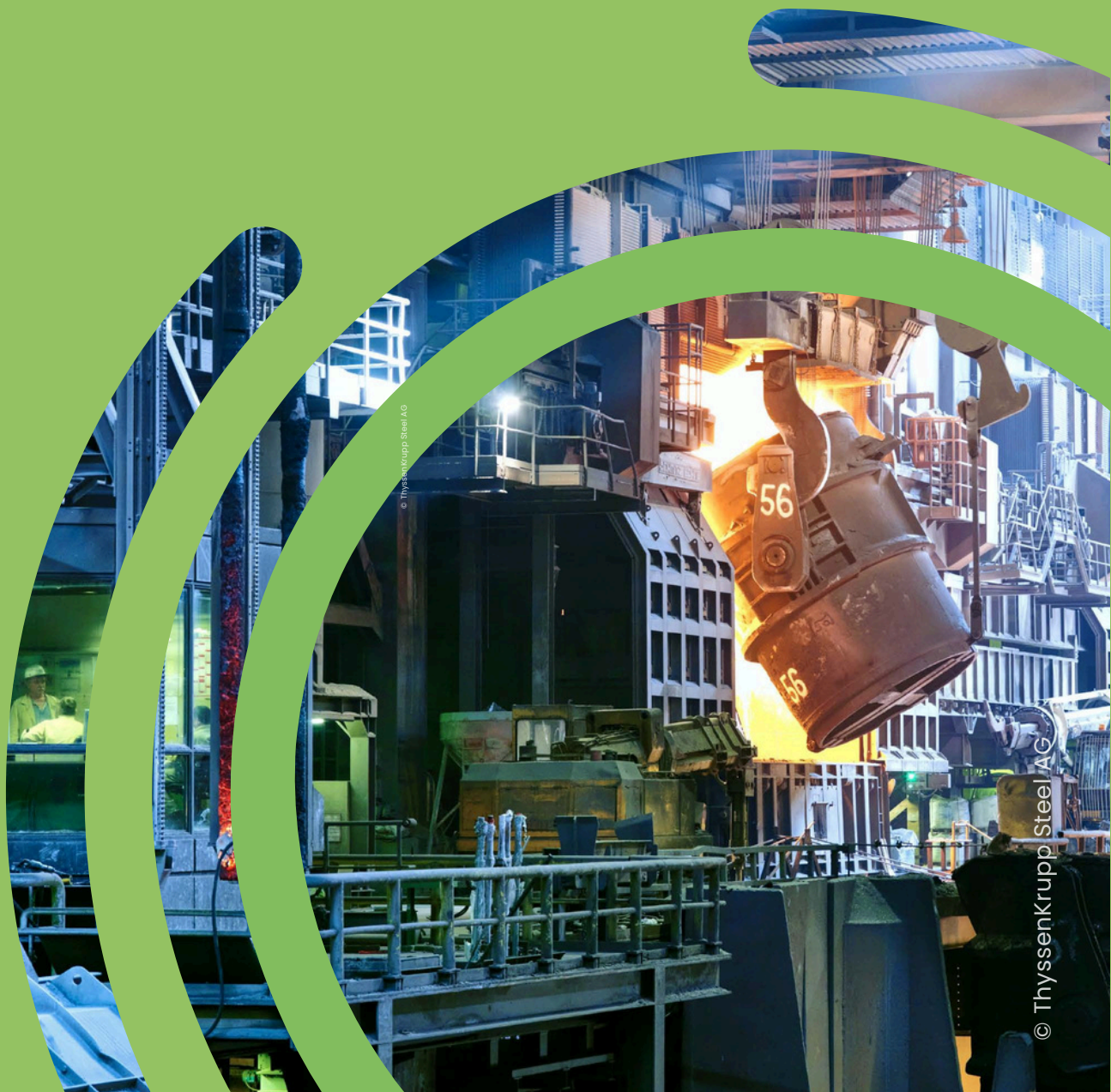
NET-ZERO INDUSTRIES
MISSION

Net-Zero Industries Mission

Country Insight Report

2024



PREFACE

Transforming hard-to-abate and energy-intensive industrial sectors into net-zero industries is both crucial and time-sensitive. While new technologies need to be developed and scaled, it is equally important to establish robust policy frameworks and funding programs. To gain the trust of the public and industry, we must successfully perform and showcase demonstration projects.

Despite the challenges, our Net-Zero Industries Mission (NIM) co-leads and member countries have united to share their strategies and progress in achieving net-zero industries. The NIM Team extends their sincere gratitude for the collaboration and commitment to this goal.

As we embark on the critical mission of helping our industry sectors accelerate their investment and adoption of decarbonisation technologies, we know that the sharing of experience, skills and above all knowledge will be a primary enabler, to transfer the experience and trust generated in the initial technology demonstrations, to those who we all need to be fast followers.

This report will help both governmental and industrial stakeholders, to identify the progress being made by your peers in both technology projects and enabling support programs, and help you to identify the knowledge, contacts and relationships that will be essential in helping accelerate and de-risk your own journey as a key stakeholder in this greatest of global challenges.

The Net-Zero Industries Mission Team

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ABOUT THE NIM COUNTRY INSIGHT REPORT

The **NIM Country Insight** report aims to provide useful knowledge by giving an overview of core members **hard-to-abate and energy-intensive industries**, including data on total industry greenhouse gases, economic data on relevant sectors, related policies especially focusing on R&D, funding programmes and flagship projects.

The report aims to inform policymakers and decision-makers in shaping effective strategies for industry decarbonisation by showcasing solutions of other countries. It also aims to create confidence in decarbonisation technologies by presenting selected flagship projects of the Mission's coalition members.

Economic data and corresponding sources, information on policies, roadmaps, funding programmes and flagship projects were provided by the member countries and updated by the NIM secretariat.

ABOUT NET-ZERO INDUSTRIES MISSION (NIM)

The NIM is part of the **Mission Innovation** (MI) initiative, which was launched during the 2015 United Nations Climate Change Conference (COP21) in Paris. The Mission is a collaboration across countries, non- and intra-governmental organisations, and industry.

The goal of the NIM is to **accelerate** the **development and demonstration** of **cost-competitive solutions** for the efficient decarbonisation of energy-intensive and hard-to-abate industries worldwide by 2030. The Mission progresses under three pillars:

- **Underpinning Research & Development**
  fast-tracking technologies to TRL 6 along different technology pathways
- **Enabling Conditions**
  overcoming technical and non-technical barriers e.g., by sharing of good practices on R&I policy, regulatory frameworks, or market incentives
- **Technology demonstration**
  realising a portfolio of at least 50 large-scale demonstration projects

Co-leads:	Austria and Australia.
Core members:	Canada, China, European Commission, Finland, Germany, South Korea, United Kingdom
Supporting member:	United States of America

ABOUT HARD-TO-ABATE & ENERGY-INTENSIVE INDUSTRIES

Climate change poses one of the most significant threats to humanity in modern times. It is imperative to limit global warming to 2°C to safeguard future generations and the ecosystem. Reducing greenhouse gas (GHG) emissions proves particularly challenging in certain sectors, notably hard-to-abate and energy-intensive industries.

These industries constitute a substantial portion of global emissions while playing a crucial role in many national economies. They are – as the name suggests – difficult to decarbonise and feature particular challenges. They are characterised by high investments costs when acquiring new equipment, coupled with extended payback periods, which heightens the risk associated with investing in emerging technologies.

It is therefore crucial to rapidly validate low-carbon solutions through demonstration projects to confirm their efficacy and commercial competitiveness. This creates trust and reduces risks for industrial companies that have the option to invest in low-carbon technologies. To reach global climate targets, the validation of technologies must happen no later than 2030 since they must be taken up in the market in time for the next 25-year refurbishment cycle.

Hard-to-abate and energy-intensive industries most notably include:

METALS	The metal sector includes both the production of non-ferrous metals such as aluminium and copper; as well as ferrous metals such as steel.
MINERALS	The mineral sector includes the production of cement, lime, glass and other carbonates. Calcination and acid-induced release of CO_2 are the two broad pathways emitting greenhouse gases.
CHEMICALS & REFINING	The chemical industry produces a broad range of products that are used in a wide variety of applications. The products range from plastics and rubbers to fertilisers, solvents, and specialty chemicals such as pharmaceuticals. Refining includes the process of transforming crude oil into useful products like gasoline, diesel, and other petrochemicals.

INFORMATION ON INDUSTRY GHG EMISSIONS BY IPCC SECTOR

GHG emissions from hard-to-abate and energy-intensive industries are not categorised in a single category within GHG inventories according to IPCC sectors. It's important to acknowledge that the represented data offers a simplified representation of industry GHG emissions and is not strictly limited to hard-to-abate and energy-intensive industries only. The purpose of the reported GHG emissions data is to facilitate comparability across different countries.

