However, the analysis excludes factors such as cost of capital, current asset lifetime, and depreciation. Calculations and underlying assumptions are provided in the appendix.

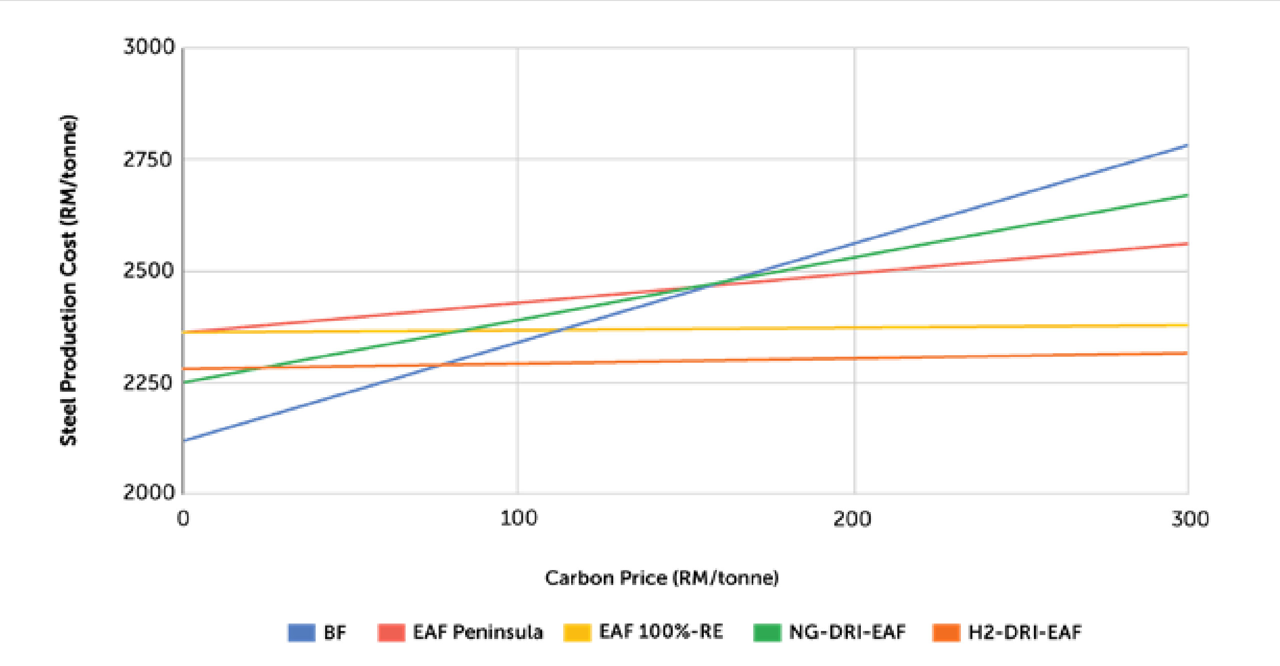
Five technological configurations are considered: BF, EAF based on the carbon intensity of Peninsula Malaysia's grid ("EAF Peninsula"), EAF based on 100% renewable energy ("EAF 100%-RE"), as well as natural gas and hydrogen DRI-EAF.

In comparing production technologies, the price of electricity is kept constant at 45.62 sen/kWh; the requested upward revision for the wholesale price of electricity in Peninsula Malaysia for Regulatory Period 3 (RP4, 2025-2027), which is pending final government approval. This price incorporates the cost of energy generation and transmission. Based on analysis by Bloomberg NEF, the cost of solar energy generation with storage is due to fall to around 29 sen/kWh by 2030. Based on the current transmission rate of 15 sen/kWh under the Community Renewable Energy Aggregation Mechanism (CREAM) scheme, this means that by 2030 RE will be available in Peninsula Malaysia for a similar price as today's coal power (see also appendix). In Sarawak the energy price is already lower, at 28 sen/kWh, including transmission costs.

For the price of hydrogen, Bloomberg NEF data forecasts a price for Sarawak green hydrogen of US$4.34 by 2030, which is a very important factor when calculating the economic viability of H2-DRI-EAF steel production.

The impact of carbon pricing between RM0 to RM300 is shown in figure 1.

Figure 1: Projection of Carbon Pricing Impact on Steel Production Cost



The 'tipping point' for low-carbon steel production in Malaysia appears to be between RM100 to RM200 per tonne, which is when H_2-DRI-EAF production becomes economically viable. The competitiveness of EAF requires a higher carbon price and is also highly sensitive to the emissions of the electricity it uses, with a large gap arising between 100%-RE and Peninsula EAF at carbon prices of RM100 or more.

