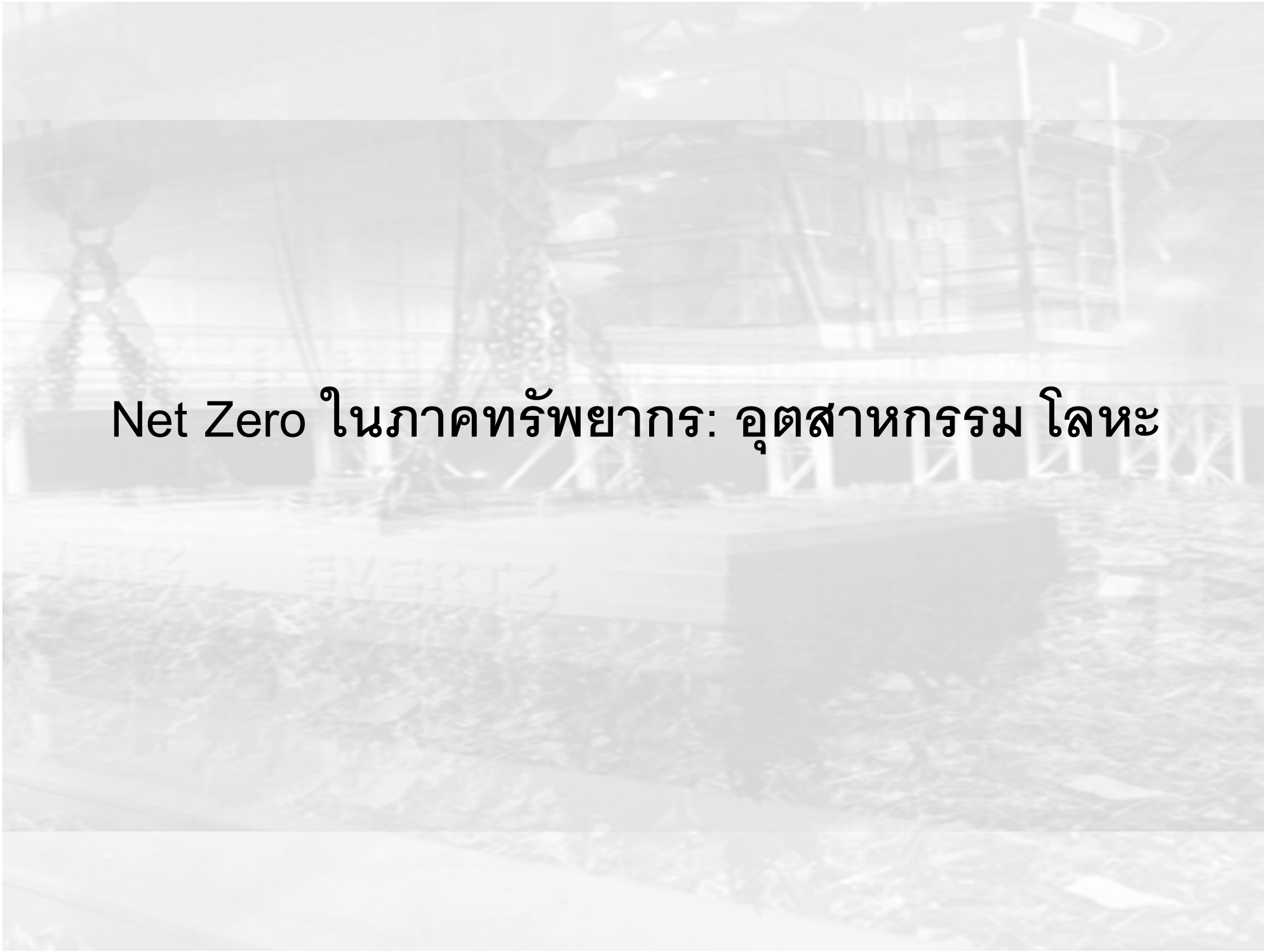


Net Zero ในภาคทรัพยากร: อุตสาหกรรม โลหะ

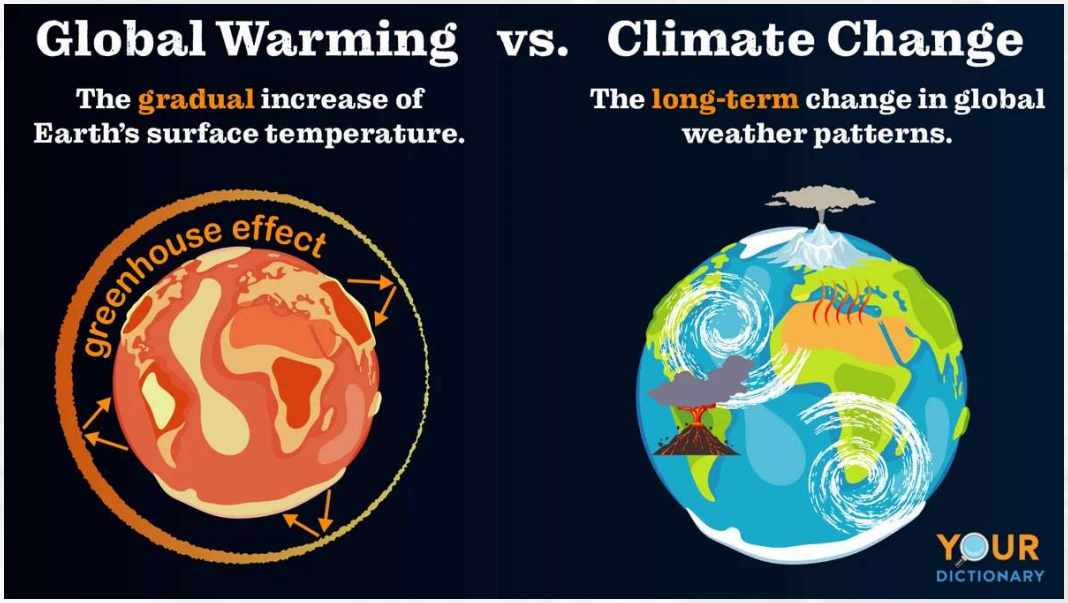
Climate Change and Global Warming

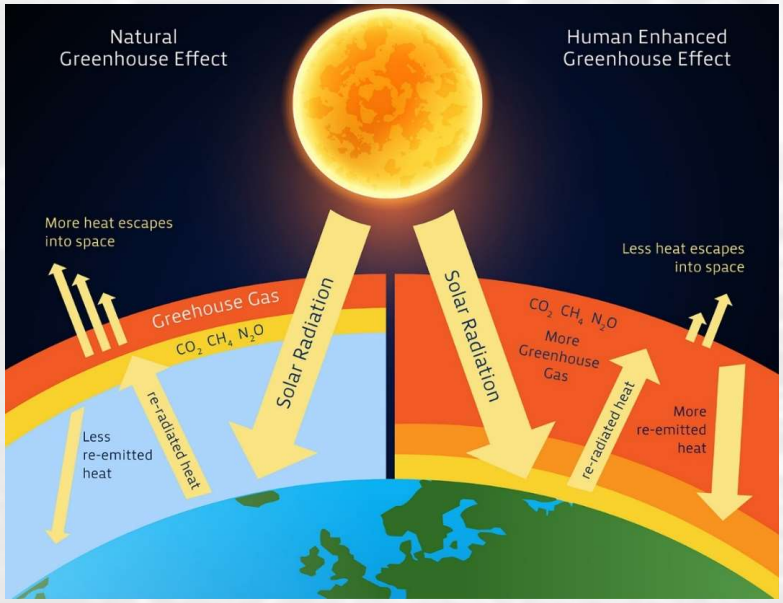
What Is Climate Change?

Climate change covers a wide range of changes in the weather, climate, and surface temperatures of the Earth.[7]

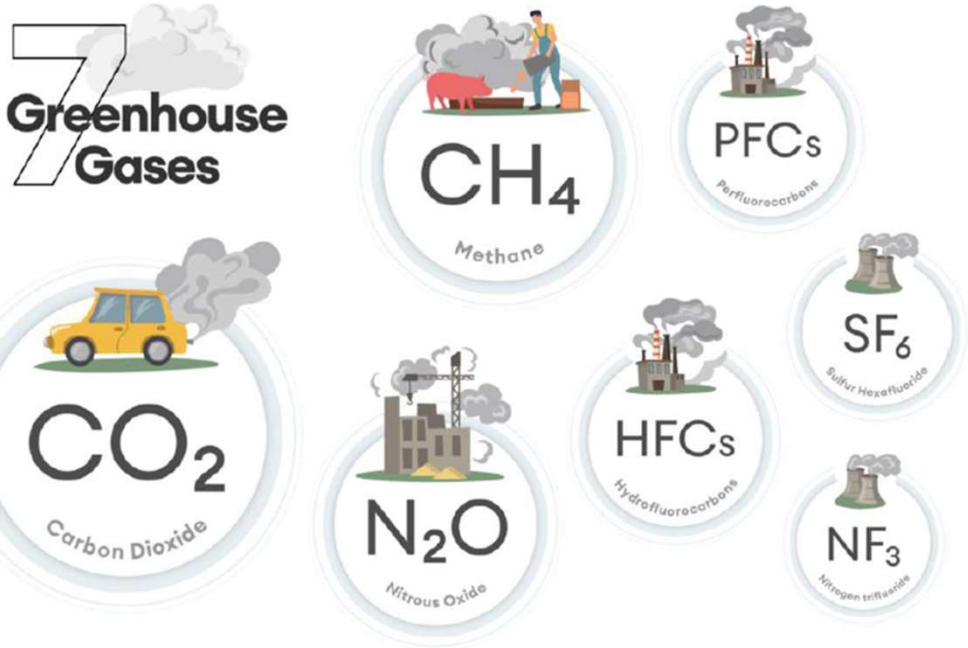
What Is Global Warming?