Information regarding GHG emissions was sourced from the most recent official GHG inventory reports publicly accessible or provided by member countries. Nevertheless, the following sectors encompass emissions from these industries and have thus been incorporated into the reported figures:

(1) ENERGY

A) Stationary Combustion Sources

2. For Manufacturing Industries & Construction

(2) INDUSTRIAL PROCESSES AND PRODUCT USE

A) Mineral Industry

B) Chemical Industry

C) Metal Industry

D) Non-Energy Products from Fuels & Solvent Use

E) Electronic Industry

F) Production and Consumption of Halocarbons, SF6 and NF6

G) Other Product Manufacture and Use

H) Other

AUSTRALIA

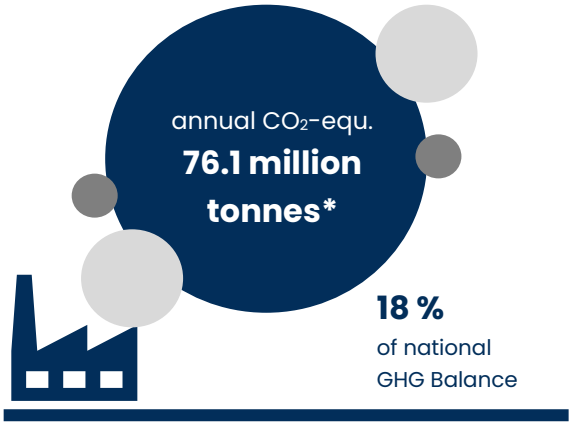
NIM - Country Insight Report 2024

Australian industries like metals, chemicals and refining are crucial for its economy and are currently facing challenges in reducing emissions. Decarbonisation is supported with initiatives like the *Future Made in Australia Innovation Fund*, *Powering the Regions Fund,* and the *National Reconstruction Fund Corporation*. Key measures, including the Safeguard Mechanism and the Net Zero Industrial Sector Plan, along with flagship projects to reduce steelmaking emissions are advancing towards net-zero emissions by 2050.

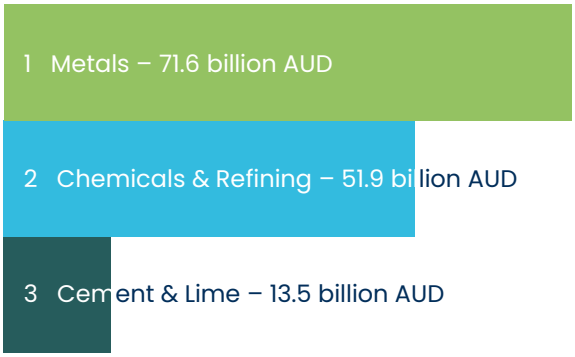
INDUSTRY GHG EMISSIONS [1]

In 2022, Australia's GHG energy emissions from the sector **Energy** – Stationary fuel combustion for Manufacturing industries & construction totalled **43.1 million tonnes** CO_2-equivalent. Here the metal industry was the largest contributor, followed by manufacturing of machinery, textiles, pulp, paper & print and basic chemical manufacturing.

Emissions from the **Industrial Processes** sector include **33 million tonnes** CO_2-equivalent, with the largest emissions from metals and product substitutes for ozone (both at 11 million tonnes), followed by minerals (5 million tonnes) and chemicals (3 million tonnes).



Greenhouse Gas Emissions of the Industry Sector 2022, Australia. *Source: own representation with data from the Australian Government, Department of Industry, Science, Energy and Resources (2024)*



Relevant Industry Sectors by gross annual revenue
Data: Country Insight Report AUSTRALIA

ECONOMIC RELEVANCE OF SECTORS [2]

Australia offers statistics along the *Australian and New Zealand Standard Industrial Classification (ANZSIC)*. Industrial areas are distributed throughout the country, with key hubs in Pilbara, Kwinana, Illawarra, Hunter and Gladstone.

In 2021 the **Metal** sector, crucial to global trade in ferrous ores and lithium, employed 72,600 people, with a turnover of 71.6 billion AUD.

Australia's **Chemical and Refining** sector employed over 58,000 people in 2021, generating a net turnover of 51.9 billion AUD.

In 2020, production included approximately 5.3 million tonnes of **Clinker**, 9.6 million tonnes of **Cement**, and 1.5 million tonnes of **Lime**. This activity generated a net turnover of 13.5 billion AUD and provided jobs for over 11,600.

[1] Australian Government, Department of Industry, Science, Energy and Resources (2024) – National Inventory Report Australia 2022
* Including Emissions from Energy – Stationary Combustion: Manufacturing Industries and Construction & Industrial Processes

[2] Detailed sources on next page

CHEMICALS & REFINING [3, 6]

Annual net turnover (2021):
51.9 billion AUD

Number of employees (2023):
58,000

Export value (2023):
15.9 billion AUD

Biggest companies based on turnover:
Glencore, Wesfarmers, Ampol BP Australia, Chevron Australia

Main export markets:
Ship and Aircraft Stores (21%), USA, China, New Zealand, Japan

METALS INCLUDING IRON AND STEEL [4, 6]

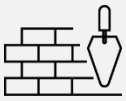
Annual net turnover (2021):
71.6 billion AUD

Number of employees (2023):
72,600

Export value (2023):
51.7 billion AUD

Biggest companies based on turnover:
Rio Tinto, BHP, The Perth Mint, BlueScope Steel, Hancock

Main export markets:
China (21%), Hongkong (11.6%), India, UK, South Korea



CEMENT & LIME [5, 6]

Annual net turnover (2021):
13.5 billion AUD

Number of employees (2023):
11,600

Export value (2023):
55.6 million AUD

Biggest companies based on turnover:
Seven, Fletcher Building, James Hardie Industries, CSR, Hanson Australia Holdings

Main export markets:
New Zealand (63.8%), Spain (12.5%), Papua New Guinea, USA, Vietnam

KNOWLEDGE SHARING AND R&D CAPABILITIES – KEY CONTACTS

The Australian Renewable Energy Agency **(ARENA)** offers programs in place to share knowledge, insights and data from funded projects to help the renewable energy industry and other projects learn from experience.

The Heavy Industry Low-carbon Transition Cooperative Research Centre **(HILT CRC)** is a collaborative venture that brings together industries, researchers, and government organisations to share the responsibility for the big shift of decarbonisation.

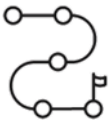
[3] Australian Bureau of Statistics (2023) – Industry data ANZSIC 17+18 (Petroleum & Coal Manufacturing + Chemical (Product) Manufacturing)
[4] Australian Bureau of Statistics (2023) – Industry data ANZSIC 21 (Primary Metal and Metal Product Manufacturing)
[5] Australian Bureau of Statistics (2023) – Industry data Cement and Lime includes ANZSIC 2031, 2033, 2034
[6] Australian Bureau of Statistics (2023) – Sales and Services Income, Labor force detailed November 2023, ABS International Trade in Goods December 2023 for Australian Industry 2021-22

DECARBONISING AUSTRALIA'S INDUSTRY – FUNDING OPPORTUNITIES

- The **Future Made in Australia – Innovation Fund** supports innovation, commercialisation, pilot and demonstration projects and early-stage development in priority sectors, including renewable hydrogen, green metals, low carbon and clean energy technology manufacturing such as batteries. The Fund is a key initiative under the $22.7 billion Future Made in Australia initiative.
  Total funding volume: 1.7 billion AUD
- The Powering the Regions Fund **(PRF)** allocates funding to support four key areas: decarbonising existing industries, developing new clean energy sectors, workforce development, and purchasing carbon credits to facilitate the transition to net zero emissions.
  Total funding volume: 1.9 billion AUD
- Australia has several public organisations that support RD&D and early-stage commercialisation of industrial decarbonisation technologies through co-investment with the private sector, including ARENA, CEFC, and CRCs.
- The National Reconstruction Fund Corporation **(NRFC)** invests in projects to support manufacturing across seven priority areas including renewables & low emission technologies, and resources like minerals and metals. The NRFC delivers NRF funding as an independent financier.
  Total funding volume: 15 billion AUD
- In 2024 **Australia and Austria** launched a joint call for industrial decarbonisation for pilot/test projects.
  Total funding volume: 24 million AUD

RELEVANT POLICIES & ROADMAPS

The Safeguard Mechanism is a policy by the Australian Government to reduce emissions from the nation's largest industrial sites. Started in 2016 and reformed in 2023, it sets declining emission limits for facilities emitting over 100,000 tonnes of CO_2 equivalent per year. This includes sectors like mining, oil and gas, manufacturing, transport, and waste management. The mechanism aims to help Australia achieve net zero by 2050, while maintaining industrial competitiveness.



The Australian Government's Net Zero Industrial Sector Plan (NZISP) is an industry focussed emissions reduction plan that will outline the role of industry in supporting Australia's transition to net zero. This plan is one of six sectoral plans, together they cover the whole of the economy and will plot a course for Australia's strategy to meet its 2035 and 2050 emission reduction targets.

FLAGSHIP PROJECTS

BlueScope has been awarded 136.8 million AUD towards the reline and upgrade of its No. 6 Blast Furnace at the Port Kembla Steelworks. This project will maintain domestic production, reduce emissions, and support pathways to producing even lower-emissions steel in the future.

LIBERTY has also been awarded 63.2 million AUD towards the purchase and commission of a low carbon electric arc furnace (EAF) to replace the existing traditional blast furnace at the Whyalla Steelworks. The new state of the art EAF will support the manufacturing of green steel and help achieve LIBERTY's aim of carbon neutrality by 2030.

