



Accelerating Decarbonization of Indonesia's Iron and Steel Industry in Ensuring Sustainable Infrastructure Development

Presenter:







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Status of Iron and Steel Industry in Indonesia

The performance of the industrial sector is the main support for the national economy and the second contributor to GHG emissions



IN 2022	
	16.48% GDP contribution
	70.67% export contribution (USD 206.34 billion)
	5.01% industry growth
	37.91% investment contribution (USD 292.12 billion)
	28.70% tax revenue contribution
	14.13% employment contribution (19.11 million by Aug 2022)

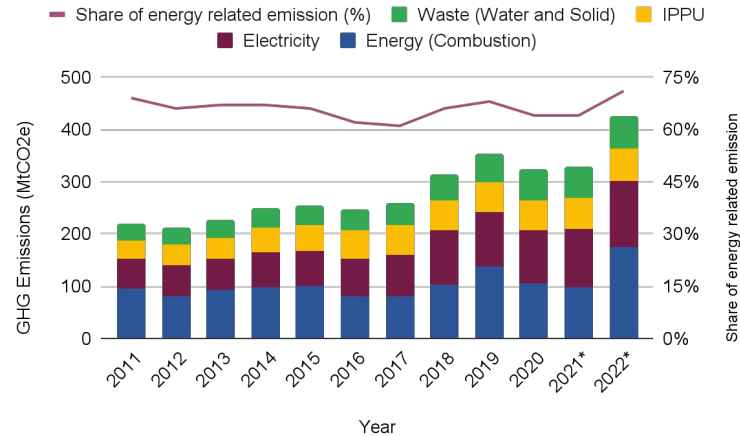


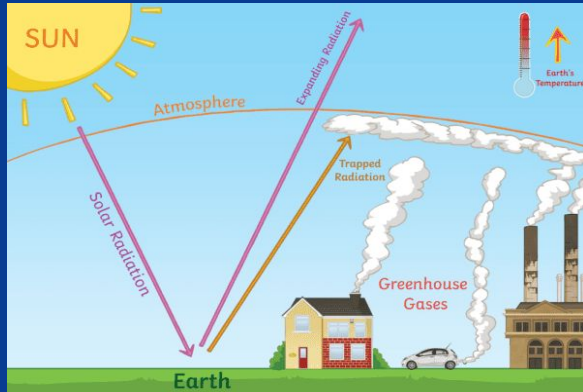
Fig 1. Historical GHG Emission from Indonesia's Industrial Activities

- In 2022, industry activities contribute the 2nd highest emissions of **430 MtCO₂**, next to power generation sector.
- According to the BaU, Indonesia's emissions will double in 2050.
- Each country should reduce emissions from energy generation-usage, IPPU and waste.

Emission Trends of Industry Sector in Indonesia



GHG emissions and global warming



Source: www.twinkl.com.au

As of late 2022, the global average temperature had **risen by 1.2°C** from pre-industrial levels, leaving the carbon budget necessary to stay within 1.5 - 2°C with implementation of decarbonization efforts.

Source: The Climate Book, 2022

GHG Emissions of Industry Subsectors Upstream Process, 2020

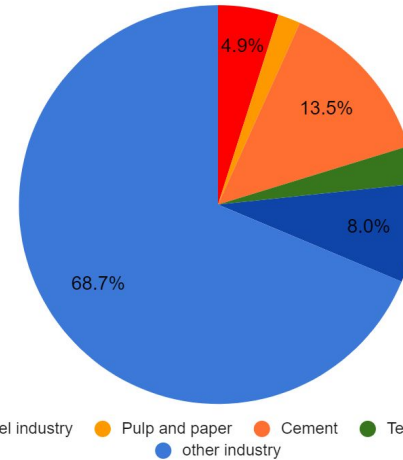


Fig 2. GHG Emissions of Industry Subsectors Upstream Process, 2020

● Iron and steel industry ● Pulp and paper ● Cement ● Textile ● Ammonia ● other industry

Source: [IESR-LBNL, 2024](#)

- Iron and steel are the primary contributors to GHG Emissions of industry subsectors.
- Decarbonization of the industrial sector, including the iron and steel industry, needs to be carried out for industrial, economic, environmental and social sustainability.