At the RM100 point, H_2-DRI-EAF, which uses mainly iron ore as its input, becomes economically viable compared to both BF and NG-DRI-EAF. This is a price point at which BF producers may be forced to scale back their production or shift towards higher value-added production, as CCS costs will likely be higher than RM100-200. For reference, the current CCS cost of the Kasawari project is nearly RM300.[4] BF producers could remain in the market if they are able to produce higher-value steel products that can offset higher carbon pricing.

[4] According to S&P Global (formerly IHS Markit), a research firm, the additional capex of US$900m and opex of US$2,100m for CCS at Kasawari would add up to a total of US$3b, causing a reduction in emissions of 46.1 million tonnes CO2. (https://cdn.ihsmarkit.com/www/pdf/0423/Upstream-CCUS-Overview-04-2023.pdf). According to Petronas, the project owner, 76 million tonnes of CO2 will be injected over the project lifetime, although this figure could refer to further phases (https://www.petronas.com/flow/technology/getting-know-ccus-petronas). The Edge also reports capex of RM4.5b for the phase 2 CCS project that the S&P Global report refers to (https://theedgemalaysia.com/article/special-report-kasawari-ccs-project-marks-new-chapter-offshore-sector). Based on S&P Global's data, US$3b/46m = US$65.21 per tonne, which depending on exchange rates, is around RM293 per tonne. The authors are not aware of a statement from Petronas that disputes this figure.

For NG-DRI-EAF, a carbon price of below RM100 is already a point at which it may become prudent to switch from natural gas to hydrogen and renewable energy.

Under a scenario in which only direct (scope 1) emissions fall under carbon pricing, the EAF Peninsula production cost would be equivalent to EAF-100% RE. However, this would be inconsistent with CBAM rules and would remove the incentive for Peninsula-based EAF producers to purchase more RE.

Looking at the high end of the range, a RM200 carbon price would push up the price of steel to approximately 2,700 RM/tonne for BF producers, who currently account for around 70% of domestic production. This would be a price increase of 11% compared to today's price of steel bars, which is around 2,440 RM/tonne.

While 11% is not a small increase, depending on the end-product and the speed at which carbon pricing is imposed, its impact over several years would be in line with typical inflation figures. If a carbon tax were gradually raised to RM200 by 2030, this would translate to an annual cost increase of around 2%. In addition, the government could choose to further reduce the impact of a carbon price by redistributing revenue raised through carbon pricing, a strategy known as revenue recycling.

Furthermore, as the cost of renewable energy and green hydrogen continue to fall, steel prices could also come down in the future. If 2050 projected Sarawak green hydrogen prices are used, the cost of steel production using H2-DRI-EAF could fall to 2,100 RM/tonne, around 7% below the current cost of BF steel production (without carbon pricing).

It is worth noting that the IEA projects that by 2035 the market value of near-zero emissions steel would reach US$300 billion under existing climate pledges, and US$ 550 billion in 2035 under a scenario compatible with net zero by 2050 (IEA, 2025).

Downstream Impact of Carbon Pricing

The steel industry is an important upstream supplier of inputs for sectors such as construction, automotives, and offshore equipment. However potential changes in steel prices will have significantly different effects on downstream industries.

Based on interviews with industry stakeholders in Malaysia and abroad, a clear distinction can be made between the construction industry and between the automotive and offshore oil and gas equipment sectors.

The construction industry is much more sensitive to carbon pricing in the steel sector than the other sectors for three main reasons. First, steel accounts for a higher share of its cost. Second, construction uses relatively inexpensive grades of steel, and therefore the relative cost of carbon pricing is higher (GHG emissions are roughly the same for higher and lower grades of steel). Third, construction steel is mainly produced domestically and margins are relatively low. As a result, domestic carbon pricing will influence the cost of domestic steel producers, the extent to which depends on the technology they use.

Construction industry stakeholders report that steel materials account for between 8.8-9.2% of total construction costs. When calculated in terms of total development costs (including land), steel may account for 3.5-4.6% of total building expenses.

As a result, stakeholders from the construction industry note that steel price increases have a meaningful influence on cost, as the sector is highly competitive. Steel price increases would be passed onto consumers — including the government. Without a carbon tax or a mandate to use low-emissions steel, stakeholders are highly unlikely to opt for higher cost low-emissions steel due to the highly competitive nature of the sector and a lack of interest from end-users.