AUSTRIA

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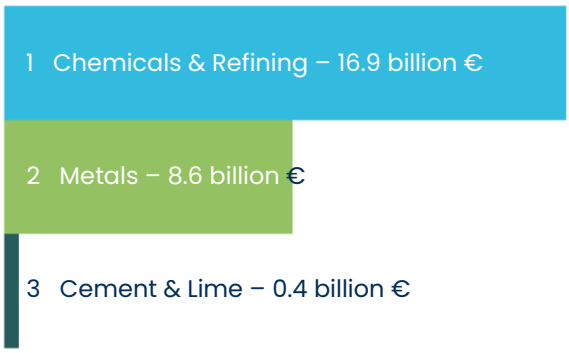
The Austrian industrial sector is crucial to the nation's economy. The country has a long-standing tradition of steel production and is home to several major steel companies, making it one of the leading producers in Europe. Recent funding initiatives have achieved success in implementing best-practice projects. National initiatives like New Energy for Industry (NEFI) accelerate research in industry decarbonisation by channelling activities in the sector.

INDUSTRY GHG EMISSIONS [7]

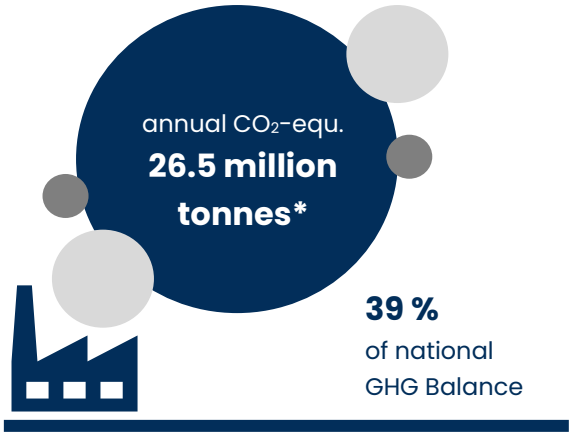
Austria's 2022 Greenhouse Gas Inventory offers a look into the country's industrial emissions landscape, totalling around 26.5 million tonnes of CO_2-equivalent emissions.

Industrial processes accounts for a total of **15.9 million tonnes** of CO_2-equivalent emissions, with the metal industry contributing approximately 10 million tonnes, followed by the mineral industry at 2.9 million tonnes and the chemical industry with 0.7 million tonnes. GHG from Product Uses as substitutes for ODS make um 1.4 million tonnes.

Additionally, emissions from **Energy** - stationary fuel combustion for manufacturing industries and construction represent a significant portion, totalling **10.6 million tonnes** of CO_2 equivalent emissions in 2022.



Relevant Industry Sectors by annual turnover
Source: Country Insight Report - AUSTRIA



Greenhouse Gas Emissions of the Industry Sector 2022, Austria. *Source: own representation with data from Environmental Protection Agency (2023)*

ECONOMIC RELEVANCE OF SECTORS [8]

Chemicals & Refining stands out as the largest industry sector in terms of annual turnover, providing employment opportunities for 88,800 individuals. Chemical companies are distributed across Austria with key clusters in Upper Austria near Linz and the Vienna region.

The **Metal** sector holds historical significance in Austria, notably marked by voestalpine's pioneering Linz-Donauwitz process. Today over 7.88 million tonnes of crude steel and 6.14 million tonnes of iron are produced annually.

In 2018 Austria also produced 5.2 million tonnes of **Cement and Lime** leading to an annual turnover of 430 million €.

[7] Environmental Protection Agency (2023). AT Annual Greenhouse Gas Inventory 1990-2022.

[8] Detailed sources on next page
* Including Emissions from Energy – Stationary Combustion: Manufacturing Industries and Construction & Industrial Processes

CHEMICALS & REFINING [9]

Annual net turnover (2021): **16.9 billion €**

Number of employees (2021): **88,800**

Export quota (approx.): **33%**

Biggest companies based on turnover: **Borealis AG, Henkel Central Eastern Europe GmbH, Lenzing AG**

Industry Hotspots: **Upper Austria, Vienna region**

METALS INCLUDING IRON AND STEEL [10]

Annual net turnover (2021): **8.6 billion €**

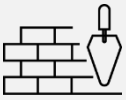
Number of employees (2023): **15,601**

Main export markets: **Germany, US, France, Italy, Switzerland**

Export quota (2023): **80%**

Biggest companies based on turnover: **voestalpine AG, Blum Group Holding GmbH, Plansee Holding AG, Amag AG**

Industry Hotspots: **Linz, Donauwitz-Leoben**



CEMENT & LIME [11]

Annual net turnover (2018): **0.43 billion €**

Members of the AT cement association: **1,200**

Biggest companies based on turnover: **Leyer + Graf BaugmbH, Ing. Hans Bodner BauGmbH & Co. KG, Baumit GmbH, Franz Oberndorfer GmbH & Co. KG**

DECARBONISING AUSTRIA'S INDUSTRY – FUNDING OPPORTUNITIE

- The RTI Initiative for Transforming Industry aims to develop and test innovative solutions to reduce energy- and process-related GHG emissions of energy-intensive industries. Projects must be between TRL 4-8, which includes the combination with pilot and demo projects.
  Timeframe: 2023-2027
  Total funding volume: 320 million €
- The Clean Energy Transition Partnership **(CETP)** offers transnational funding, including calls for integrated industrial energy systems and CCU/CCS.
- In 2024 **Austria and Australia** launched a joint call for industrial decarbonisation with a planned funding volume of 7 million €.

Further funding opportunities include:

Transforming Industry funding programme – 2023-2030 (CAPEX & OPEX), annual 4 million €
Energy Research programme
Twin Transition – sustainable/digital transformation of production processes – 200 million €
FFG General programme & FFG Talents (including Young and Female Talents)

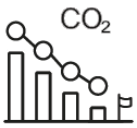
[9] Statista Research Department (2024) - Größte Chemieunternehmen in Österreich nach Nettoumsatz 2022
[10] Advantageaustria (2024) - Facts and Figures - Metals / Metal processing
[11] Cemnet (2024) – Country Statistics

R&D SUPPORT CAPABILITIES – KEY CONTACTS

The New Energy for Industry **(NEFI)** innovation network acts as the primary Austrian contact point for R&D efforts to decarbonise the industry. Within NEFI, stakeholders team up with researchers to develop green technologies.

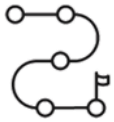
The Austrian Research Promotion Agency **(FFG)** offers funding consultation for a variety of research and demonstration projects. Further, all FFG-funded projects can be found in its database with abstracts available in English.

RELEVANT POLICIES, ROADMAPS & PUBLICATIONS



The National Energy and Climate Plan (NEKP) is a plan that all EU countries must use to demonstrate their path towards achieving their EU energy and climate targets. It must set goals within a 2030-horizon and concrete measures and policies to be implemented in the time period.

The Federal Ministry for Climate Protection (BMK) has initiated the **dialogue process** "Climate Neutral Industry Austria" with the Federation of Austrian Industries (IV) and eleven emission-intensive industrial companies. The dialogue process with continuous exchange formats is designed for the long term.



transform.industry supports Austria's path to climate neutrality by 2040, recommending carbon-neutral technology investments and stable regulations. By modelling various transformation scenarios and proposing roadmaps for different sectors, it seeks to reconcile climate goals with industrial competitiveness.

Relevant publications include:

Study: "Transform.industry - Transformation paths and R&D roadmap for a climate-neutral industry by 2040 in Austria." (2024)
Process 'Climate-Neutral Industry Austria' –framework conditions for the transformation of industrial processes (2023)
Study: "Pathway to Industrial Decarbonisation: Scenarios for the development of the industrial sectors in Austria" (2022)

FLAGSHIP PROJECTS

Primetals Technologies Austria GmbH has developed **HYFOR®**, the world's first direct reduction process for iron ore concentrates that does not require any prior iron ore treatment. This leads to a reduction of energy consumption by 20% and CO_2 emissions by 80%.

The Industry4Redispatch **(I4RD)** project conducted by the Austrian Institute of Technology GmbH & various partners aims to develop innovative grid support solutions, enabling industrial plants to provide flexibility for redispatch while optimising their market participation and energy security.

CANADA

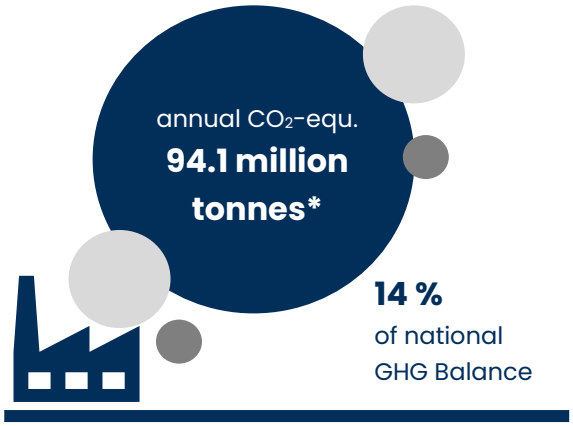
NIM - Country Insight Report **2024**

Canada's industry sector thrives due to abundant resources and skilled labour. Chemicals & Refining, along with Steel production, are vital components, contributing to construction, automotive, and infrastructure. Canada has taken significant steps towards Industry Net-zero with new policies, funding opportunities like the Strategic Innovation Fund & Net Zero Accelerator Initiative and various flagship projects.