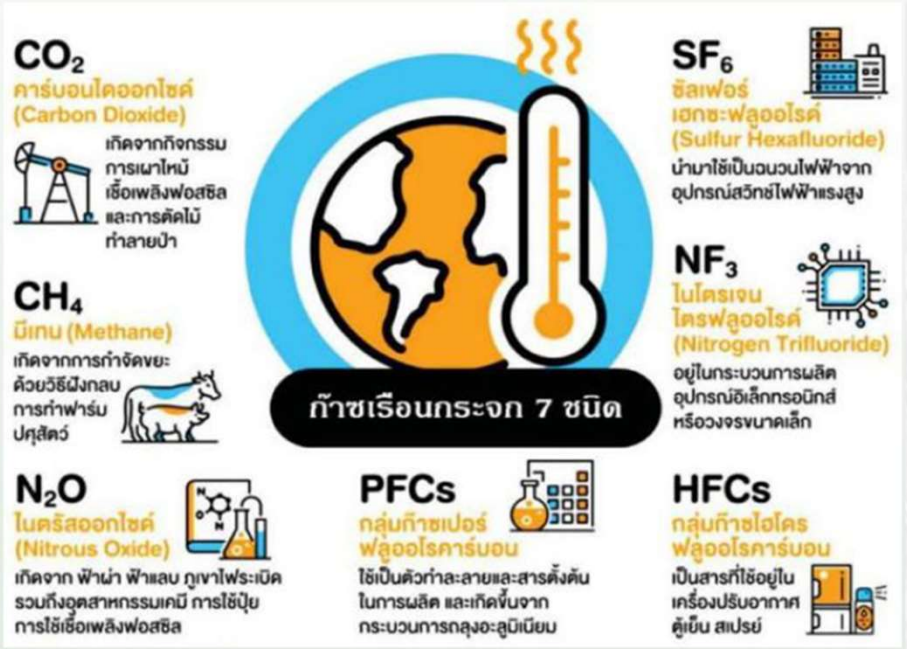
Global warming is the result of a buildup in **greenhouse gases** that traps heat in the lower atmosphere of the Earth. This results in a gradual increase in average temperatures around the world.



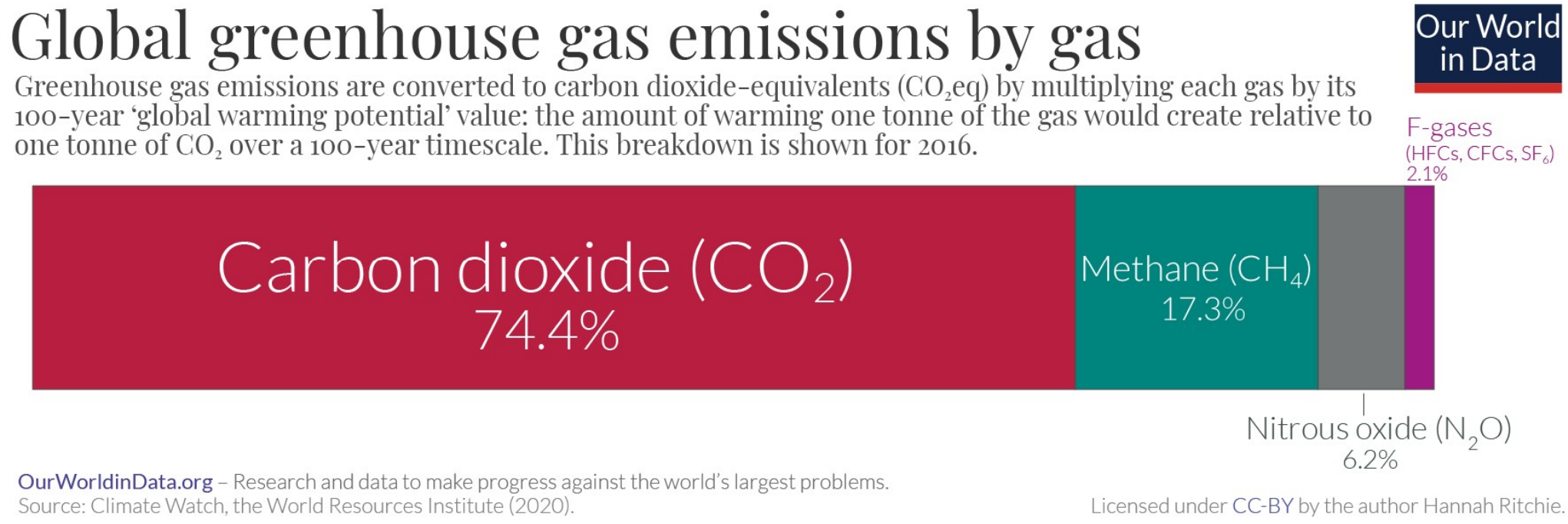


7 Greenhouse Gases: Named in Kyoto Protocol





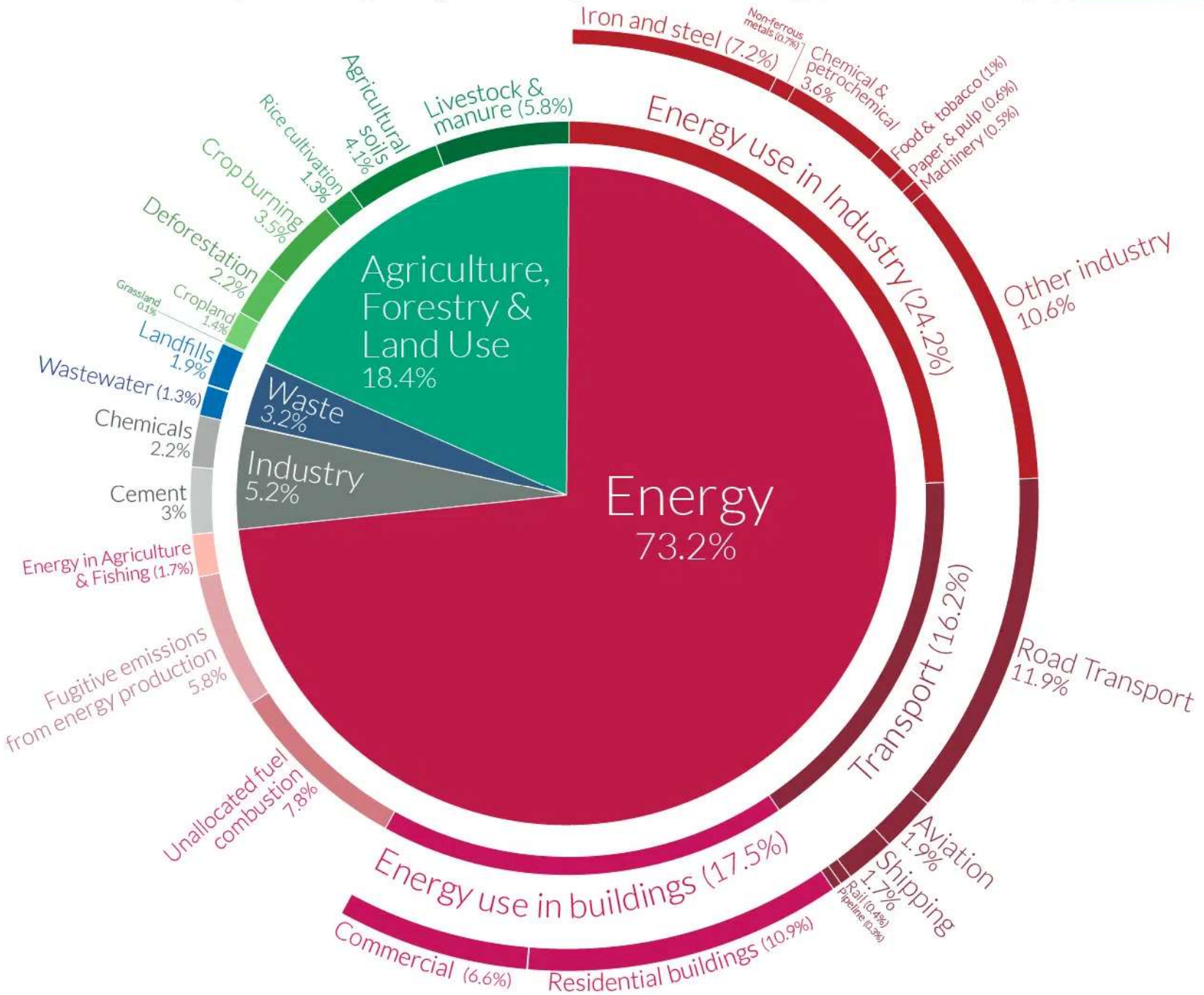
Why CO2 ? Why “net zero carbon”