For the automotive and offshore equipment sectors, high-value specialty steel is typically imported, as it is not produced in Malaysia. Because of the higher prices of specialty steels, typically at around three to five times that of construction steel, price increases due to carbon pricing are likely to influence the mass-market price of vehicles by around 1.1% (Proton Persona), and offshore equipment by 0.7% (for a floating production storage and offloading platform, FPSO). A 10% increase in the price of construction steel due to carbon pricing would thus lead to a roughly 0.11% increase in the price of cars and 0.07% increase in the price of offshore equipment. This compares to a roughly 0.9% increase in construction costs.

For perspective, a recent IEA study (IEA, 2025) puts the price-premium of using low-carbon steel and cement on final products like cars and houses to be 5% or less. The reason is that these materials make up only a tiny proportion of the final product price. Even at that level, there are policy choices to minimise impact to consumers while providing producers with the long-term signals to invest in decarbonisation processes. Malaysia's LT-LEDS cites a cost increase of up to 20% for green steel in Malaysia (p. 8).

Due to the small cost impact, there seems to be little concern about steel costs and carbon pricing in the automotive and offshore equipment sectors when compared to the construction sector. The lack of domestic high value-added steel production means that carbon import taxes on specialty steel would not impact domestic steel producers (there are none), while downstream cost inflation would be very small.

Policy Options for Implementing Carbon Pricing

While a strong case can be made for implementing a carbon pricing mechanism for the Malaysian iron and steel sector as a way to address its rapidly increasing GHG emissions, the way in which such a measure is implemented can have wide-ranging implications.

As the first sector to be subject to carbon pricing in Malaysia, the policy approach chosen for the steel sector will likely be applied to other sectors in future. In this sense, the iron and steel sector should be seen as the first phase of what will likely develop into a much broader policy, which could then be extended to cover additional sectors.

Carbon pricing for the steel sector has the potential to drive industrial upgrading and decarbonisation, but it can also have positive spillovers for other sectors of the economy. For example, low-carbon steel production would increase demand for renewable energy and green hydrogen, while carbon pricing could be used to generate demand for carbon credits traded on the Bursa Carbon Exchange (BCX), potentially creating demand for millions of credits annually.

If carbon pricing is expanded to other sectors, funds from hard-to-abate sectors like the steel industry could also flow towards supporting the decarbonisation of other sectors. Large-scale investments in low-carbon steel production could also stimulate Malaysia's ringgit-denominated sustainability bond sector by offering high-quality debt linked to large-scale decarbonisation efforts.

As a second-order effect, the scaling of renewable energy and green hydrogen production, and possibly CCS, along with other specialised decarbonisation-related technologies and services, could enhance Malaysia's attractiveness as a destination for high value-added foreign investment. The steel sector could play a pioneering role by generating early but sufficiently large-scale demand for these products and services, providing critical mass and economies of scale.

Choosing a Carbon Pricing Model

Broadly speaking, there are two ways the government could approach the question of carbon pricing: by implementing a carbon tax (setting a price), or by establishing an emissions cap-and-trade system (setting a volume). While a carbon tax may seem simpler to implement, and has been adopted by neighboring Singapore, it carries significant political risks. A cap-and-trade scheme, which is generally preferred in larger economies, including in Brazil, China, Indonesia and South Africa, may appear more complex, but it could also offer a more robust framework for pricing and reducing carbon emissions in the long term and across different sectors.

The World Bank estimates that about 24% of the world's total global emissions are covered under a pricing scheme, with roughly the vast majority (19%) under an ETS system.[5] It is important to note that these systems may overlap — for example, a regional or national carbon tax may also be part of a larger ETS (such as the EU) regime or designed from the start as a hybrid format. Indonesia, for example, advanced a "cap-tax-and-trade" regime scheduled to start in 2025, complementing its intensity-based ETS for the power sector introduced in 2023. As of January 2025, there were 38 ETFs in force, with another 11 under development, with a collective track record of having raised US$373 billion since 2007.[6]

Both options are discussed below, with specific attention being paid to the potential spillover effects and political risks.

A Carbon Tax: Simpler and Better?

One of the great advantages of a carbon tax is its simplicity and predictability. By setting a per-unit tax for GHG emissions, the government charges all large emitters a tax based on their actual GHG emissions. Firms are incentivised to avoid paying the tax by either reducing their emissions, or by offsetting them using emission credits — when allowed.

In the case of China, Indonesia and Singapore, firms can offset 5% of their emissions using high-quality voluntary carbon credits. In Colombia, the threshold is 50%.

The predictability of the carbon tax, assuming governments release a schedule for gradual increases and can commit to it, also helps firms plan investments in carbon emission reduction technologies. With clear signals about future costs of carbon, investors can decide today when deploying new investments and choosing lower-carbon solutions. This can be particularly helpful to avoid investing in outdated technologies which can become stranded assets.