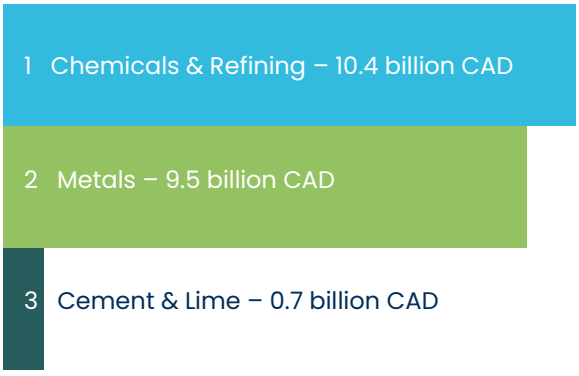
INDUSTRY GHG EMISSIONS [12]

Industrial processes and product use totalled **51.9 million tonnes** CO_2-equivalent emissions. Among the hard-to-abate sectors, production of minerals accounts for 9 million tonnes, while the chemical industry contributes 5.7 million tonnes and metal production amounted to 14 million tonnes.

Emissions related to **Energy** - Stationary combustion in manufacturing industries & construction make up for **42.2 million tonnes** of CO_2-equivalent emissions, including 8 million tons for metal production, 9.2 million tonnes for chemicals, 6.8 million tonnes for pulp and paper, 3.8 million tonnes for cement and 12.4 million tonnes for other manufacturing.



Greenhouse Gas Emissions of the Industry Sector 2021, Canada. *Source: own representation with data from Government of Canada (2023)*



Relevant Industry Sectors by annual turnover
Source: Country Insight Report - CANADA

ECONOMIC RELEVANCE OF SECTORS [13]

In total the hard-to-abate Industry sectors of chemical & refining, metals (including steel & iron) and lime & cement generate an annual net turnover of over 36 billion CAD and offer employment to over 270,000 people.

In 2021, Canada's **Metals** industry generated 15 billion CAD in turnover, exporting to the US and Mexico. The **Cement and Lime** sector supported 158,000 jobs within the associated field of building & construction. Meanwhile, the **Chemicals & Refining** industry, boasting a 9.4 billion CAD turnover in 2017, employed over 88,000 people and exported to the US, Italy, and Japan.

[12] Government of Canada (2023). National inventory report 1990-2021: Greenhouse gas sources and sinks in Canada

[13] Detailed sources on next page
* Including Energy – Stationary Combustion Sources for Manufacturing Industries & Industrial Processes and Product Use

CHEMICALS & REFINING [14, 15]

Annual net turnover (2021):
10.4 billion CAD

Number of employees (2021):
direct - **78,500**
indirect - **392,000**

Main export market (2023):
US, China, UK, Japan, Netherlands, Germany, Mexico, Belgium, France

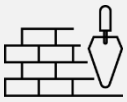
METALS INCLUDING IRON AND STEEL [16, 17]

Annual net turnover (2023):
9.5 billion CAD

Number of employees (2021):
Steel & Aluminium - **347,000**

Main export markets (2023):
US, Norway, Netherlands

Biggest companies based on turnover:
ArcelorMittal, Algoma & Stelco



CEMENT & LIME [18, 19]

Annual net turnover (2021):
0.74 billion CAD

Number of employees (2022):
Cement - **158,000**

Main export market (2023):
United States, Jamaica, Bermuda

Biggest companies based on turnover:
Lafarge Canada, Heidelberg Materials

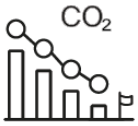
DECARBONISING CANADA'S INDUSTRY - FUNDING OPPORTUNITIES

- Strategic Innovation Fund **(SIF)** & Net Zero Accelerator **(NZA)** Initiative: SIF supports companies across Canada's industrial and tech sectors with repayable and non-repayable contributions. NZA invests in **decarbonisation, transformation and cleantech ecosystem development**.
- Sustainable Development Technology Canada **(SDTC)**: Offers **start-up** and **scale-up funding** for cleantech entrepreneurs and technological projects.
- Energy Innovation Program **(EIP)**: Funds clean energy research, **development, and demonstration projects**, including carbon capture, clean fuels, and industrial fuel switching.
- Clean Fuels Fund: A 1.5 billion CAD investment over five years to **support clean fuel production facilities** (including conversion), **biomass supply chains**, and **regulatory alignment**.

Further funding opportunities include:
Green Industrial Facilities and Manufacturing Program
Canada Infrastructure Bank (CIB)
Low Carbon Economy Challenge
Business Development Bank of Canada (BDC)
National Research Council of Canada Industrial Research Assistance Program (NRC IRAP)

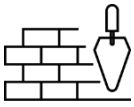
[14] Government of Canada (2024) – Summary Canadian Industry Statistics, Chemical manufacturing (NAICS code 32)
[15] Chemistry Industry Association of Canada - 2022 Economic Review of Chemistry
[16] Government of Canada (2024) – Summary Canadian Industry Statistics, Primary metal manufacturing (NAICS code 331)
[17] Government of Canada (2024) – Export and import controls: Steel
[18] Government of Canada (2024) – Summary Canadian Industry Statistics, Cement & lime manufacturing (NAICS code 32731 & 32741)
[19] Government of Canada (2024) - Roadmap to Net-Zero Carbon Concrete by 2050

RELEVANT POLICIES



The overarching 2030 Emissions Reduction Plan sets ambitious targets to reduce greenhouse gas emissions in Canada by 40% compared to 2005 levels by 2030.

Specifically within the Industry sector, the Hydrogen Strategy for Canada positions hydrogen as a vital element in the energy transition, while Canada's Carbon Management Strategy emphasises Carbon Capture, Storage, and Utilisation initiatives.



The Roadmap to Net Zero Carbon Concrete by 2050 outlines plans to decarbonise the cement and concrete sectors. These policies are pivotal in Canada's industrial decarbonisation activities.

Other relevant policies include:
Greenhouse Gas Pollution Pricing Act
Greenhouse Gas Reporting Program (GHGRP)
Policy on Green Procurement
Standard on Embodied Carbon in Construction

FLAGSHIP PROJECTS

Steel producers like ArcelorMittal and Algoma Steel are transitioning their production methods and investing in electric arc furnaces, potentially cutting Canadian GHG emissions by up to 3 million tons CO_2-equivalent per year.

The Canadian Government supports BHP to develop a world-leading low-emission **potash mine** in Saskatchewan, prioritising CO_2 footprint reduction and worker safety. It is expected to generate the lowest direct on-site emissions intensity of any potash mine.

Canada has invested 49 million $ in Inter Pipeline's Heartland Petrochemical Complex to support the production of highly recyclable **polypropylene**, creating new jobs and saving up to 1.75 million tonnes of CO_2 per year.

Furthermore, collaborating with Air Products Canada, the Canadian government has been advancing the **clean hydrogen** sector with a jointly 1.3 billion $ investment in a net-zero hydrogen production facility in Edmonton, aiming to secure an early foothold in the global hydrogen market.

ELYSIS, a joint venture between Alcoa and Rio Tinto, focuses on scaling up an innovative process in **aluminium production**, eliminating GHG emissions from the smelting process. The project has the potential to create more than 1,000 jobs by 2030 and secure over 10,500 current work positions.

CHINA

NIM - Country Insight Report 2024

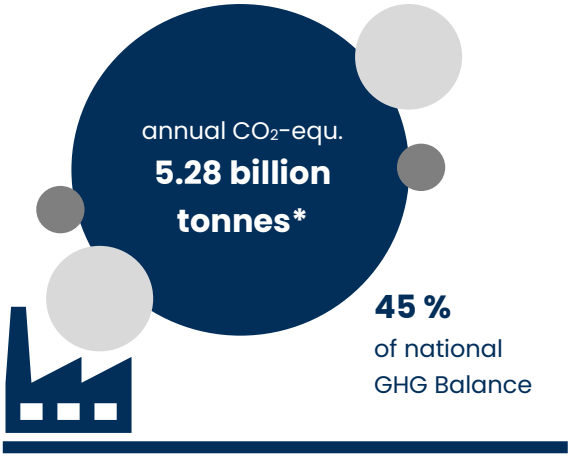
The industrial landscape of China is a cornerstone of its global economic influence, marked by staggering turnovers and significant contributions to GDP. Alongside economic proficiency, the sector is faced with challenges concerning greenhouse gas emissions. This overview delves into China's industry sector's economic significance, its impact on GHG emissions, and governmental policies addressing climate targets.

INDUSTRY GHG EMISSIONS [20]

In 2018, China's sector **Industrial processes & product use** emitted a total of **1.89 billion tonnes** of CO_2-equivalent GHG. The mineral industry was the largest contributor, responsible for more than half of these emissions at 991 million tonnes. The chemical industry accounted for approximately 24% of the emissions, with 457 million tonnes of CO_2-equivalent. The metal industry contributed around 10%, or 202 million tonnes. Another significant sector includes emissions from halocarbons and SF6, which together accounted for 234 million tonnes (12.4%).

In addition to these figures, GHG emissions from **Energy** – stationary fuel combustion in manufacturing industries and construction were substantial, totalling over **3.4 billion tonnes** of CO_2-equivalent.

Relevant Industry Sectors by annual turnover
Source: Country Insight Report – CHINA (2023)



Greenhouse Gas Emissions of the Industry Sector 2018, China. *Source: own representation with data from Ministry of Ecology & Environment, People's Republic of China (2023)*

ECONOMIC RELEVANCE OF INDUSTRY [21]

China's industry sector is the world's largest manufacturer and exporter. It fuels employment, technological progress, and drives China's GDP growth and global trade.