Global greenhouse gas emissions by sector

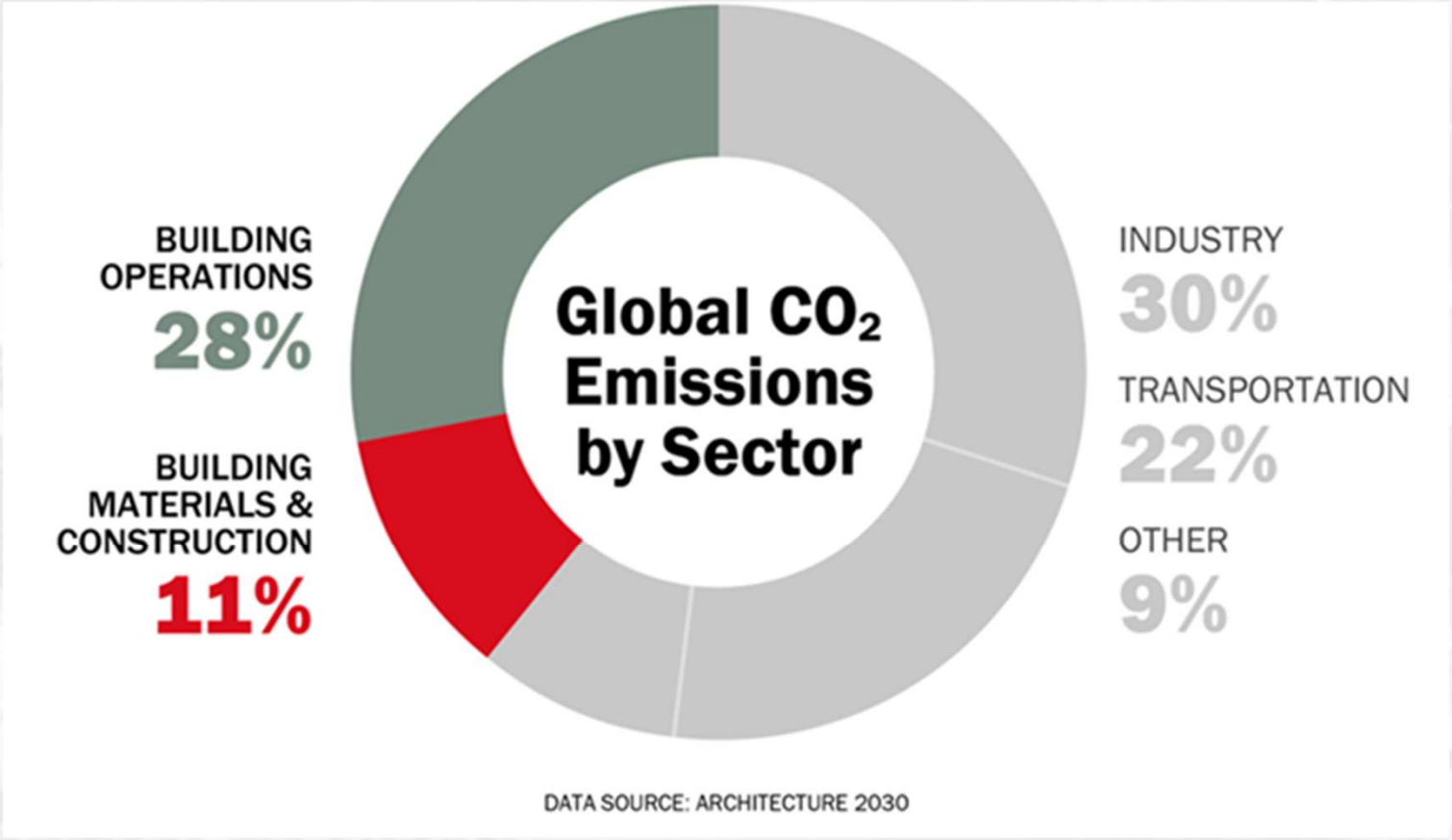
This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO_2eq.

Our World in Data



OurWorldinData.org – Research and data to make progress against the world's largest problems.
Source: Climate Watch, the World Resources Institute (2020).
Licensed under CC-BY by the author Hannah Ritchie (2020).

Global CO_2 emission by sector



Building and construction accounts for 39%

while 11% came from construction phase and materials

Operational Carbon

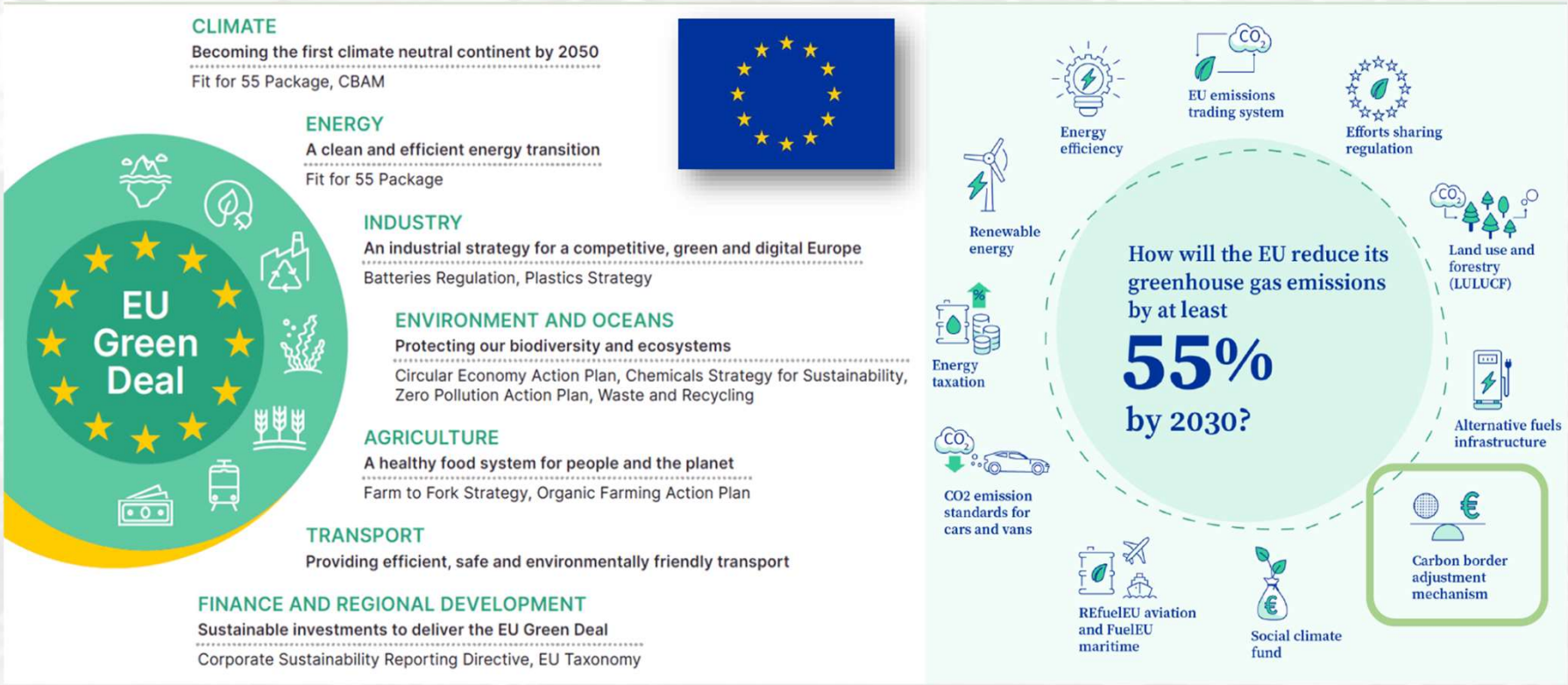
Building and Operations โดยหลักอยู่ใน Scope 1 และ Scope 2

Embodied Carbon

Materials and Construction ถือเป็น Scope 3

European Green Deal

The European Green Deal is the EU's growth strategy. Launched in 2019, it consists of a package of policy initiatives, which set the EU on the path to a green transition, with the ultimate goal of reaching climate neutrality by 2050.



Carbon Border Adjustment Mechanism (EU CBAM)

Carbon border adjustment mechanism is expected to be a tool **to counter carbon leakage**

a situation when industries with GHG emissions shift production outside of the EU to jurisdictions with lower climate policy standards than those of the EU it will help to reduce emission globally while providing level playing field for businesses

How will CBAM work

EU CBAM Goods

Initial phase

In the first phase CBAM would cover sectors with high carbon emissions and high risk of carbon leakage


iron and steel


cement


fertilisers


aluminium


hydrogen production


electricity

Future Expansion

paper, ceramics, glass, plastics, chemicals, petroleum, non-ferrous metals, rubber, and gases