Source: [IESR-IETO, 2024](#)

Significance of decarbonizing the iron and steel industry



Iron and Steel Industry Sector Indicators (2022)	Indonesia	Global
Market size	-	≅ USD 1.7 trillion
Export value	≅ USD 28.8 billion	≅ USD 563 billion
Share of total trade	-	≅ 2.38%
Employment	Over 300 thousand people	Over 6 million people
Share of GHG emissions (upstream)	≅5%	≅<u>7-9%</u>
Share of CO ₂ emissions (upstream)	≅ 20-30 MtCO ₂ /year	<u>11%</u> ≅ 3.7 GtCO ₂ /year
Average CO ₂ emission intensity (tCO ₂ /t steel production) in 2018	<u>0.8-3.9</u>	<u>1.81</u>
Average CO ₂ emission intensity (tCO ₂ /t steel production) in 2019		<u>1.82</u>
Average energy intensity (GJ/t crude steel cast) in 2020	<u>12.1</u>	<u>20.38</u>

Source: IESR Analysis adapted from [Carbon Brief, 2023](#); [GEI, 2023](#); [GP, 2023](#); [PR, 2023](#); [GNW, 2023](#); [GVR, 2023](#); [OEC, 2024](#); [WS, 2024](#); [Kontan, 2023](#); [CT, 2020](#); [CT, 2022](#); [IISIA, 2023a](#); [IESR-IETO, 2024](#); [GEM, 2022](#)

Historical production and emission projection of Indonesia's iron and steel industry



Current status production

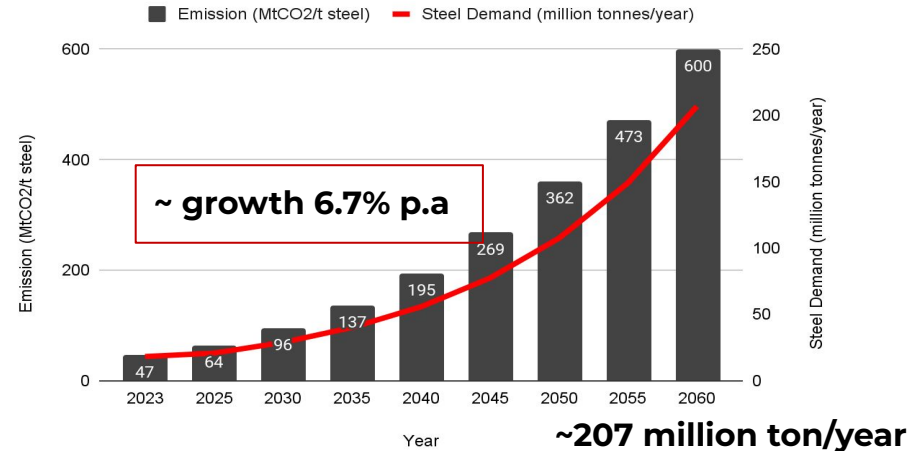


Fig 3. **Steel production (left), current status (right)** Projected emission of Steel industry to 2060

Source: IESR adapted from [IESR-IETO, 2024](#); [IISIA, 2023](#); [Bloomberg, 2024](#)

*Prediction

Projected emission of all iron and steel industry tree ** to 2060



Source: Adapted from [IISIA, 2023b](#)

** [Mol national iron and steel industry tree](#)

- Potential for emissions reduction: 6.6 million Tons CO₂e (Mol estimation in 2018)
- Estimation of abatement Cost of USD 462 / Ton CO₂e (Mol estimation in 2018)
- The trend in iron and steel production in Indonesia is consistently increasing with an average increase of almost 12% each year from 2015 to 2023