The **Metals** sector boasts an annual net turnover of 650 billion USD producing more than 1.3 billion tonnes steel in the year 2022, closely followed by the **Cement & Lime** sector at 565.1 billion USD producing more than 2.3 billion tonnes cement in 2021.

Despite the mineral sector clearly accounting for the most GHG emissions, China's **Chemicals & Refining** sector leads in annual turnover, reaching a staggering 4.7 trillion USD.

[20] Ministry of Ecology and Environment, The People's Republic of China. (2023) - The People's Republic of China Third National Communication on Climate Change.
[21] Detailed sources on next page

* Including Emissions from Energy – Stationary Combustion: Manufacturing Industries and Construction & Industrial Processes and Product Use

CHEMICALS & REFINING [22]

Annual net turnover (2022):
4.711,5 billion USD

Production capacity ethylene:
29 million tonnes

Production capacity sulfuric acid:
95 million tonnes

Production capacity caustic soda:
39 million tonnes

Industry Hotspots:
Xinjiang Uygur Autonomous Region and Shandong Province

METALS INCLUDING IRON AND STEEL [23]

Annual net turnover (2022):
4.7 trillion yuan / 650 billion USD

Production capacity (2022):
1,340.3 million tonnes steel

Export quantity (2022):
67.3 million tonnes steel

Main export markets:
Asia (71%), Africa (12%), South America (9%), Europe (7%), North America (< 2%)

Industry Hotspots:
Liaoning Province and Shandong Province

CEMENT & LIME [24]

Annual net turnover (2022):
565.1 billion USD

Production capacity cement (2021):
2.38 billion tonnes cement

Production capacity clinker (2021):
1.59 billion tonnes

Export quantity (2022):
1.96 million tonnes

Industry Hotspots:
Anhui Province and Fujian Province

RESEARCH AND DEMONSTRATION – KEY CONTACTS

Policy Research Center for Environment and Economy (PRCEE)
Ministry of Ecology and Environment

- Research on social development & synergistic development of energy, environment, climate & economy
- Evaluation of relevant policies

Institute of Carbon Neutrality
Tsinghua University

- Focus on dual-carbon goal
- Collaborating in development of disruptive technologies

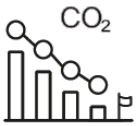
[22] China's Petroleum and Chemical Industry Economic Operation Report (2022)
[23] China Steel Industry Annual Inspection (2022)
[24] China building materials industry economic operation report (2022)

DECARBONISING CHINA'S INDUSTRY – FISCAL SUPPORT

In 2022, China's Ministry of Finance issued the 'Opinions on Financial Support for Achieving Peak Carbon Emissions and Carbon Neutrality' as part of the Dual Carbon goals, emphasising **fiscal support**, **market-based approaches**, **tax incentives**, and **international cooperation**. The document aims to optimise fiscal expenditures, reward regions achieving outstanding results, and enhance support for key industries.

It proposes establishing a national **low-carbon transition fund**, leveraging existing **investment funds**, and encouraging **private capital for green projects**. Tax policies will incentivise energy conservation, resource utilisation, and carbon emission reduction while optimising tariff structures for environmental objectives.

RELEVANT POLICIES



The Chinese government has set the target of peaking carbon emissions by 2030 and being carbon neutral by 2060. China's so-called **Dual Carbon goals** are implemented by ministry-level initiatives in key sectors and industries (including energy, industry, and others). Additionally, supporting measures in legal regulation, finance support, market systems, technological innovation, statistical accounting are included. **Key policies** include:

- State Council's Guiding Opinions on Accelerating the Establishment of a Sound Green, Low-Carbon, and Circular Development Economic System (Feb 2021)
- Implementation Plan Supported by Technology for Carbon Peaking and Carbon Neutrality 2022-2030 (June 2022)
- Action Plan for Standardising Energy Carbon Peaking and Carbon Neutrality (September 2022)

Industry-specific policies include:

- Implementation Plan for Carbon Peaking in the Industrial Sector (July 2022)
- Implementation Plan for Carbon Peaking in the Buildings Material Sector (Nov 2022)
- Implementation Plan for Carbon Peaking in the Nonferrous Metal Industry (Nov 2022)

FLAGSHIP PROJECT

On June 2, 2023, the National Energy Group inaugurated Asia's largest **thermal power carbon dioxide capture, utilisation, and storage (CCUS) project** at the Taizhou Power Plant. This demonstration project, entirely designed and executed by China, boasts the capacity to capture and utilise 500,000 tonnes of carbon dioxide annually. The project yields high-purity (>99%) dry-based carbon dioxide.

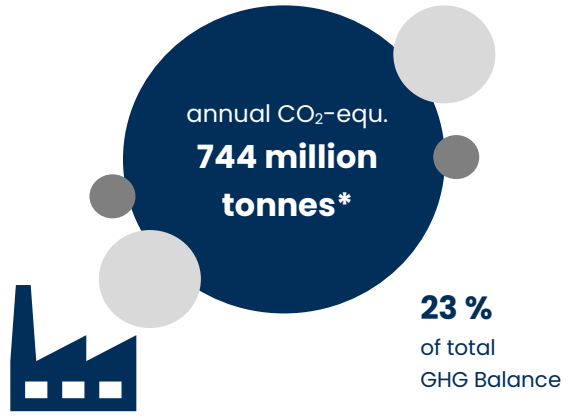
EUROPEAN UNION

NIM - Country Insight Report 2024

The EU aims to be climate-neutral by 2050, with an intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030. This objective is at the heart of the European Green Deal. Climate neutrality transformation affects a wide area of sectors, with energy intensive industries playing an important role on this path. At the same time, related sectors are crucial in the region's economy, employing millions of people. Instruments such as Horizon Europe and Innovation Fund assist industries in transitioning to climate neutrality, offering financial support for R&I scale up and deployment.

INDUSTRY GHG EMISSIONS [25]

In 2021, European greenhouse gas emissions experienced an increase compared to 2020, as economic activity rebounded following the Covid-19 pandemic. The total emissions surpassed 3 billion tonnes of CO_2-equivalent, with 23% stemming from industrial uses, amounting to 744 million tons of CO_2-equivalent. Within the sector **Energy**, stationary combustion sources in manufacturing industries and construction contributed **426 million tons,** while **Industrial processes & product use** were attributed to **318 million tons**. Specifically, industrial processes included emissions from cement and lime (approximately 90 million tons), chemicals (around 45 million tons), and metals (about 67 million tons).



Greenhouse Gas Emissions of the Industry Sector 2021 of the EU27. *Source: own representation with data from European Environment Agency (2023)*

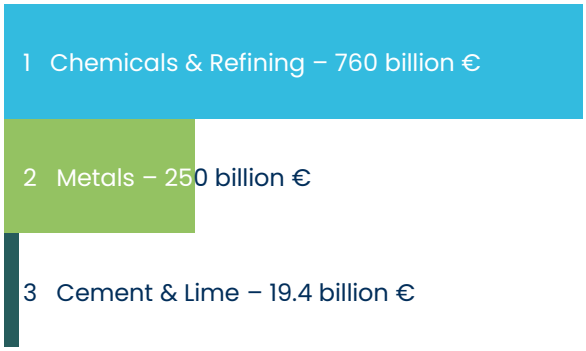
ECONOMIC RELEVANCE OF SECTORS [26]

Europe's **Chemicals & Refining** industry is the second largest producer worldwide after Asia. It includes annual sales of over 760 billion €, R&I investments of over 11 billion € and a workforce of over 1.2 million.

The **Metal** sector, both non-ferrous and ferrous, is highly relevant to Europe's job market, providing direct jobs for over 4.8 million people and a combined annual turnover over 250 billion €.

The European cement sector is the third largest worldwide, after China and India, making up around 6% of annual production. According to the RE4Industry Project, the **Cement & Lime** sector encompasses an annual turnover above 19.4 billion € and 58,000 jobs.

Affordable renewable energy availability, energy efficiency and circularity are some of the priorities for industry transformation.



Relevant Industry Sectors by annual turnover
Source: Country Insight Report – EU COMMISSION

* Including Emissions from Energy – Stationary Combustion: Manufacturing Industries and Construction & Industrial Processes

[25] EEA (2023) – Annual European Union greenhouse gas inventory 1990–2021 and inventory report 2023
[26] Detailed sources on next page

CHEMICALS & REFINING [27]

Annual turnover (2022):
760 billion €

Biggest producers (2022):
Germany (30%), France (18%), Netherlands (11%), Italy (9%)

Export sales (2022): **240 billion €**

Direct jobs (2018): **1.2 million**
Indirect jobs (2018): **3.6 million**

Main export markets (2022):
USA (16%), UK (12%), Turkey (4%), Brazil (2%)

METALS INCLUDING IRON AND STEEL [28, 29]

Annual turnover:
Non-ferrous – **120 billion €**
Steel (2022) – **130 billion €**

Annual production:
Non-ferrous – **47 million tonnes**
Steel (2022) – **130 million tonnes**

Direct jobs:
Non-ferrous – **500,000**
Steel (2022) - **306,000**

Steel exports (2022):
16.6 million tonnes

Main steel export markets (2022):
UK, Turkey, US, Switzerland, Egypt

CEMENT & LIME [30, 31]