Embedded emission : System Boundary for Iron &Steel Product

DIRECT EMISSIONS

INDIRECT EMISSIONS

SCOPE 1

Direct emissions from our sites

- Fuel combustion
- Process emission

SCOPE 2

Indirect emissions
Energy purchased

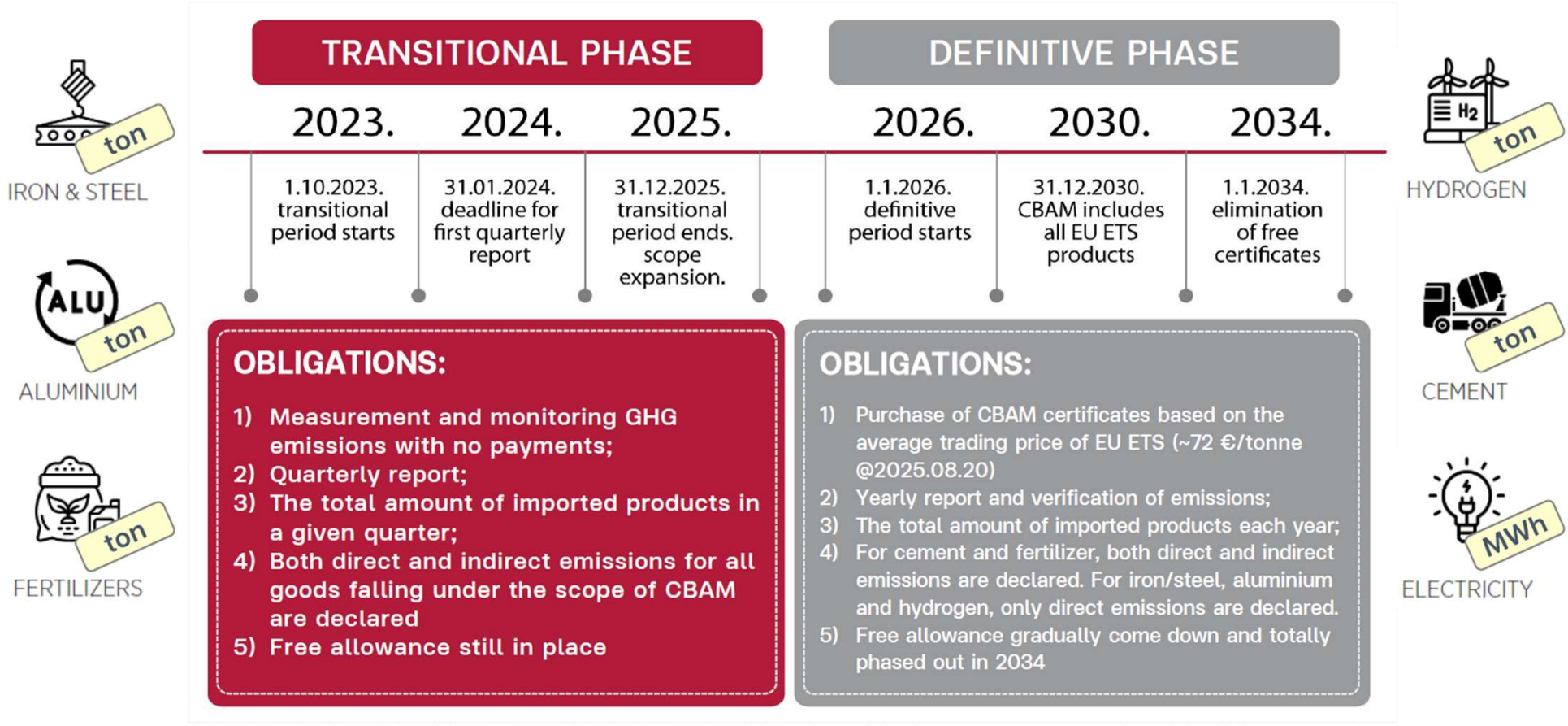
- Electricity

SCOPE 3

Indirect emissions
Precursor

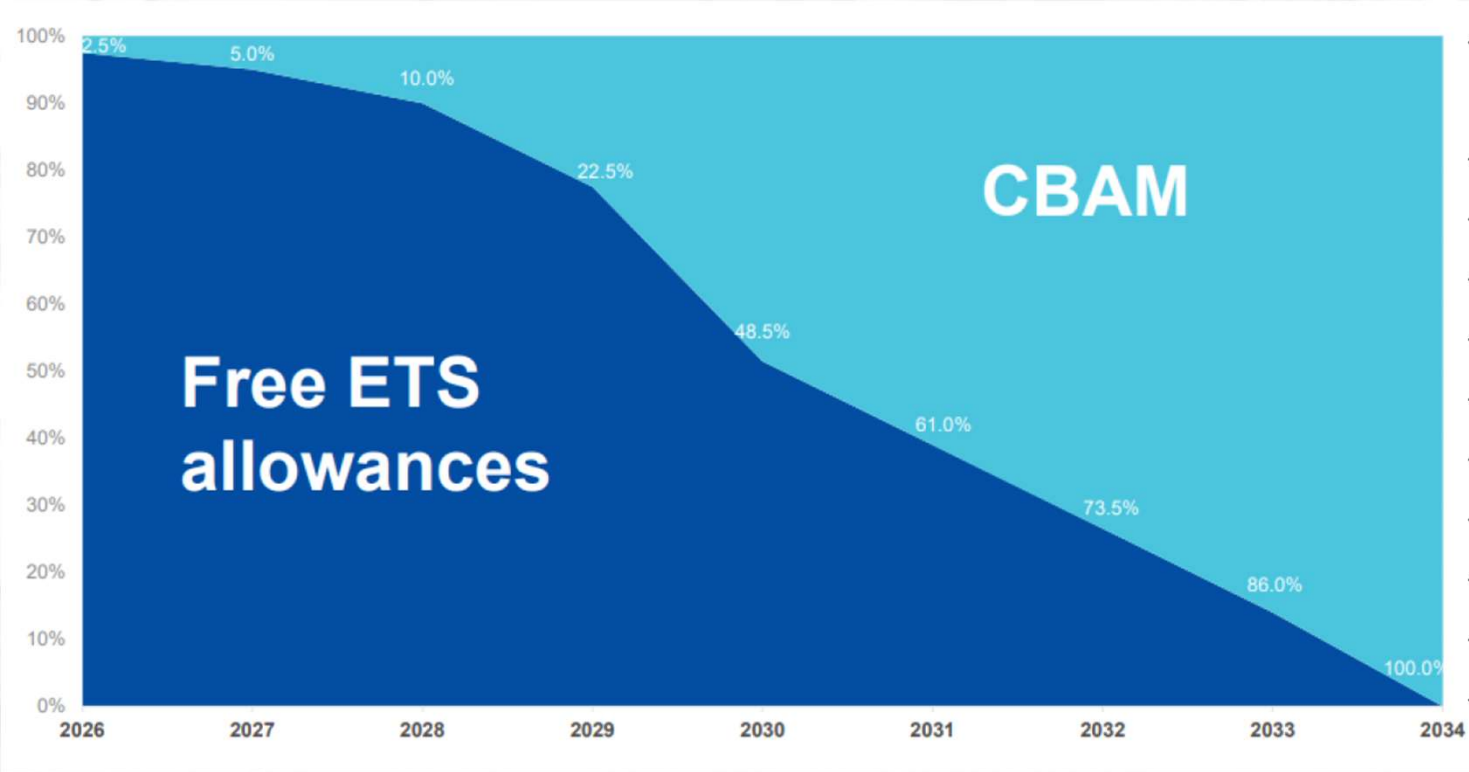
- Pig Iron, Ferro Alloys

EU-CBAM Implement Timeline



EU ETS Products: 1) Energy and heat generation 2) Energy intensive industry sectors, including oil refineries, steel works, and production of iron, aluminium, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids, bulk organic chemicals 3) Aviation and maritime shipping

EU CBAM phase in/Free allocation phase out

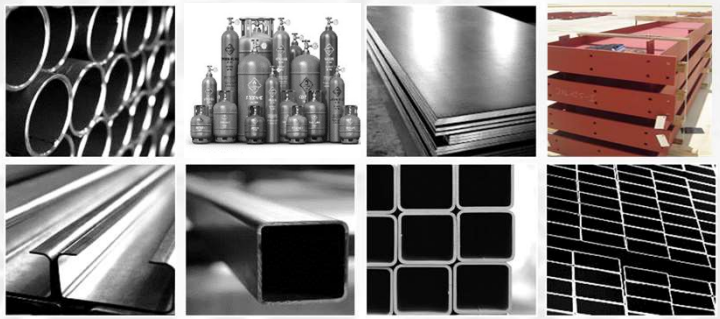


Year	Proportion of reported emissions
2026	2.5%
2027	5%
2028	10%
2029	22.5%
2030	48.5%
2031	61%
2032	73.5%
2033	86%
2034	100%