The urgency of decarbonizing the iron and steel industry

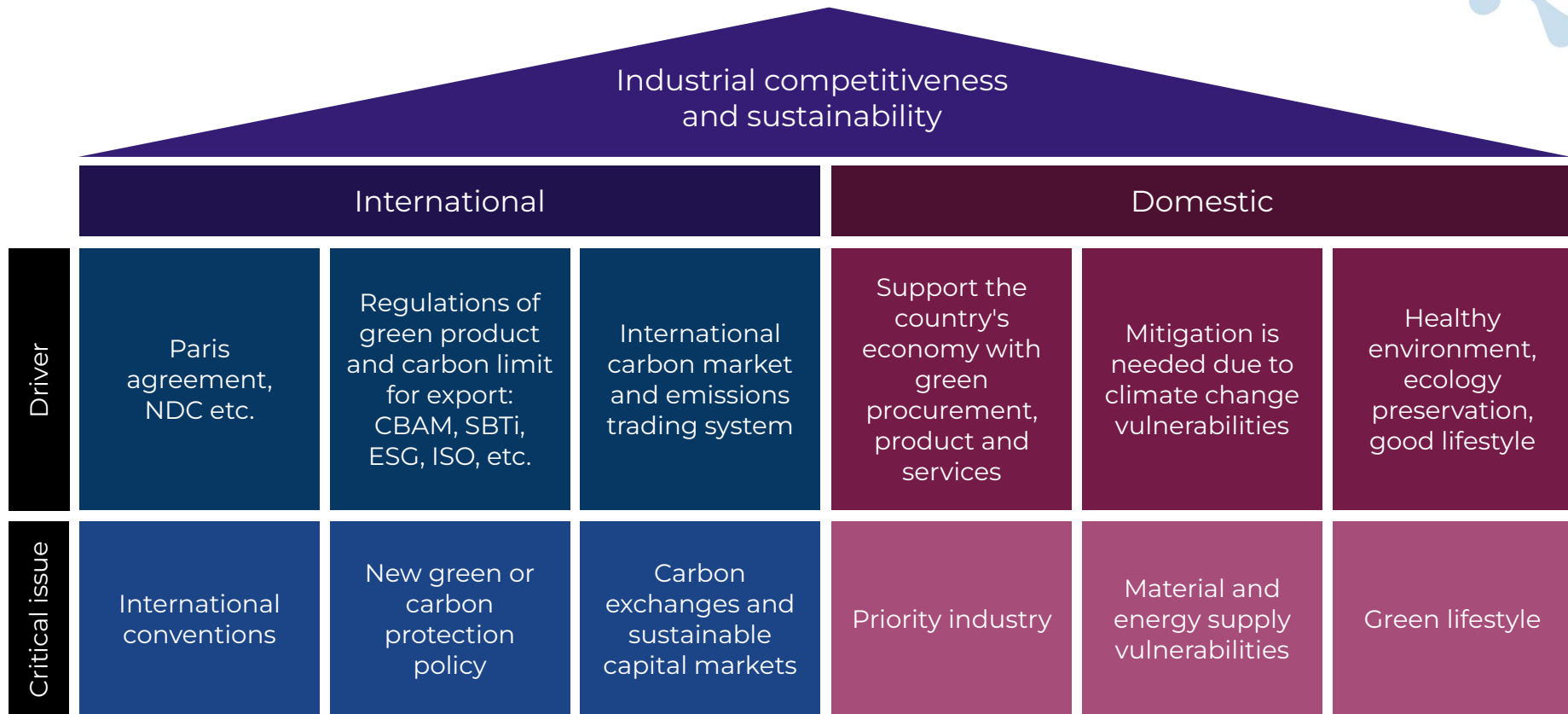


Fig 4. The urgency of decarbonization of the iron and steel industry, reasons and driving factors

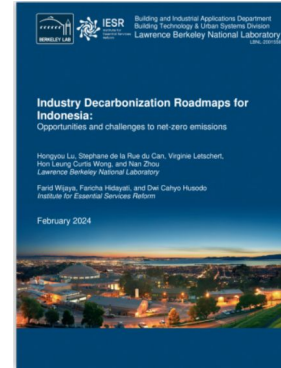
Source: IESR Analysis adapted from Mol, 2023a and many sources