Turnover (2019):
Cement – **15.2 billion €**
Lime – **4.2 billion €**

Number of employees (2019):
Cement – **47,000**
Lime – **11,000**

Annual production (2020):
171.5 million tonnes cement

Export (2023):
9.3 million tonnes cement

Main export markets (2023):
Turkey, Algeria, Ukraine

R&I EVIDENCE-BASED KNOWLEDGE SUPPORT – KEY CONTACTS

The Joint Research Centre **(JRC)** provides independent, evidence-based knowledge and science, supporting a variety of the EU policies, including the industrial policy, at multiple stages of the EU policy cycle. It contributes significantly to the overall objective of a major EU R&I funding programme, the Horizon Europe. The JRC includes a publications repository and an **EU Science Hub.**

[27] European Chemical Industry Council (2023) – The European Chemical Industry, Facts and Figures 2023
[28] Data on non-ferrous metals: Eurometaux (2023) – Key Industry Data
[29] Data on steel: EUROFER (2023) - European Steel in Figures 2023
[30] Cembureau (2022) - EU CEMENT INDUSTRY TRADE STATISTICS 2022
[31] RE4industry (2023) – Report on Project Progress / Cement & Lime

NET-ZERO INDUSTRY IN EUROPE – INITIATIVES AND FUNDING

On the level of the European Union many interrelated policies, programmes, and initiatives, covering a wide variety of fields, currently contribute to the EU industrial policy. From the R&I perspective relevant to energy intensive industries we can mention as examples the following instruments:

- The Horizon Europe programme is a R&I funding programme. Projects related to energy intensive industries under Horizon Europe are targeting technology readiness level (TRL) ≥ 7.

  Timeframe: 2021 until 2027

  Total funding volume: 95.5 billion €

- Processes4Planet is a Horizon Europe co-programmed partnership. Its ambition is to make European energy intensive process industries, including cement, metals, ceramics, chemicals, engineering, minerals, water, refineries, and pulp & paper, circular and climate neutral by 2050 and enhance their global competitiveness.

  Overall public/private budget: 2.6 billion €;

- For the **steel sector**, the Clean Steel partnership is another co-programmed partnership to pilot and demonstrate breakthrough technologies up to TRL 8 that can reduce CO2 emissions stemming from EU steel. By 2027 it will implement at least two demonstration projects that could cut CO2 emissions by 50% compared to 1990 levels and achieve TRL 8 by 2030 in at least twelve areas funded by the partnership.

  The European Commission is also implementing a Research Fund for Coal and Steel (RFCS), to support research projects in the **coal and particularly steel industries**, especially new technologies leading to net-zero-carbon steel making.

  Overall public/private budget: 1.7 billion €

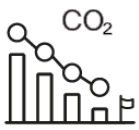
- The Innovation Fund is one of the world's largest funding programmes for the deployment of net-zero and innovative technologies. It is fully funded by the EU Emissions Trading System (ETS), and aims to bring to the market solutions to decarbonise European industry and support its transition to climate neutrality while fostering its competitiveness. Amongst other, the Fund supports projects focusing on innovative low-carbon technologies and processes in energy-intensive industries, including products that can substitute carbon-intensive ones, as well as on carbon capture utilisation and storage.

  Total funding volume: 40 billion € (assuming a carbon price of 75 €/t CO_2)

- The European Innovation Council and the European Investment Bank offer further important funding opportunities, for example for larger scale / more mature projects or start-ups and SME's.

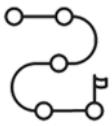
Examples of other funding opportunities:
EU Funding & Tenders Portal
Important Projects of Common European Interest (IPCEI)

RELEVANT EXAMPLES OF POLICIES & ROADMAPS



The fulfilment of **National Climate and Energy plans** serve as a successful instrument for coordinating Member States on the path towards decarbonisation and achieving climate targets.

With the Green Deal Industrial Plan flagship, including major key initiatives such as the Net Zero Industry Act and the Critical Raw Materials Act, the EU enhances the competitiveness of Europe's net-zero industry and is supporting acceleration of the transition to climate neutrality. It does so by creating a more supportive environment for scaling up the EU's manufacturing capacity for the net-zero technologies and products required to meet Europe's ambitious climate targets.



Each industrial ecosystem must transform its business models and value chains to become the foundation of a green, digital, and resilient European economy. The European Commission is working with stakeholders in an inclusive process on concrete and actionable plans (transition pathways) developed for each of the industrial ecosystems. Furthermore the Industrial Technology Roadmaps are a core action in the new European Research Area (ERA) strategy. They are a tool brought forward by the Commission to accelerate transfer of research and innovation results into the market for the green and digital transformation of industries across the EU.

The roadmap on low-carbon technologies for energy-intensive industries highlights the most relevant technologies to achieve the decarbonisation of Europe's most energy-intensive industries, such as steel, cement, or chemicals, among others.

The roadmap on circular industrial technologies addresses the circularity of 3 industrial ecosystems: textiles, construction, and energy-intensive industries, which stand out for their resource intensity and waste generation, but also their potential for circularity.

FLAGSHIP PROJECTS

The European Commission's report on **"Scaling up innovative technologies for climate neutrality"** maps demonstrators in energy-intensive industries financed either by EU instruments or by individual EU countries through IPCEI Projects.

The report gives an overview of over 184 demonstrators or technologies in sectors like chemicals, cement, steel, glass, paper, ceramics industries, and oil refineries implemented until January 2023.

On the **European Steel Technology Platform** a list of The Clean Steel Partnership projects can be found.

It is also possible to consult ongoing projects of various themes and technical fields on the Processes4Planted Website.

Further examples can be found through JRC Energy and Industry Geography Lab, European industrial associations, etc.

FINLAND

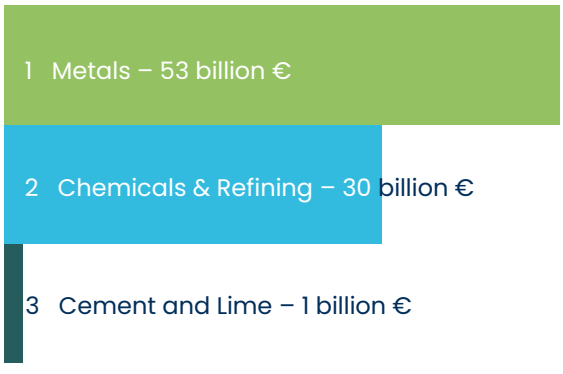
NIM - Country Insight Report 2024

Industry sectors such as Metals, Chemicals and Manufacturing shape Finland's economic landscape in the hard-to-abate sectors although the forest industry is the largest industrial sector. Finland has embraced the EU's most ambitious climate objective, striving to achieve carbon-neutrality by 2035. This commitment is supported by R&D funding such as the Hydrogen and Batteries program, as well as policies aimed at solidifying emission reduction targets, including tackling hard-to-abate emissions from the industry sector.

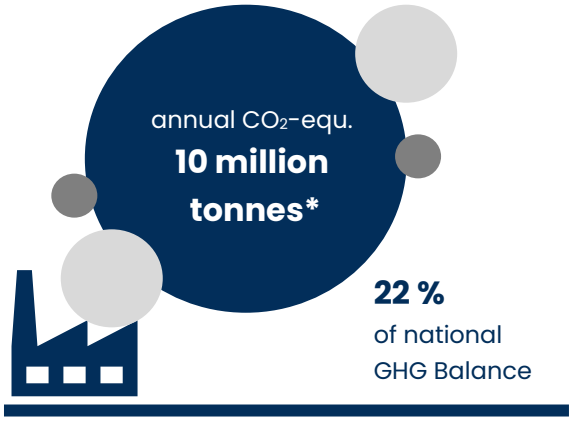
INDUSTRY GHG EMISSIONS [32]

Within 2023 Greenhouse Gas Inventory of Finland **Industrial processes & product use**, emissions amount to **4.7 million tonnes** of CO_2-equivalent. This includes contributions from the metal industry (approximately 1.98 million tons), the chemical industry (1.07 million tons), the mineral industry (0.77 million tons) and non-energy products from fuels and solvent use (0.13 million tons).

Emissions from **Energy** – stationary combustion of fossil fuels in manufacturing industries & construction totalled **5.3 million tons** of CO_2 equivalent. Notably, there has been a decrease of over 50% since 1990 of this emission category.



Relevant Industry Sectors by annual turnover
Source: Country Insight Report – FINLAND



Greenhouse Gas Emissions of the Industry Sector 2023, Finland. *Source: own representation with data from Statistics Finland (2024)*

ECONOMIC RELEVANCE OF SECTORS [33]

Industry plays a crucial role in Finland's economy, with hard-to-abate sectors like Metals and Chemicals contributing significantly to the GDP.

The **Metal** sector alone generates an estimated annual turnover of 53 billion €, providing employment opportunities for over 180,000 individuals.

Chemicals & Refining contribute around 30 billion € per year and offer stable employment for approximately 12,500 people.

Additionally, the **Cement & Lime** sector, with a net turnover of a little over 1 billion € annually, holds considerable significance.