การจำแนกเหล็กประเภทต่าง ๆ

Flat Product

ทรงแบน

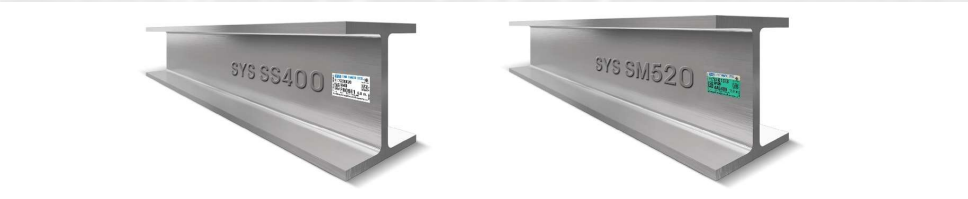


Long Product

ทรงยาว

Section

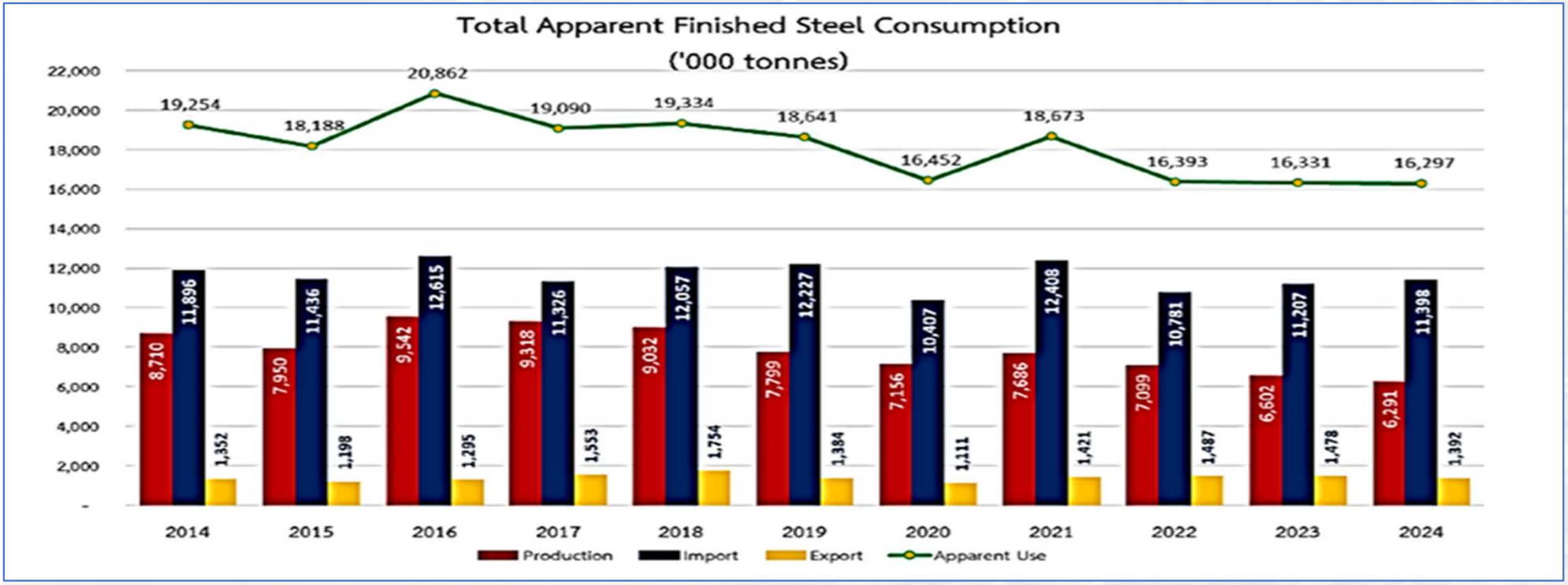
รูปพรรณ



Thailand steel industry situation

สถาบันเหล็กและเหล็กกล้าแห่งประเทศไทย
IRON AND STEEL INSTITUTE OF THAILAND

Item (Unit in tons)	Jan – Oct 24	Jan – Oct 25	% y-o-y
Finished Steel Production	5,425,070	6,649,896	22.6%
Finished steel Consumption	13,800,078	15,399,855	11.6%
Imports of finished steel	9,513,898	10,089,379	6.0%
Exports of finished steel	1,138,890	1,339,420	17.6%



THAILAND FINISHED STEEL

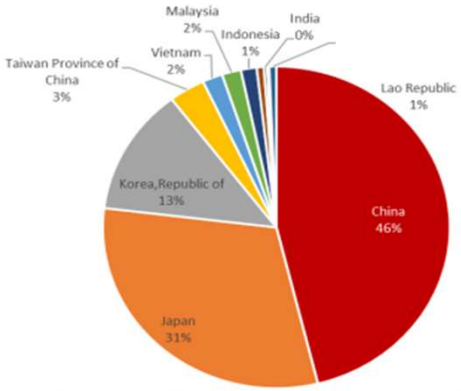
สถาบันเหล็กและเหล็กกล้าแห่งประเทศไทย
IRON AND STEEL INSTITUTE OF THAILAND

"IMPORT MARKET"

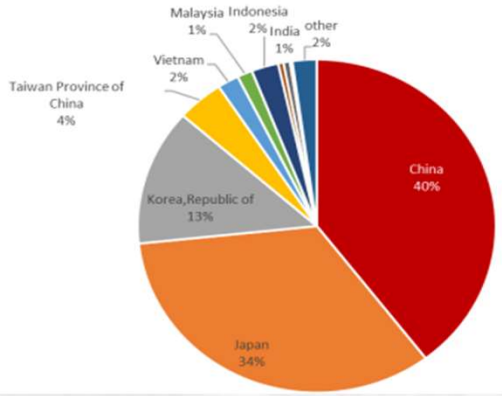
Quantity (tonne) | Value (Million baht)

Counrty	Import Quantity (tonne)		% y-o-y	% share of import Jan-Oct 2025	Import Value (Million Baht)		% y-o-y	% share of import Jan-Oct 2025
	Jan-Oct 24	Jan-Oct 25			Jan-Oct 24	Jan-Oct 25		
China	4,136,818	4,656,416	12.6%	46%	117,945	113,627	-3.7%	40%
Japan	3,125,996	3,104,141	-0.7%	31%	110,655	96,789	-12.5%	34%
Korea,Republic of	1,148,109	1,288,611	12.2%	13%	40,186	37,945	-5.6%	13%
Taiwan Province of China	312,711	339,406	8.5%	3%	13,446	12,140	-9.7%	4%
Vietnam	135,157	189,816	40.4%	2%	4,568	5,547	21.5%	2%
Malaysia	271,381	179,472	-33.9%	2%	6,519	3,953	-39.4%	1%
Indonesia	156,068	148,472	-4.9%	1%	7,205	7,002	-2.8%	2%
Lao Republic	47,879	66,424	38.7%	1%	1,060	1,368	29.0%	0%
India	46,921	31,158	-33.6%	0%	2,413	1,675	-30.6%	1%
Cambodia	41,360	19,020	-54.0%	0%	1,602	617	-61.5%	0%
other	91,498	66,437	-27.4%	1%	8,065	6,294	-22.0%	2%
Total	**9,513,898**	**10,089,373**	**6.0%**	**100%**	**313,664**	**286,957**	**-8.5%**	**100%**

ตลาดนำเข้าผลิตภัณฑ์เหล็กสำเร็จรูป ม.ค-ต.ค. ปี 2025 (ปริมาณ)



ตลาดนำเข้าผลิตภัณฑ์เหล็กสำเร็จรูป ม.ค.-ต.ค. ปี 2025 (มูลค่า)



THAILAND FINISHED STEEL

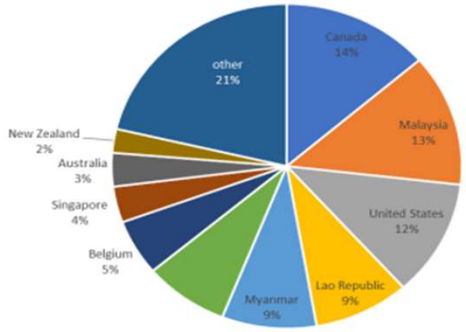
สถาบันเหล็กและเหล็กกล้าแห่งประเทศไทย
IRON AND STEEL INSTITUTE OF THAILAND

"EXPORT MARKET"

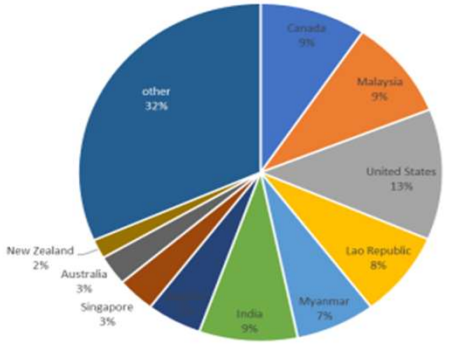
Quantity (tonne) | Value (Million baht)

Counrty	Export Quantity (tonne)		% y-o-y	% share of export Jan-Oct 2025	Export Value (Million Baht)		% y-o-y	% share of export Jan-Oct 2025
	Jan-Oct 24	Jan-Oct 25			Jan-Oct 24	Jan-Oct 25		
Canada	102,193	182,981	79.1%	14%	2,445	3,933	37.8%	9%
Malaysia	177,126	176,355	-0.4%	13%	4,648	3,948	-17.7%	9%
United States	160,208	155,123	-3.2%	12%	6,201	5,211	-19.0%	13%
Lao Republic	76,134	118,623	55.8%	9%	2,163	3,400	36.4%	8%
Myanmar	104,988	117,111	11.5%	9%	3,059	2,949	-3.7%	7%
India	75,122	105,152	40.0%	8%	3,381	3,641	7.1%	9%
Belgium	10,205	74,157	626.7%	6%	843	2,030	58.5%	5%
Singapore	42,926	48,007	11.8%	4%	2,473	1,407	-75.8%	3%
Australia	64,190	44,770	-30.3%	3%	2,160	1,187	-81.9%	3%
New Zealand	20,968	31,835	51.8%	2%	614	764	19.7%	2%
other	304,828	285,304	-6.4%	21%	14,883	13,136	-13.3%	32%
Total	**1,138,888**	**1,339,419**	**17.6%**	**100%**	**42,870**	**41,608**	**-3.0%**	**100%**