Revenue raised from a carbon tax can be used to fund general government expenses, but can also be redistributed. In Canada, certain households received a cheque funded by a federal fuel charge to offset their increased cost of living. Malaysia has pledged to use revenue raised from carbon taxes to finance research, industrial upgrading and decarbonisation in the steel industry (Bernama, 2024).

The main political risk for implementing a carbon tax is that it is unpopular, which increases the likelihood of adopting a low carbon price. Because carbon taxes often cannot be avoided in the short term, and might be too low to trigger investments into new technologies, they simply act as a pseudo-consumption tax. Depending on market conditions, firms will pass the carbon tax on to consumers by increasing their prices, or reducing production, and thus lowering economic activity. An emission trading system

5. See https://carbonpricingdashboard.worldbank.org related to the 2024 data.
6. International Carbon Action Partnership (ICAP). "Emissions Trading Worldwide - Status Report 2025."

could offer greater flexibility for firms to adapt via offsetting or the trading of credits, allowing firms to reduce emissions at a lower cost. These options are often not available under carbon tax regimes.

Malaysia has had difficulties in imposing consumption taxes and removing subsidies for fossil fuels. The country adopted and then quickly abolished the Goods and Services Tax (GST, a value added tax system) following a change of government in 2018, and continues to subsidise petrol and other energy for billions of ringgit annually.

A worst-case outcome for carbon taxation would be that the government imposes a low carbon tax that is relatively ineffective, and which it subsequently cannot raise due to lingering cost-of-living concerns. The tax then fails to meet its goals of advancing the decarbonisation of the steel industry because it is too low, but it is still blamed for high(er) steel prices. While the carbon tax might raise significant government revenue, that revenue might be appropriated for other purposes and not advance a green development agenda.

While a simple carbon tax may work well in Singapore, which is a relatively small city-state with a highly stable government, with commanding Parliamentary majority, the experiences from other larger countries have shown that a cap-and-trade scheme is often preferred. While carbon tax schemes are often viewed as being easier to implement, both a tax and a carbon trading scheme rest on a carbon register which records GHG emissions and removals. Even countries which are traditionally seen as having relatively weak institutions, such as Indonesia or South Africa, have successfully created carbon registers and implemented GHG emissions trading schemes.

Capping Emissions and Capping Political Risk?

The basic principle behind an emissions capping scheme is also a simple one. If Malaysia is to reach zero emissions from the steel sector by 2050, one possibility is to simply reduce steel sector emission rights by 4% annually.[7] Instead of imposing a tax, emission rights can be auctioned to the highest bidder, or distributed free of charge based on some other criterion, such as steel output or historical emission levels.

Compared to a carbon tax, a cap-and-trade scheme allows market forces to allocate resources towards decarbonisation, and could allow funds to be redistributed within the steel sector. In the case of Malaysia, emissions rights allocated based on steel production could lead EAF producers to have a surplus of emissions rights, and BF producers to have a deficit, thus encouraging EAF producers to sell their rights to BF producers. It could also encourage producers to use more renewable energy to reduce their emissions, allowing them to sell emission rights to higher emitting producers.

7. 4% per year, over a 25-year period from 2025 to 2050, leads to a 25 x 4 = 100% reduction in emissions, assuming linear reductions from existing absolute values for simplicity. More realistically, reductions would take into account a number of factors, including technological adoption curves and renewable energy deployment.