[32] Statistics Finland (2024) – Greenhouse Gas Emissions 1990-2023

[33] Detailed sources on next page
* Including Emissions from Energy – Stationary Combustion: Manufacturing Industries and Construction & Industrial Processes

CHEMICALS & REFINING [34]

Annual net turnover (2023):
30 billion €

Number of employees:
~12,500

Main export markets (2023):
Sweden, USA, Netherlands, Belgium, Germany, UK, Poland

Biggest companies based on turnover:
Neste, Kemira, Yara, Umicore, Linde, Jervois, Borealis Polymers, PPG Tikkurila

METALS INCLUDING IRON AND STEEL [35]

Annual net turnover (2023):
53 billion €

Number of employees:
~187,000 (Industrial Union)

Main export markets (2023):
EU, USA, UK

Biggest companies based on turnover:
SSAB Finland, Outokumpu, Boliden, Terrafame

CEMENT & LIME [36]

Annual net turnover (2023):
1 billion €

Number of employees:
~5,000

Biggest companies based on turnover:
Parma, Rudus, Lujabetoni

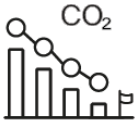
DECARBONISING FINLAND'S INDUSTRY - FUNDING OPPORTUNITIES

- **Clean Energy Transition Partnership**
  In 2023, the Business Finland finances the Clean Energy Transition Partnership (CETP) with a total budget of 5 million €. Especially module 9 "Integrated Industrial Energy Systems" and module 4 "Carbon capture, utilisation, and storage (CCUS)" are directed towards decarbonisation of industries.
- **Sustainable Manufacturing Finland**
  The Sustainable Manufacturing Finland program focuses on renewing business models and increasing productivity, while actively seeking solutions to the challenges of climate change.
- **Hydrogen and Batteries program**
  The Hydrogen & Batteries – Dual Helix of Decarbonisation program promotes the development and international growth of the Finnish hydrogen and battery industry value chains, technologies, solutions, and services. This program has been in favour of Finnish industry striving for zero-carbon.
  Program runtime: 2023-2028

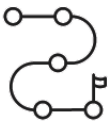
More about Finland's funding opportunities:
BusinessFinland

[34] Statistics Finland (2024)
[35] Statistics Finland (2024)
[36] Statistics Finland (2024)

RELEVANT POLICIES & ROADMAPS



In 2019, Finland set the target of becoming **carbon-neutral by 2035** and being the world's **first fossil-free welfare society**.



Finland aims to achieve climate targets through integrated **sector-specific low-carbon** Climate roadmaps created collaboratively by public and private sectors, providing a blueprint that reflects the diverse solutions of Finnish industries. In 2020, 14 Finnish sectors produced their own sectoral roadmaps, pathways for the sector's decarbonisation. In autumn 2023, according to the Government programme of Prime Minister Orpo, the work started to update the sector specific low carbon roadmaps. The updating of low-carbon roadmaps will be completed in summer 2024 (status in June: 8 out of 14 roadmaps were published). Ministry of Economic Affairs and Employment will publish a summary of the findings in autumn 2024.

Roadmaps for hard-to-abate and energy-intensive industries include:
- Roadmap for Finnish Technology Industries (includes metals, industrial minerals): Roadmap 2020 (in English), Roadmap 2024 (in Finnish)
- Roadmap for the Finnish chemical sector (2020)

In addition, according to the Government Programme the government is updating the energy and climate strategy and preparing an industrial policy strategy.

FLAGSHIP PROJECTS

SHARC is a **renewable hydrogen** project backed by 88 million EUR from the Innovation Fund. It will introduce electrolysis and carbon capture and storage technologies at **Neste's Porvoo refinery.** Set to operate at near-market conditions by 2025, it aims to reduce greenhouse gas emissions by more than 4 million tonnes of CO_2-equivalent over its first decade of operation.

PULSE is a **chemical recycling** project that plans to integrate advanced technologies into the **Porvoo refinery**. The demonstrator is expected to be close to market by 2028. Its goal is to cut 10.3 million tonnes of CO_2-equivalent in greenhouse gas emissions within its first 10 years of operation.

P2X-Europe is a project that showcases **power-to-liquid** technology solutions using hydrogen derived from renewable energy in the chemicals sector. Finland is contributing 70 million EUR to this **demonstrator in Harjavalta,** which is expected to be close to market by 2024, through the Hydrogen IPCEI.

MORSE is a multi-country project that demonstrates digitalisation technologies at TRL 7 in the steel industry, with **two operational plants in Finland** and one in Austria.

GERMANY

NIM - Country Insight Report 2024

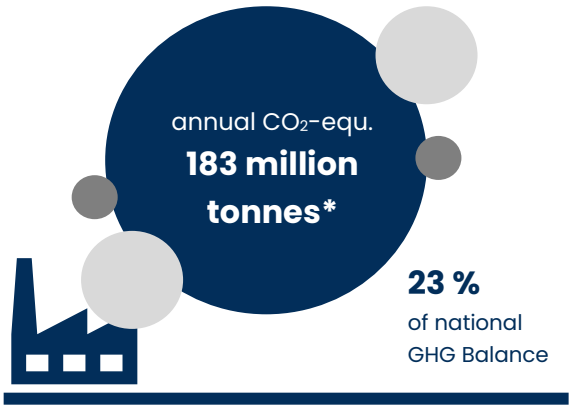
The German industry sector is highly diversified and renowned for its engineering, automotive and chemicals production. Efforts towards carbon neutrality by 2045 are evident through initiatives such as the National Hydrogen Strategy and funding programs like Carbon Contracts for Difference, supporting the transition to innovative technologies in energy-intensive sectors like steel, chemical, and cement.

INDUSTRY GHG EMISSIONS [37]

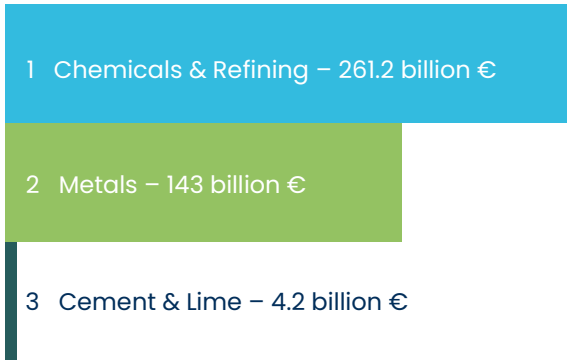
In 2021, Germany's greenhouse gas inventory reported a total of 764 million tonnes of CO_2-equivalent emissions, with approximately 23% stemming from industry, amounting to over 183 million tonnes CO_2-equivalent.

Within **Industrial processes**, emissions reached around **57 million tonnes**, led by cement and lime as the largest contributors with 18.2 million tonnes, followed by Iron & Steel at 16.4 million tonnes, and chemicals and refining at approximately 6 million tonnes.

Emissions from **Energy** - fuel combustion in manufacturing industries and construction were estimated at around **126 million tonnes** CO_2-equivalent. Iron and steel constitute roughly 30% of these emissions, making it the largest sector in this category.



Greenhouse Gas Emissions of the Industry Sector 2021, Germany. *Source: own representation with data from the German Environment Agency (2023)*



Relevant Industry Sectors by annual turnover
Source: Country Insight Report GERMANY

ECONOMIC RELEVANCE OF SECTORS [38]

The German **Chemical & Refining** industry is a major global player, ranking fourth worldwide with an annual turnover of over 261.2 billion € and providing employment for more than 353,500 individuals. This places it behind only the United States, China, and Japan.[39]

The **Metal** industry in Germany includes the production of 37 million tonnes of steel and 7.3 million tonnes of non-ferrous metals, while supporting over 190,000 jobs. In 2022, the sector was valued at 143 billion €.[40]

The combined annual revenue of the **Cement & Lime** industries in Germany exceeds 4 billion €, with more than 15,000 people employed and producing more than 30 million tonnes of cement and 6 million tonnes of lime annually.

[37] German Environment Agency (2023) – National Inventory Report for the German Greenhouse Gas Inventory 1990-2021
* Including Emissions from Energy – Stationary Combustion: Manufacturing Industries and Construction & Industrial Processes

[38] Detailed sources on next page
[39] GTAI (2020) – The Chemical Industry in Germany
[40] Statista (2024) - Revenue of the German metal industry worldwide 2005-2022

CHEMICALS & REFINING [41]

Annual turnover (2022):
261.2 billion €

Biggest companies based on turnover:
BASF SE, DOW, Wacker, Bayer, Shell, BP

Number of employees (2022):
353,512

Main export markets:
EU, USA, China

METALS INCLUDING IRON AND STEEL [42]

Annual turnover:
Primary Steel industry (2022) - **55.2 billion €**
Non-ferrous (2020) – **53.2 billion €**
Steel & metal processing industry – **80 billion €**

Number of employees:
Primary Steel Industry (2022)- **90,000**
Non-ferrous (2020)- **108,295**

Production capacity:
Raw Steel (2022) - **37 million tonnes**
Non-ferrous (2020) - **7.3 million tonnes**

Biggest companies based on turnover:
ArcelorMittal, ThyssenKrupp

CEMENT & LIME [43, 44]

Annual turnover:
Lime (2021) – **0.7 billion €**
Cement (2022) – **3.5 billion €**

Number of employees:
Lime (2021) – **3,100**
Cement (2022) – **12,100**

Production capacity lime:
Lime (2021) – **6 million tonnes**
Cement (2022) – **30 million tonnes**

Biggest companies based on turnover:
Lhoist, Fels Werke, HeidelbergCement, Cemex

DECARBONISING THE GERMAN INDUSTRY – FUNDING OPPORTUNITIES

- The German Ministry for Economic Affairs and Climate Action (BMWK) launched the funding program Carbon Contracts for Difference (CCfD) to help energy-intensive industries like steel, chemical, and cement transition to climate-neutral practices. The program offers financial support for companies investing in innovative, eco-friendly technologies.