**Iron and Steel Industry
Scenario and Decarbonization
Opportunities in Indonesia**

Study Scope

- The study scope is limited to:
 - upstream processes in steelmaking industry, where the highest energy consumption (thermal and electricity) is required. It includes steelmaking process until steel rolling
 - Scope 1 and 2 emission with consideration only from energy use and IPPU
- This scenario was modelled from the bottom up approaches using LEAP. Some considerations include production technologies, sizes and ages of production facilities, energy and material inputs, and energy intensity levels
- For modelling the steel production forecast, some considerations include
 - historical steel production,
 - forecasted national infrastructure growth (**steady demand**, annual growth 2.3% p.a), and
 - expected infrastructure growth compared to global level (**high demand**, annual growth 3.3% p.a)



Available to download at

<https://iesr.or.id/en/pustaka/industry-decarbonization-roadmaps-for-indonesia>



Source: [IESR-LBNL, 2024](https://iesr.or.id/en/pustaka/industry-decarbonization-roadmaps-for-indonesia)

Technologies and measures of the key to decarbonizing the iron and steel industries



Material Efficiency

- Improving design, construction, product yield with circular principles
- Extending product lifetime
- Lightweight and higher strength materials
- Alternative materials and construction



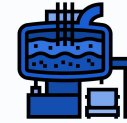
Energy Efficiency

- Improving efficiency of thermal and electrical energy
- Smart energy management
- Integrative design/system optimization



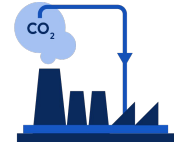
Fuel Switching

- Onsite renewables
- Increasing electrification production process
- Alternative reducing agent (H₂, biomass)
- Hydrogen DRI
- Molten Oxide Electrolysis
- Electrowinning aqueous
- Electrowinning – molten salt



Low-carbon Technologies

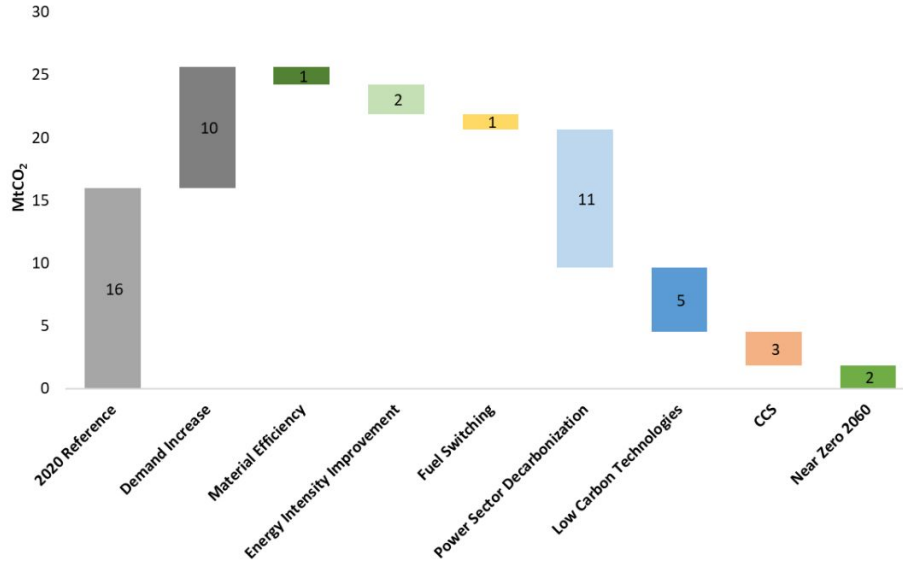
- Increasing use of Scrap-EAF, DRI-H₂ based DRI while decreasing BF-BOF and natural-gas-based DRI



CCS/CCUS

- CCU technologies: carbon to methanol, carbon to chemical
- Post-combustion CCS on BF
- CCS on DRI process
- CCS on smelting reduction process