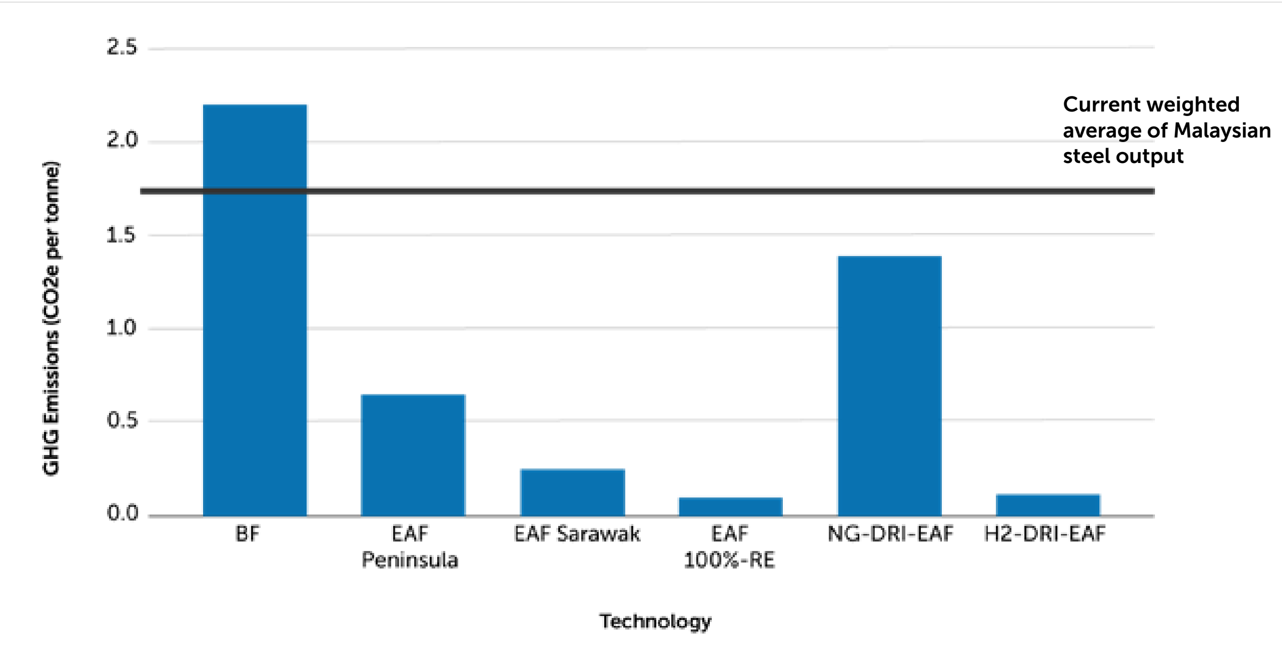
Such a scheme would avoid direct government involvement in setting carbon prices and in allocating funds. The role of the government would be to set an emissions cap, and leave the market to decide where and how emissions can be cut most effectively. As the scope of carbon pricing expands, a cap-and-trade scheme could enable direct inter-sectoral funding of decarbonisation efforts. It could also help fund investment in nature-based solutions, a sector which Malaysia is lagging behind other countries (Stek et al., 2025), and CCS for sectors in which this is most economical.

It is also important to note the potential scale of carbon taxes to be collected. With a carbon price of RM200 per tonne, and emissions from the steel sector currently at 14,945,923 tonnes CO_2e (NRES, 2024), as reported by the federal administration, the government would potentially find itself redistributing RM3 billion annually. Should the government seek to use this revenue to compensate losers or further incentivise decarbonisation, a clear and transparent approach is essential to ensure efficient and equitable redistribution.

An alternative approach to capping emissions is to set intensity targets, which could reduce the need for the government to redistribute carbon pricing revenue.

For example, the IEA has suggested a 0.34 tonne CO_2e emissions target per tonne of steel for "near-zero" emissions primary steel. Under an emission intensity scheme, producers with emissions above the threshold would be required to buy emission rights, while those below the threshold could sell them. Over time, emissions intensity thresholds could be lowered, raising emission costs for high-emission producers. Differences in emissions intensity by production technology are shown in Figure 2.

Figure 2: Steel Production Emissions Intensity



An emissions intensity scheme could be used to redistribute revenue from high-emitting producers to lower-emitting producers, by setting the threshold at a point between the two levels. In the case of Malaysia, around 70% of steel production is BF, and 30% is EAF located in Peninsula Malaysia, hence the weighted average emissions per tonne of steel are around 1.7 tonne CO_2e. If this threshold is adopted, and the emissions price is around RM100, this mechanism would increase the cost for BF producers by RM46.60 per tonne, while reducing costs for EAF producers by RM109 due to their sale of permits. Based on steel production of 8.8 million tonnes per year, this would enable an intra-industry revenue redistribution of approximately RM287 million towards lower-emission producers. A carbon price of RM200 would raise this amount to approximately RM574 million.

From a political perspective, a carbon market mechanism is often much less politically controversial as funds are redistributed between different producers. Once an entire cap-and-trade ecosystem has been created, it becomes more difficult to make political interventions, as many different market-actors have been calibrating their strategies towards a sustained carbon market policy. While steel producers may object to a further reduction in emissions, renewable energy, CCS and nature-based solutions providers will encourage the government to stay the course.

The Malaysian system can be designed in a way that further promotes associated carbon offsetting activities. In fact, one trend observed in the design of new carbon market systems has been the adoption of offsetting and crediting mechanisms from voluntary markets into the compliance requirements. According to a recent report, out of the 38 ETSs currently operating, 24 allow for the use of carbon credits as a compliance option, although at varying rates and quality specifications (ICAP, 2025).