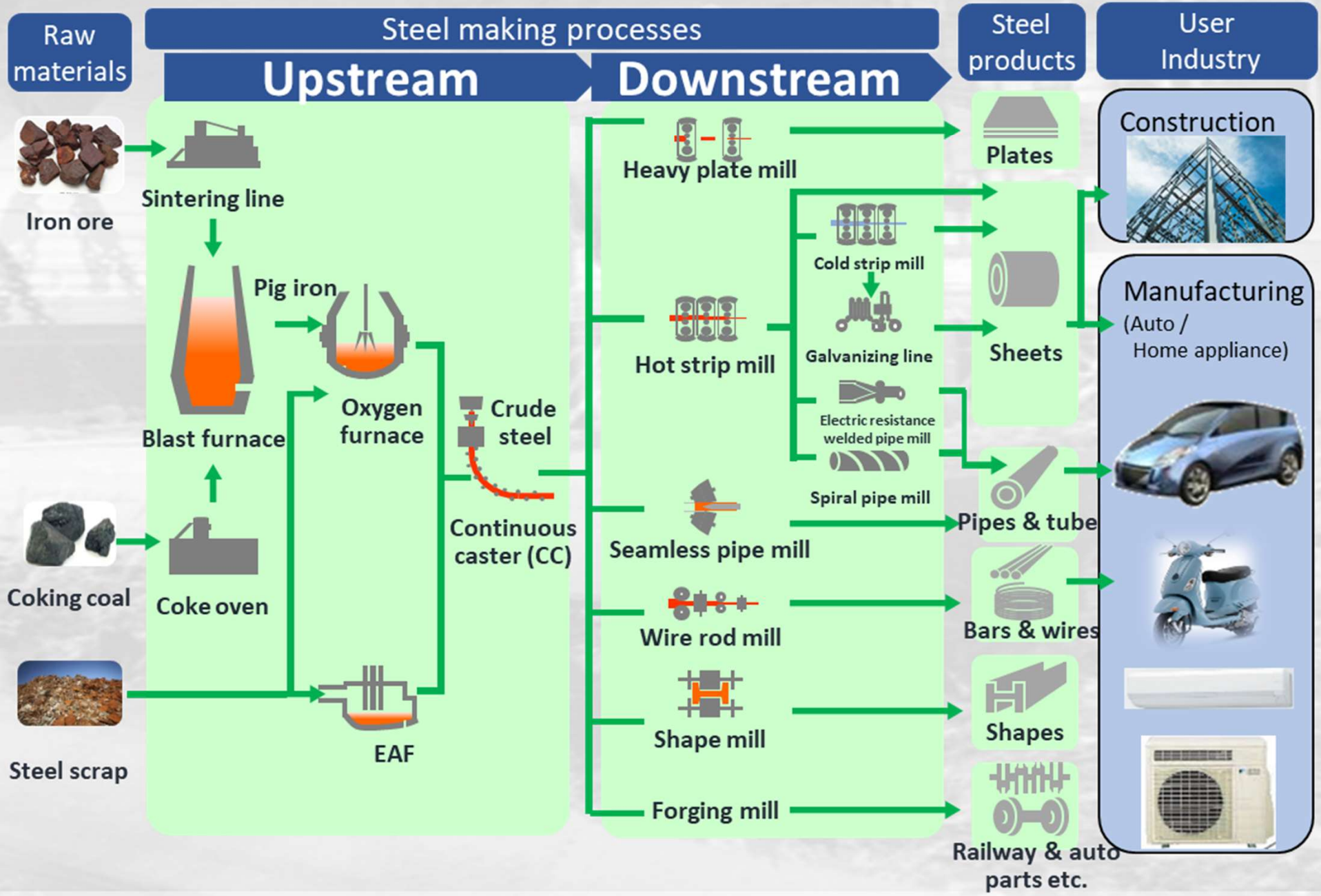
ตลาดส่งออกผลิตภัณฑ์เหล็กสำเร็จรูป ม.ค.-ต.ค.ปี 2025 (ปริมาณ)



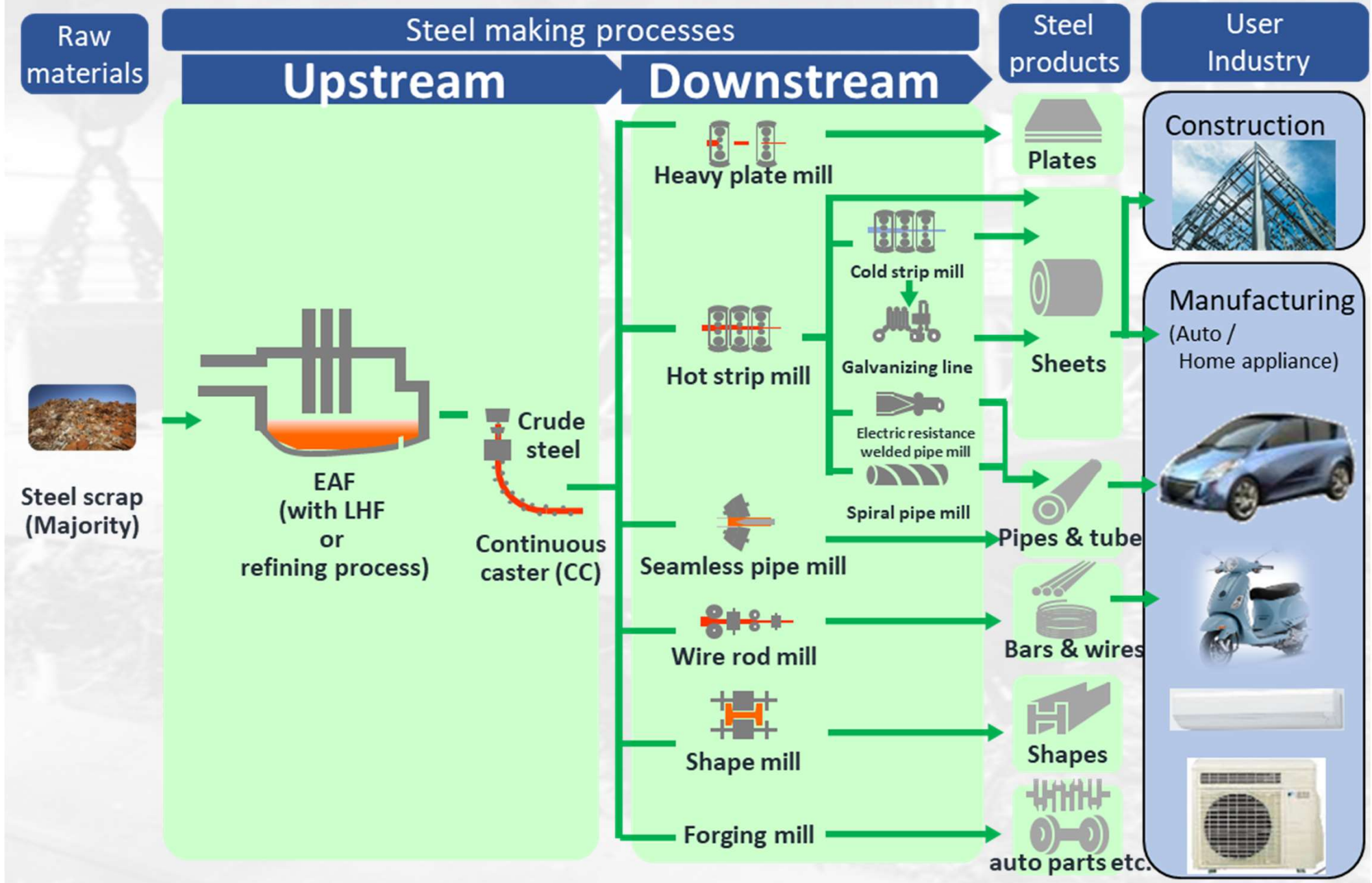
ตลาดส่งออกผลิตภัณฑ์เหล็กสำเร็จรูป ม.ค.-ต.ค. ปี 2025 (มูลค่า)



STEEL Manufacturing Structure



STEEL Manufacturing Structure (in Thailand)



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION | NET ZERO PARTNERSHIP

Why countries should integrate industries into their NDCs

Industrial emissions are rising fast, particularly for heavy industries

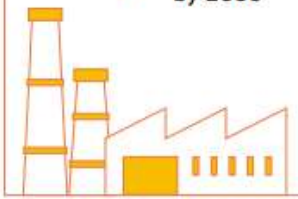
Since **2020**, **INDUSTRIAL EMISSIONS** have grown faster than in any other sector and **continue to rise every year.**[1]

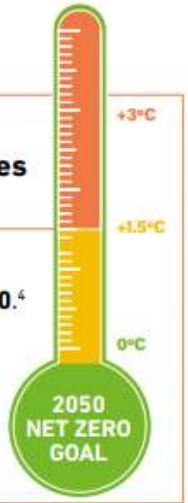
STEEL, **CEMENT** and **CHEMICALS** account for **70%** of **industrial GHG emissions.**[2]

65% of **industrial energy** is **FOSSIL-FUEL BASED.**[3]

To keep 1.5°C in reach, emissions from heavy industries should fall by

20% by **2030** & **90%** by **2050.**[4]





Transition to net-zero industries requires massive investment

DECARBONIZING STEEL requires up to **USD 335 billion** of cumulative **investment** by **2050.**[5]

DECARBONIZING CEMENT requires **USD 30 billion** in additional capital expenditure and **USD 300 billion** for **infrastructure** by **2050.**[5]

DEVELOPING COUNTRIES will need up to **USD 2.5 trillion annually** for **climate-related investments** by **2030.**[6]

Investment needs are not yet investment opportunities

Limited market readiness of breakthrough technologies and related infrastructure.

Long lifetime of assets, high investment costs and technology risks.

Insufficient policies and low demand for low-carbon industrial products.

66% of **business executives report** that investment and infrastructure are the most **urgent barriers for net-zero transition.**[10]

90% of **businesses** say they would invest more if governments **implemented policies** to address sector specific barriers.[10]

This decade is decisive for industry decarbonization, especially for developing countries

THE NEXT 10 YEARS ARE CRITICAL

30% of **emissions-heavy** assets will **need upgrades or replacements by 2030.**[7]

2050 IS ONLY ONE INVESTMENT CYCLE AWAY.

75% of the **GLOBAL URBAN INFRASTRUCTURE that will exist in 2050** is yet to be built, with most of this growth in developing countries.[8]

This next round of NDCs should be powerful blueprints to build a thriving low-carbon manufacturing sector, reaping long-term national benefits.