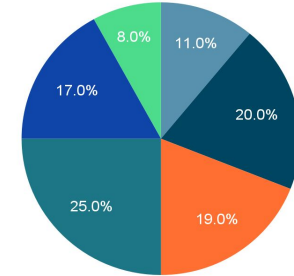
CO₂ emission impact of key decarbonization options for the iron and steel industry in high heat - upstream process



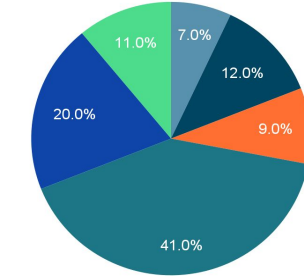
- The main reduction contributor comes from power sector decarbonization and transition towards low carbon technologies. With Scrap-EAF production share is expected to grow to 70% and BF-BOF technology has successfully been phased out by 2060.
- Accelerated 2050 scenario relies more to material efficiency and fuel switching and less to power sector decarbonization

- Material Efficiency
- Energy Intensity Improvement
- Fuel Switching
- Power Sector Decarbonization
- Low Carbon Technologies
- CCS

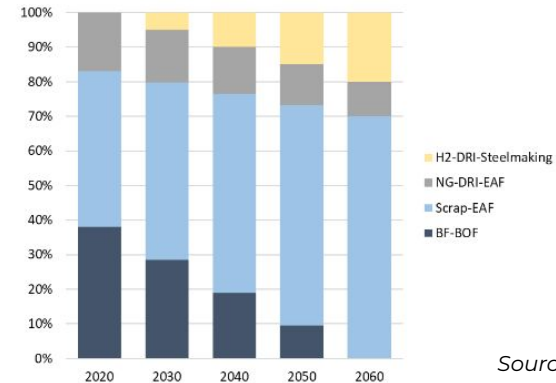
Contribution in period of 2020-2030



Contribution in period of 2030-2060



Production Share of Steelmaking Technologies in the Near Zero 2060 Scenario



Source: [IESR-LBNL, 2024](#)



**National Effort in
Decarbonizing Industry Sector
and Readiness of Iron and
Steel Industry toward
Decarbonization**

Industry decarbonization has been a focus in national energy transition plan despite the absence of sectoral roadmap



2021 - 2025

2026 - 2030

2031 - 2035

2036 - 2040

2041 - 2050

2051 - 2060

- Utilization of Solar PV, waste to energy, co-firing in coal-fired power plants
- Development RE electricity generation from wind and biomass
- Start in **implementation of Energy Management and Conservation in Industry**
- Battery Energy Storage System (BESS) adoption
- Increasing biofuels to 40% in Industry** and transportation
- Increasing the use of natural gas in the industry**
- Widespread implementation of carbon credits**
- Gradual shift from fossil subsidies to RE subsidies
- Increasing capacity of RE power plants
- RE Green H₂ adoption**
- 11 GW RE thermal power plant in 2035
- Implementation of CCS/CCUS in Industry**
- First commercial nuclear power plant operation
- Nuclear use for electricity generation
- Variable Renewable Energy (VRE) of solar and wind from 2037
- CCS/CCUS for the steel industry**
- Low carbon fuel for shipping
- Electricity in industrial sectors: increasing share and efficiency**
- Green H₂ and NH₃ adoption for replacing natural gas in industry - high temperature processes**
- More electricity is generated from RE than fossil energy
- Electrification in steel Industry**
- Utilization of CCS/CCUS in Industry 13 MMTCO₂e**
- Utilization of H₂ gas for electricity generation
- Power generation GHG emission reach zero (NZE)**
- Emissions of industrial - transportation sectors of 129 MMTCO₂e**

Is the iron and steel industry on the right track to decarbonize?