The development of a compliance carbon market, like a cap-and-trade scheme, may lead to the creation of an influential pro-carbon pricing industry coalition which can resist pressure from anti-carbon pricing actors. Such a coalition may provide long-term support for the continuation of the policy despite top-level political changes, which may make the carbon pricing policy more politically resilient and inclusive.

International Dimensions

While the development of Malaysia's carbon pricing system makes explicit reference to CBAM, Malaysia itself may wish to impose its own carbon tax to avoid carbon leakage. Carbon leakage occurs when production is shifted abroad to avoid carbon pricing, and products are then imported into the home market. CBAM aims to prevent this carbon leakage by imposing a tax based on embedded GHG emissions while deducting carbon prices already paid abroad.

The principle underlying CBAM is that domestic and imported products are treated equally. Thus, if domestic steel products are subject to a carbon tax, so are imported goods. But equally, if domestic low-carbon steel products receive some kind of exemption or subsidy, foreign low-carbon steel products should also receive this.

A common feature of many cap-and-trade schemes is the issuing of free emissions permits, often on the basis of past emissions or another objective measure. Emissions permits were often used to overcome political opposition or to protect certain sectors from carbon leakage. Within the EU context, CBAM has replaced free emission permits as a tool to address carbon leakage.

If emissions permits are maintained within a cap-and-trade scheme, this could mean that foreign low-emissions steel could also be entitled to a free emission permit, which it can then sell to an importer of high-emissions steel, or a domestic Malaysian steel producer.

Viewed specifically through the lens of exporting to the EU, such a permit scheme could create further challenges for Malaysian steel exporters. As the EU no longer offers free emission permits, the free emission permits received by Malaysian producers would not be recognised by the EU, and steel from these producers would still attract a CBAM charge. However, high-emission Malaysian producers who had to purchase emission rights would be able to offset these costs against their CBAM charges when exporting to the EU.

An approach by which emission rights are sold first (or all emissions are taxed), and funds are then channelled back to the steel industry, for instance through a negative sales tax or low-carbon steel rebate, could be a way to achieve intra-industry redistribution of funds. However, at this point, it is unclear if this would align with the EU's CBAM regime.

A final consideration concerns the export competitiveness of domestic steel producers to markets without CBAM. While the imposition of a carbon price will have relatively little impact on EAF producers, it could make BF producers significantly less competitive, especially for low value-added construction steel. However, this shift in relative costs could also serve as a catalyst for firms to move up the value chain by investing in higher value-added production — an area where Malaysia has historically lagged behind.

Alternatives or Supplements to Carbon Pricing: A Low-Carbon Steel Mandate

In addition to market mechanisms such as carbon pricing, Malaysia could also stimulate demand for low-carbon steel through direct interventions, such as government procurement or a government mandate to reduce embodied carbon. These mandates would likely focus on specific sectors, and would not create the type of broad-based policy foundation that a carbon pricing scheme would provide.

A low-carbon steel mandate could require the steel used in certain products, such as buildings, vehicles or heavy equipment, to have a certain maximum embodied carbon intensity. Products with a lower carbon intensity could receive certain advantages in licensing or taxation, or receive preferential treatment in public procurement. Products with a high carbon intensity could be penalised by higher taxes or exclusion from public procurement and licensing eligibility.

In the Malaysian case, such a mandate would be most effective when implemented in the construction sector. Construction is a large source of demand for steel, and it is also largely met with domestic production, thus having an effect on domestic GHG emissions. If the construction sector were targeted with an emissions mandate, this could also extend to cement. Since reducing emissions from cement is also very difficult, initially the mandate could encourage decarbonisation of the steel industry.

A concern of a low-carbon steel mandate would be its cost to end-users, which is a particular concern for low-cost housing and public infrastructure. A low-carbon steel mandate could increase construction costs for vulnerable groups and government procurement. However, it could be implemented for commercial buildings and high-end residential developments.

A low-carbon steel mandate could also be considered for other sectors where steel is currently imported. As Malaysia's main source of steel imports are China, Japan and South Korea, countries which do not have a comparative advantage in low-carbon steel production, a low-carbon steel mandate could be an opportunity to attract low-carbon steel investment for Malaysia.

Currently, a mandate is not on the table, but it could be part of a broader policy initiative to support low-carbon materials production in Malaysia.

Conclusion

Carbon pricing for Malaysia's steel industry would be a highly significant policy step for a number of reasons. It would be the first time that Malaysia puts a price on GHG emissions, sending an important signal about its resolve to address climate change. It would mark the implementation of a more active industrial policy, especially with regards to heavy industry, a sector that has not seen major policy interventions since the 1980s. It would also lay the foundation for future environmental-economic policy-making, which will likely also be applied to support decarbonisation, and investment in carbon offsets, in other sectors.