[1] Next Generation NDCs, Opportunities in the Industry Sector in NDCs, World Resources Institute, 2024 [2] Achieving Net Zero Heavy Industry Sectors in G7 Members, IEA, 2022 [3] Direct use of energy, Energy System, Energy Supply & Transformation, IEA, 2024 [4] Steel and Cement Can Drive the Decade of Action on Climate Change, Industrial Analytics Platform, 2022 [5] IFIs and Heavy Industry Decarbonization in Emerging and Developing Economies, LeadIT, 2023 [6] Making Net-Zero Steel Possible, Mission Possible Partnership, 2022 [7] The New Collective Quantified Goal on Climate Finance, OECD, 2024 [8] Net Zero Emissions by 2050 Scenario, IEA, 2024 [9] 4th Summit Report, Global Infrastructure Basel, 2014 [10] Business Breakthrough Barometer, WBCSD, 2024

What is the average CO2 intensity of the steel industry

GHG emission intensity in 2024

	BF-BOF (Scrap use – 10%)	Scrap-EAF (Scrap use >70%)	DRI-EAF (Scrap use <30%)	Global
Original Indicator	**2.34**	**0.69**	**1.47**	**1.92**
Direct CH_4 and N_20 (GWP 100)	0.09	<0.01	<0.01	–
Upstream mining $C0_2$ only	<0.01	<0.01	0.01	–
Upstream mining CH4 and N20 (GWP 100)	0.23	0.03	0.18	–
Expanded indicator	2.66	0.71	1.66	2.18

Sustainability Indicators Report 2025
Sustainability performance of the steel industry
WORLD STEEL ASSOCIATION

“Defining low-carbon emissions steel: A comparative analysis of international initiatives and standards”

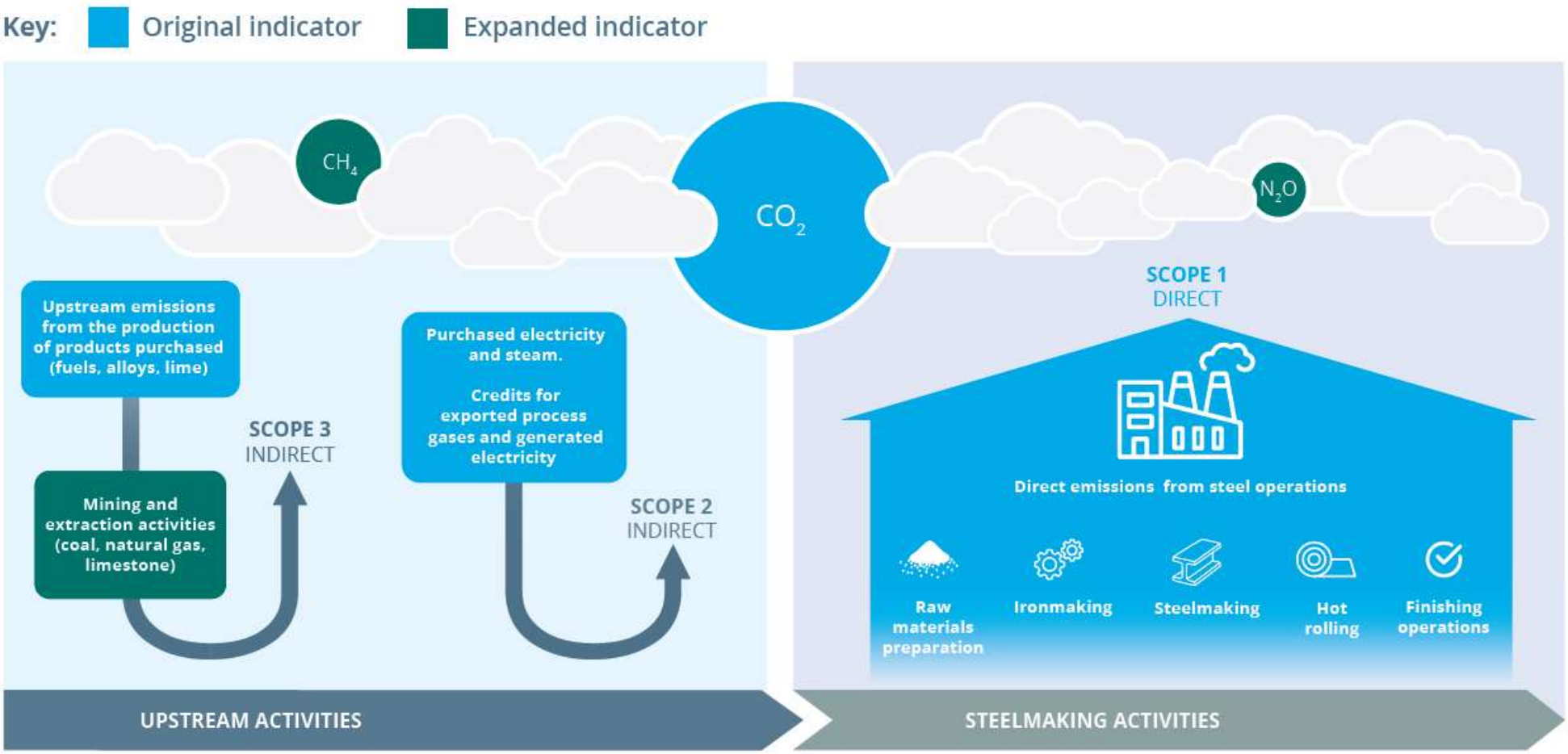
The topic of “green steel” or “low-carbon emissions steel” has gained considerable attention in recent years. As a significant contributor to global greenhouse gas (GHG) emissions, the steel industry is under pressure to transform. Currently, the industry is **responsible for 7% of global GHG emissions annually and is the largest industrial consumer of coal, which supplies around 75% of its energy demand** (IEA, 2020).

In the EU, steel is primarily produced through two main routes: the **Blast Furnace-Basic Oxygen Furnace (BF-BOF)** route, often referred to as the "primary" route, and the **Electric Arc Furnace (EAF)** route, known as "secondary" steelmaking. The BF-BOF route is used for virgin steel production, whereas the EAF is mainly used for recycling steel scrap. An alternative method of primary steel production is the **Direct Reduced Iron-Electric Arc Furnace (DRI-EAF)** route. However, this requires high-quality DRI pellets, whereas the BF-BOF route allows for greater flexibility in raw material inputs (EUROFER, n.d.; IEA, 2020). The **carbon intensity of these routes varies significantly**.

The global average CO_2 emissions intensity is 2.32 t CO_2 per tonne of crude steel cast for BF-BOF, compared to 0.70 t CO_2 for scrap-based EAF and 1.43 t CO_2 for DRI-EAF (World Steel Association, 2024). These figures illustrate the stark contrast in emissions between scrap-based production and ore-based steelmaking, highlighting the potential of increased circularity for reducing the industry’s carbon footprint.

Ref. European Commission

Expanded indicator vs original indicator



Transportation and downstream activities are not included in our scope 3 calculation.

Defining low-carbon emissions Steel:
A comparative analysis of international initiatives and standards

The topic of **"green steel"** or "low-carbon emissions steel" has gained considerable attention in recent years. As a significant contributor to global greenhouse gas (GHG) emissions, the steel industry is under pressure to transform. Currently, the industry is responsible for 7% of global GHG emissions annually and is the largest industrial consumer of coal, which supplies around 75% of its energy demand (IEA, 2020).

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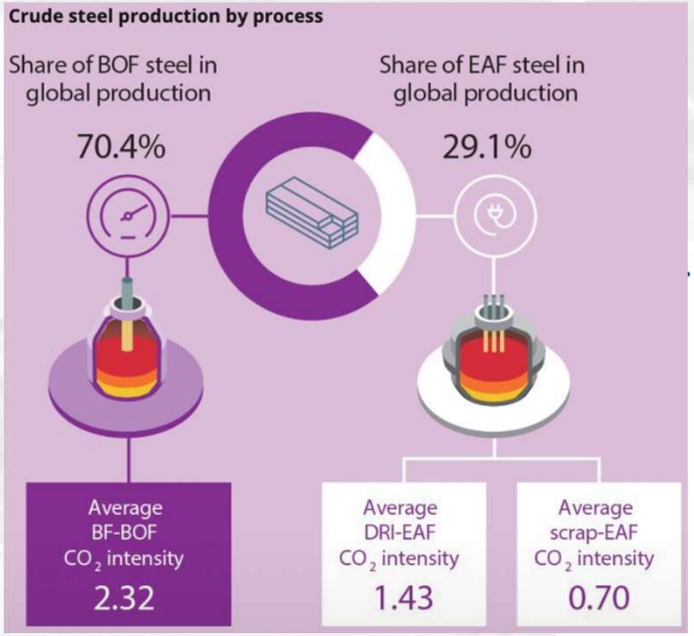
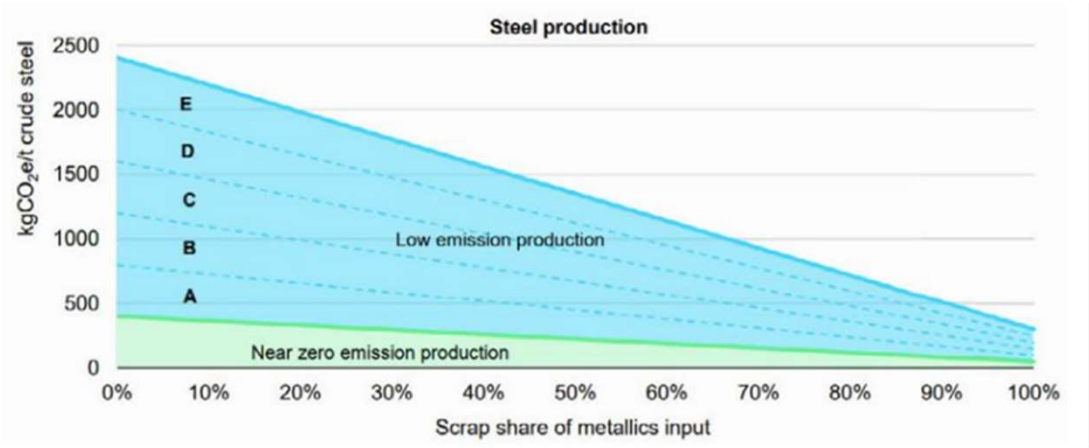