Concept		Implementation	
Awareness for Decarbonization	75-100%	Energy Efficiency	0-25%
GHG and Energy Accounting	75-100%	Fuel Switching to Green Fuels	0-25%
NZE target	75-100%	Material Efficiency	0-25%
Net Zero Strategy	75-100%	Process Improvement	75-100%
Net Zero Strategy Implementation	25-50%	Electrification and RE Electricity	25-50%

- The critical issue is that the industry has **limitations access** to
 - Financing,
 - Optimization time,
 - Alternative fuels stock
 - Technological innovation and knowledge, as well as
 - Expert personnel
 As the industry must continue to operate to gain profits for the sustainability of the industry

Source: IESR analysis adapted from IESR desk study, [IESR-LBNL 2023](#); WRI Indonesia, 2023

No iron and steel industries certified with green industrial standard

Legal Basis for Green Industry

- 01 Law No. 3 of 2014 concerning Industry
- 02 Government Regulation (GR) No.41 of 2015 concerning Industrial Resource Development
- 03 Government Regulation (GR) No. 14 of 2015 concerning the National Industrial Development Master Plan 2015 – 2035
- 04 Government Regulation (GR) 29 of 2018 concerning Industrial Empowerment
- 05 Presidential Decree (PD) No. 59 of 2017 concerning Implementation of the Achievement of Sustainable Development Goals
- 06 Presidential Decree (PD) No.18 of 2020 concerning the 2020-2024 National RPJM

37 Green Industry Standard

16 Green Industry Certification Institutions (LSIH)

80 green industri certified

- There are 316 iron and steel companies in 2023, up from 43 in 2013
- The green industrial standard for steel industry is newly established and limited for coated sheet steel (Mol regulation No.12/2023 for SIH 24102.2:2023)
- 10% of medium and large industrial companies have received green industry certificates while there is **no iron and steel company has yet obtained it**

• Source: Mol, 2023a; Bappenas, 2023; [Mol-Sisih, 2024](#)

Raw Material



EAF Minimum 60%



BOF Minimum 30%

Renewable Energy (RE)



There is a plan to use RE at a minimum of 3% of the total electrical energy consumption for lighting in the production area.

Waste



There are recycling and/or reuse activities for solid waste



Benefits of decarbonization for economic growth and key recommendations to accelerate the implementation

Prospects Industrial decarbonization for economic growth



Drivers for Industrial Decarbonization

Main Drivers: International efforts and agreements for **reducing GHG emissions**

Socio-economic Drivers:

1. Turning the economic wheels and fostering economic growth (**Golden Indonesia by 2045 as advanced country**)
2. Achieving **National Self-sufficiency and security** in the industrial net zero emission (NZE) journey
3. To protect the domestic supply chain and future economy (increase **Circular and Green Economy Index**)
4. Enhancing **export competitiveness** for the global market which is becoming more conscious towards green practices

Targets

Targets

1. **Sustainability** – lower emission intensity of Indonesian industries, green product and services
2. High **resources efficiency, minimum emission and waste** and **cost saving**
3. **Market expansion** and increased **sales of green products**
4. **Job creation** - the Indonesian renewable energy sector is projected to bring 3.2 million green jobs

Efforts

Lower emissions, more **sustainable**, and more **competitive** industries

Efforts

1. Building a **green industrial ecosystem** within the **framework of regulations and standards**
2. **Building green Industry** through **green energy, green process, green product and services** and its supporting regulations based on sectors
3. **Roadmaps** by individual industries and associations (still limited to few sectors), and the government (on progress)

Source: IESR Analysis, 2023 adapted from [WPI Economics, 2023](#); [DOE, 2023](#)



Key Recommendations

1. Completion of the industrial decarbonization roadmap by the MoI by the end of 2024 or sooner
2. Strengthening reporting and data collection on the implementation of
 - a. Government Regulation No. 28/2021 and
 - b. Minister of Industry Regulation No.2/2019,
 - c. Publication of a sustainability report for transparency and information access especially reporting on energy use, IPPU, waste and emissions produced by industry which is still in voluntary basis
3. It is imperative to establish targets, especially for industries that are energy-intensive, including the steel and iron industry,
 - a. Standardization of production processes (green industry standards) including energy intensity threshold for energy-intensive industries
 - b. Planning, Targets and Realization of RE Provision, especially Biomass supply, and use of Solar PV.
 - c. Accompanied by a mandatory policy framework

Thank You

**Accelerating Low Carbon
Energy Transition**

Any follow up questions?

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