While following Singapore's approach and implementing a carbon tax might seem attractive, it may not best suit Malaysia's economic and political circumstances. Concentrating decision-making about carbon taxes in the hands of the government officials will make raising the quantum of tax politically challenging. This has been the case for almost every tax, levy or subsidy reduction effort in Malaysia in recent memory — they have been very difficult to raise, or remove.

A cap-and-trade system may therefore offer a more robust policy framework for implementing carbon pricing and a way to directly align emissions (cap) with the country's net zero aspiration. Once the initial goals and parameters of a carbon trading framework are agreed, carbon prices are set by the market, thus removing political pressure from the government to control prices. A well-regulated and transparent carbon market would also help market participants, including foreign investors, develop long-term plans.

An emissions trading system would also provide significant flexibility, and could be used to support a variety of decarbonisation objectives. The trading system could be designed to channel funds towards nature-based solutions, renewable energy, and to the decarbonisation of other economic sectors, once they are included into the system. International experience shows that there is a great variety in carbon market designs, as well as a tendency for such systems to expand and evolve. By raising the price of carbon, an emissions trading system could also push local steel players towards higher value added products, either as a way to increase their revenue relative to the carbon price, or to directly lower GHG emissions.

The basic calculations presented in this study suggest that a low carbon tax is unlikely to incentivise significant changes in the steel industry. While the exact price needed to incentivise a shift in steel production depends on a variety of factors, including the cost of renewable energy, cost of capital, and technological developments, we estimate that GHG emissions should be priced at around RM200 per tonne CO_2e in 2030 to provide an incentive for producers to shift towards low-emissions steel production. This figure is lower than the cost of some CCS projects, but around four times higher than the current price of carbon offsets traded on the BCX. While carbon pricing would increase the cost of steel in Malaysia, the cost increase is negligible for the automotive and offshore equipment industries, although the construction industry could face price increases, especially if carbon and steel prices rise abruptly.

Given the current international trade environment, Malaysia could consider the implementation of an EU-style CBAM for steel to avoid carbon leakage. The implementation of CBAM is usually seen as incompatible with a carbon pricing scheme with free emission permits for domestic producers. Under 'national treatment' trade principles imported and domestically produced steel should be treated equally, and this includes carbon pricing policies. Hence, the government can also consider imposing carbon pricing on all steel produced and imported into Malaysia. The subsequent revenue collected could be used to minimise socially and economically adverse inflationary effects.

Carbon pricing for the steel industry has the potential to kickstart one important policy tool in Malaysia's decarbonisation policy agenda. For this to happen, Malaysian policymakers and stakeholders would benefit from implementation of a bold and comprehensive emissions trading scheme that maximises spillovers to other sectors (renewable energy, hydrogen, nature-based solutions, etc.) while providing strong incentives for the industry to push for high value-added steel production in Malaysia.

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Appendix: Economic Analysis of Steel Technologies

Table A1: Reference Prices

Item	Price	Source
Steel bars	2,436 RM/tonne	Malaysia Steel Institute, December 2024[8]
Scrap	1,341 RM/tonne	Malaysia Steel Institute, December 2024
Iron ore	458 RM/tonne	Malaysia Steel Institute, December 2024
Metallurgical coal	842 RM/tonne	GMK Center, February 2025[9]
Electricity Peninsula 2025	45.62 sen/kWh	Tenaga Nasional, January 2025[10]
Electricity Sarawak 2025	28 sen/kWh	Sarawak Energy[11]
Solar-with-Storage 2030	29 sen/kWh	Bloomberg NEF[12]
Transmission charge 2025	15 sen/kWh	Tenaga Nasional CREAM, March 2025[13]
Natural gas	42.07 RM/MMbtu	Petronas, October 2024[14]
Sarawak Green Hydrogen 2030	19.53 RM/kg	Bloomberg NEF[15]
Sarawak Green Hydrogen 2050	8.78 RM/kg	Bloomberg NEF

Exchange rate used: US$ 1 = RM 4.50

Table A2: Input and Emissions Assumptions (per tonne of steel)

	BF[16]	EAF[17]	NG-DRI-EAF	H2-DRI-EAF
Scrap Iron ore Metallurgical coal	125 kg 1,370 kg 780 kg	1,100 kg – -	125 kg* 1,370 kg* –	125 kg* 1,370 kg* –
Electricity	–	2.5 GJ	–	2.5 GJ**
Natural gas[18]	–	–	17.1 GJ	–
Hydrogen[19]	–	–	-	54 kg
Direct emissions[20]	1.2 tonne	0.1 tonne	1.0 tonne	0.1 tonne**
Indirect emissions	1 tonne	varies	0.4 tonne	varies