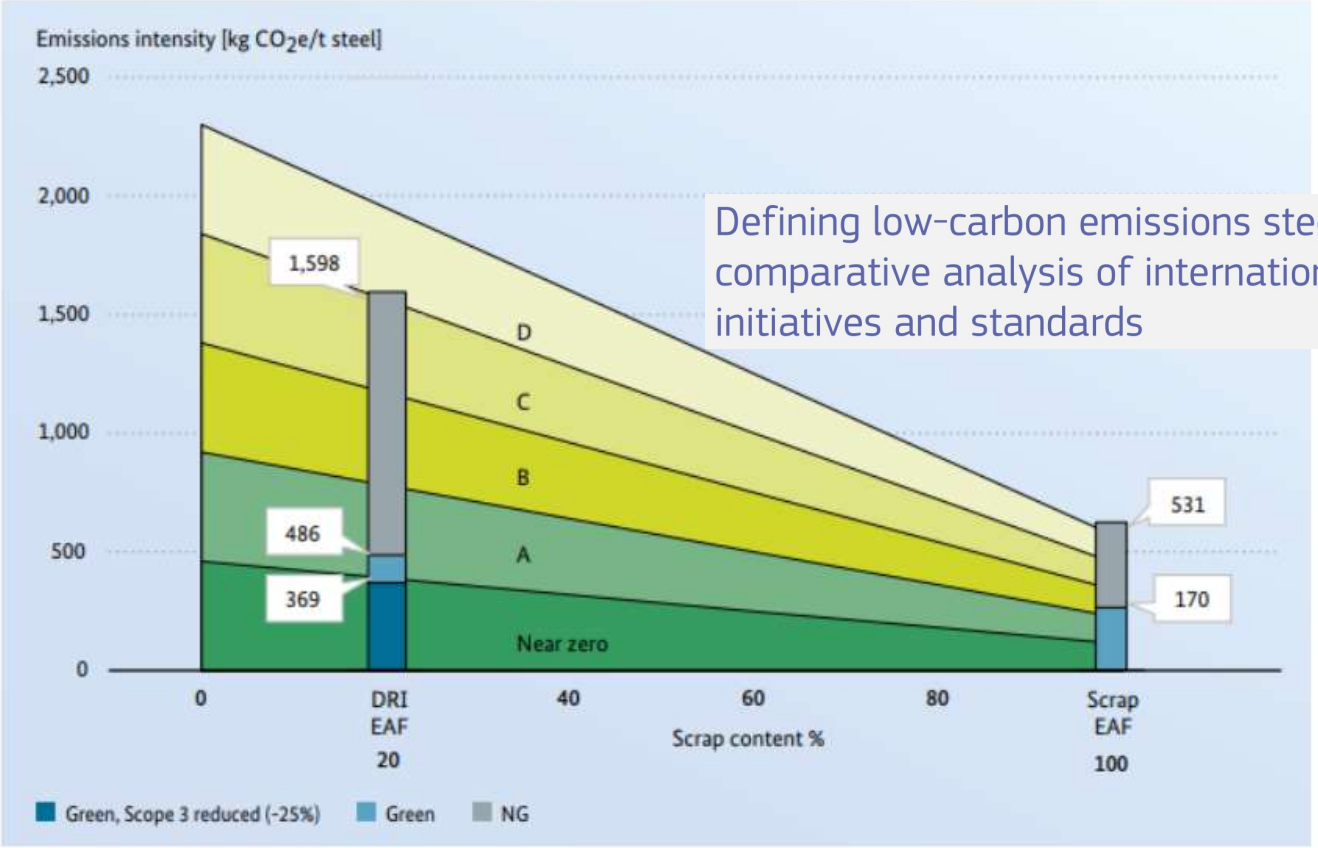
. The IEA's near zero emission crude steel production threshold and proposed classification system



Source: Achieving Net Zero Heavy Industry Sectors in G7 Members (IEA, 2022)

EAF Recycle benefits

Figure 9. Definition for Near Zero and Low Emissions for quality steel (BST) and structural and reinforced steel (BST)



Defining low-carbon emissions steel: A comparative analysis of international initiatives and standards

Source: Lead markets for climate-friendly basic materials (Guidehouse GmbH, Fraunhofer ISI, and Wuppertal Institute, 2023) on behalf of the German Federal Ministry for Economic Affairs and Climate Action (BMWK)

Ref. European Commission

ร่าง พ.ร.บ. การเปลี่ยนแปลงสภาพภูมิอากาศ พ.ศ. ....

*Department of Climate Change and Environment : DCCE

ร่างพระราชบัญญัติการเปลี่ยนแปลงสภาพภูมิอากาศ พ.ศ. ....

205 มาตรา 14 หมวด 1 บทเฉพาะกาล

นโยบายและแผน

หมวด 1
บททั่วไป

หมวด 2
เป้าหมายการดำเนินงาน
ด้านการเปลี่ยนแปลงสภาพภูมิอากาศของประเทศไทย

หมวด 3
คณะกรรมการนโยบาย
การเปลี่ยนแปลงสภาพภูมิอากาศ
แห่งชาติ

หมวด 5
แผนแม่บทรองรับ
การเปลี่ยนแปลงสภาพภูมิอากาศ
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A Timeline of Technologies for Decarbonizing Steel

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Steel production accounts for about 7% of global energy-related CO_2 emissions, largely due to a significant amount of the sector's energy coming from coal. Decarbonizing the sector is vital for climate goals and will require a mix of ready, emerging, and future solutions to cut emissions across the production line and reach near-zero by mid-century. Technology choices depend on local conditions (e.g. electricity mix, furnace age, scrap access, and finance availability).

SHORT-TERM

Widely available and can be **implemented now**

Energy & process efficiency

Basic maintenance, digital monitoring, and low-cost upgrades like waste heat recovery and efficient motors can improve energy use by 10 to 20 percent, especially in older plants in developing countries.

Partial fuel substitution in BF–BOF*

Where possible, partially replace coal with locally available biomass or green hydrogen to lower emissions without major infrastructural changes.

Improved scrap access

Enhance scrap collection, sorting, and recycling innovations to improve impurity removal and increase recycling rates. Scrap use is high in mature markets (EU, US, Turkey) but remains limited in rapidly growing economies where scrap supply is constrained.

Electrification of auxiliary processes

Moving additional processes such as steel reheating and finishing operations from fossil fuel-based to electricity-powered processes.

Electric arc furnace (EAF)

Uses electricity to melt scrap steel, with near-zero emissions if powered by low-carbon energy.

MEDIUM-TERM

Scaling up through pilots and early deployment **by 2030**

Hydrogen-based DRI + EAF

Replaces coal with hydrogen for iron ore reduction, then uses an EAF, cutting emissions by over 90%, if hydrogen and electricity are sourced from renewables. Pilots are concentrated in Europe and China, but scaling will depend on renewable energy access (e.g feasible in Brazil, but constrained in coal-heavy grids like South Africa).

Hydrogen-based DRI + smelter (BOF)

Hybrid route that combines DRI with basic oxygen furnaces, suitable for low-grade ores, however requires additional carbon input for BOF steelmaking.

Carbon capture & storage (CCS) on BF–BOF*

Captures up to 70% of CO_2 emissions from traditional plants. Requires complex retrofit and new infrastructure. Seen as transitional, with very limited projects advancing, particularly in Asia.

Hot briquetted iron (HBI) trade

Export-ready form of DRI for steelmaking countries with limited domestic hydrogen capacity.

LONG-TERM

Emerging technologies expected **post-2040**

Molten oxide electrolysis

Uses clean electricity to directly reduce iron ore at very high temperatures, without relying on carbon or hydrogen. This high-temperature approach sets it apart from other electrolysis methods. Efficient but still at an early pilot stage.

Alkaline electrolysis + EAF (AEL–EAF)

Solid-state (low temperature) direct electrolysis of iron ore, followed by EAF steelmaking. Well suited for the use of intermittent renewable energy.

Electrowinning processes

Electrochemical methods under development in Europe, the US, and Australia that reduce iron ore in solid form, without melting or using carbon.

Low-grade ore processing via electrolysis

Electrolysis pathways can handle ores not usable in traditional BF routes.

Material efficiency and circular economy: Design for reuse, recycling, and longevity while enabling systemic change to reduce steel demand to reduce steel demand and emissions.

Technologies marked with an asterisk () are considered transitional measures*

These measures should not be used to maintain or extend fossil-based steelmaking or delay the transition to near-zero emission technologies. Their role is transitional, limited to reducing emissions where cleaner alternatives are not yet viable, and must be paired with a clear phase-out of coal and a shift to solutions like scrap-based EAF and green hydrogen DRI.

In partnership with: Agora Industry

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