** assumption made based on material use for BF*
*** assumption made based on energy consumption and emissions of EAF*

8. https://malaysiasteelinstitute.com
9. https://gmk.center/en/posts/global-coking-coal-prices-fell-at-the-beginning-of-the-year
10. https://theedgemalaysia.com/node/741680
11. https://www.sarawakenergy.com/investors/tariff-structure
12. https://assets.bbhub.io/professional/sites/24/Malaysia-A-Techno-Economic-Analysis-of-Power-Generation.pdf
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14. https://www.petronas.com/mpm/malaysia-e-p/gas-pricing
15. https://assets.bbhub.io/professional/sites/24/Malaysia-A-Techno-Economic-Analysis-of-Power-Generation.pdf
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17. https://www.agora-industry.org/fileadmin/Projekte/2021/2021-06_IND_INT_GlobalSteel/A-IND_324_Low-Carbon-Technologies_WEB.pdf
18. https://ieefa.org/sites/default/files/2022-06/steel-fact-sheet.pdf
19. https://eurometal.net/lhyfe-foresees-54kg-green-hydrogen-per-tonne-requirement/
20. https://ieefa.org/sites/default/files/2022-06/steel-fact-sheet.pdf

Table A3: Basic Cost Estimates (RM) without carbon pricing

	BF	EAF	NG-DRI-EAF	H2-DRI-EAF
Scrap Iron ore Metallurgical coal	167.63 627.46 656.37	1,475.10 – –	167.63 627.46 –	167.63 627.46 –
Electricity (Peninsula)	–	316.81	–	316.81
Natural gas	–	–	758.91	–
Hydrogen (2030)	–	–	–	1054.62
Capital cost*	170.52	73.08	194.88	194.88
Other costs**	500			
Total cost**	2,121.98	2,364.99	2,248.88	2,280.89
Margin per tonne**	314.03 (13%)	71.01 (3%)	187.12 (8%)	155.11 (6%)

** Capital expenditure based on the estimated Levelized Cost of Steel (LCOS), 7% for BF, 3% for EAF and 8% for DRI.[21]*
*** Based on a very rough assumption, which includes costs such as labor, maintenance, taxes, and other overheads and operating expenses, and which is assumed to be equal for all steel production types.*

***Note:** The above calculations were compared to those by the China Iron & Steel Research Institute Group (CISRI), Beijing (1 June 2025). CISRI's calculations exclude capital cost and fixed cost. CISRI estimates BF production at RM1,746.67 per tonne and EAF 100% scrap at RM2025.80 per tonne. This places the gap between the two technologies at RM279.13. Our calculations suggest a gap of RM243.01. If using CISRI's estimate, BF-EAF production cost parity under carbon pricing would occur at a price of around RM180 per tonne. Under our calculations it would occur at a price of around RM160 per tonne (see figure 1).*

Table A4: GHG Emissions Cost (RM/tonne of steel)

Carbon Price	Kuamut Project (Bursa VCM)	Kuamut Project x4	Kasawari CCS (US$ 65)[22]	EU 2030 (€ 149)[23]
RM per tonne	50	200	293	715
BF	110.00	440.00	644.60	1,573.00
EAF Peninsula*	32.38	129.50	189.72	462.96
EAF Sarawak*	26.95	107.80	157.93	385.39
EAF 100%-RE	2.00	8.00	11.72	28.60
NG-DRI-EAF	70.00	280.00	410.20	1,001.00
H2-DRI-EAF	5.00	20.00	29.30	71.50

** Grid emissions intensity of 0.79 kg CO_2e / kWh for Peninsula, 0.21 kg CO_2e / kWh for Sarawak[24]*

[21]. https://transitionasia.org/wp-content/uploads/2024/07/Green_Steel_Economics_240725.pdf; https://transitionasia.org/challenge-of-decarbonisation-malaysia/
[22]. https://cdn.ihsmarkit.com/www/pdf/0423/Upstream-CCUS-Overview-04-2023.pdf
[23]. https://about.bnef.com/blog/europes-new-emissions-trading-system-expected-to-have-worlds-highest-carbon-price-in-2030-at-e149-bloombergnef-forecast-reveals/
[24]. https://myenergystats.st.gov.my/documents/d/guest/grid-emission-factor-gef-in-malaysia (2022)

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