Total funding volume: 50 billion €

- The Federal Funding for Industry and Climate Protection (BIK) supports both investment and application-oriented **research, development, and innovation projects.** It aims to back investments that achieve a minimum 40 percent reduction in CO_2 emissions compared to previous levels.

Minimum project size:
Investment of at least 1 million €
or 0.5 million € for SME

Other funding opportunities: Förderwegweiser

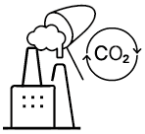
[41] Verband der Chemischen Industrie e.V. (2023) – Chemiewirtschaft in Zahlen 203
[42] Bundesministerium für Wirtschaft und Klimaschutz (2024) – Wirtschaftsbranchen Stahl und Metall
[43] Bundesverband der deutschen Kalkindustrie e.V. (2024) – Die Branche
[44] VDZ (2024) – Zahlen und Daten: Zementindustrie in Deutschland

INITIATIVES & SUPPORT CAPABILITIES – KEY CONTACTS

The Cluster Decarbonisation in Industries **(CDI)** supports Germany's aim of achieving greenhouse gas neutrality by 2045. CDI serves as an **interdisciplinary network** based in Cottbus, engaging stakeholders across science, business, politics, and administration to drive solutions and innovations for a climate-friendly industrial future.

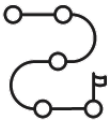
RELEVANT POLICIES & ROADMAPS

The German government works on different strategies to reach the goal of climate neutrality in 2045.



The BMWK released an outline for its carbon management strategy, alongside a draft law to amend the Carbon Dioxide Storage Act (KSpG). Emphasising carbon neutrality by 2045, the strategy aims to tackle emissions, with decarbonisation as the central focus of current climate efforts.

The Federal Government's National Hydrogen Strategy **(NHS)** outlines plans for hydrogen production, transport, and utilisation, aiming for carbon neutrality by 2045. Through doubling electrolyser capacity and enhancing infrastructure, Germany seeks to lead in hydrogen technologies by 2030 to meet the ambitious climate goals.



Germany's cement association **(VDZ)** has released a report outlining a roadmap to decarbonise cement and concrete production. The report stresses collaboration across the construction industry to achieve net zero emissions.

FLAGSHIP PROJECT

The Everest project, undertaken by the company **Lhoist**, a member of the Federal Association of the German Lime Industry (BVK), is a significant initiative aimed at achieving **carbon neutrality in the lime industry**.

The project involves the implementation of **CCUS** and securely stores approximately **1.5 million tonnes of CO_2** annually. This project marks the largest carbon capture project in Germany to date and demonstrates.

Everest project
Wülfrath, Lhoist Group

The project Concrete Chemicals at the **CEMEX** site in Rüdersdorf, one of Germany's largest cement plants, aims to establish a **large-scale demonstration facility.**

It involves two stages of scaling, initially producing **hydrogen** locally using renewable energy sources to create **15,000 tons of e-kerosene** annually. The project will advance innovative catalytic processes and reactor technologies to achieve long-term low-CO_2 cement production.

Concrete Chemicals project
Rükersdorf, CEMEX

REPUBLIC OF KOREA

NIM - Country Insight Report **2024**

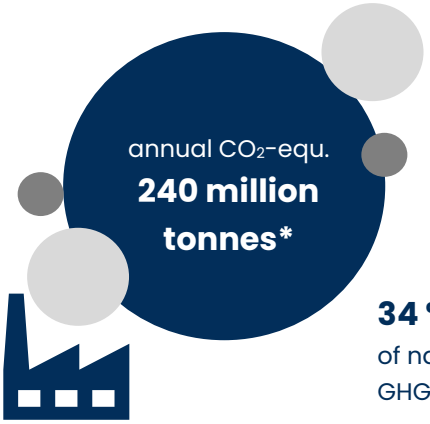
The diverse Korean industry, including hard-to-abate sectors, is undergoing a shift towards sustainability, supported by government policies and investments in carbon neutrality and climate-tech. With a 100 billion USD investment in public-private partnerships by 2030, Korea aims to foster climate-tech startups, generate employment, and advance high-tech manufacturing.

INDUSTRY GHG EMISSIONS [45]

In 2018, total GHG emissions in the Republic of Korea were 727.6 million tonnes of CO_2-equivalent, where approximately 34% could be attributed to the industry sector.

Emissions from the sector **Industrial Processes and Product Use** amounted to **57 million tonnes** CO_2-equivalent.

Emissions from **Energy** - fuel combustion in manufacturing industries and construction amounted to around **187 million tonnes** of CO_2-equivalent. Together they account for 240 million tonnes of CO_2-equivalent GHG emissions, that can be attributed to the industry sector.



Greenhouse Gas Emissions of the Industry Sector 2018, Republic of Korea. *Source: own representation with data from the Government of the Republic of Korea (2021)*

ECONOMIC RELEVANCE OF SECTORS [46]

The Korean industry sector is known for its diverse range of industries, where hard-to-abate and energy-intensive sectors play a pivotal role in shaping its landscape.

1 Chemicals and Refining – 322.7 billion USD

2 Metals – 118.7 billion USD

3 Cement – 3.9 billion USD

Relevant Industry Sectors by annual turnover
Source: Country Insight Report – REPUBLIC OF KOREA

In 2022, the **Chemicals and Refining** sector emerged as the frontrunner in terms of annual turnover, boasting an impressive 322.7 billion USD in 2022 and providing employment opportunities for over 165,000 individuals.

The **Metals** industry proved its significance with an impressive annual net turnover exceeding 118 billion USD. Notably, POSCO (Pohang Iron and Steel Company) stands out as one of the world's largest steel producers.

South Korea's **Cement** production in 2022 reached 51 million tonnes, resulting in a substantial annual net turnover of 3.9 billion USD.

* Including Emissions from Energy – Stationary Combustion: Manufacturing Industries and Construction & Industrial Processes

[45] Government of Korea (2021) – Fourth Biennial Update Report of the Republic of Korea under the UNFCCC
[46] Detailed sources on next page

CHEMICALS & REFINING [47, 48]

Annual turnover (2023):
322.7 billion USD

Number of employees (2023):
165,934

Production capacity ethylene (2022):
12.8 million tonnes

Main export markets:
China, USA, India, Vietnam, Japan

Production capacity refining (2022):
3,363 thousand barrels / day

Industry Hotspots:
Daesan, Yeosu, Ulsan, Onsan

METALS INCLUDING IRON AND STEEL [49, 50]

Annual net turnover (2022):
Ferrous - **97.1 trillion KRW / 71.7 billion USD**
Nonferrous – **46.95 billion USD**

Main export markets:
EU, Japan, China, US, India, Vietnam

Production capacity (2022):
Ferrous - **65.8 million tonnes crude steel**
Nonferrous – **2.25 million tonnes**

Biggest companies (2022):
POSCO, Hyundai Steel, LS MnM, Korea Zinc, Poongsan, Novelis Korea, Youngpoong SOONC

Number of Employees (2022):
197,410

Industry Hotspots:
Pohang, Cwangyang, Ulsan, Dangjin

CEMENT [51]

Annual net turnover (2022):
5.3 trillion KRW / 3.85 billion USD

Biggest companies (2022):
Sampyo Cement, Ssangyong C&E, Hanil Cement, Sungshin Cement, Halla Cement

Production capacity cement (2022):
51 million tonnes

Number of Employees (2022):
5,100

Industry Hotspots:
Gangwon-do, Chungcheongbuk-do

R&D SUPPORT / NATIONAL KNOWLEDGE SHARING – KEY CONTACTS

Korea Energy Technology Evaluation and Planning **(KETEP)**

Korea Planning & Evaluation Institution of Industrial Technology **(KEIT)**
Mail: djfls100@keit.re.kr
Phone: 825 37 18 82 44

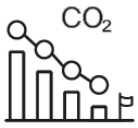
[47] Korea Petrochemical Industry Association (2023) -Korea Petrochemical Industry in 2023
[48] Kosis.kr (2023)
[49] Korea Iron & Steel Association (2023)
[50] WBMS World Metal Statistics (2023)
[51] Korea Cement Association (2023)

KOREAN PUBLIC-PRIVATE-PARTNERSHIPS – FUNDING OPPORTUNITIES [52]

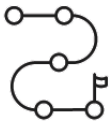
By 2030, the Korean government plans to invest **over 100 billion USD** in **public-private partnerships** as outlined in its Strategy for Fostering the Climate Tech Industry. This initiative aims to support the emergence of 10 climate tech unicorn companies and create 100,000 jobs within the sector.

A dedicated **fund for high-tech manufacturing and emerging technologies** will be established, accompanied by strategies to attract **153 million USD in private funding** for ESG initiatives, including impact investing and corporate venture capital.

RELEVANT POLICIES & ROADMAPS



The Framework Act on Carbon Neutrality and Green Growth for Coping with Climate Crisis is a law that stipulates principles and systems related to climate crisis response policies. According to Article 10 of the law, *National Carbon Neutrality & Green Growth Basic Plans* must be established. These include sector-specific emission reduction targets.



The Carbon Neutrality **Technology Innovation Roadmap** presents step-by-step goals for applying Korean Carbon Neutrality Top 100 Core Technologies to actual sites. The Korean government plans to use this roadmap as a basic blueprint for government research and development investment in the carbon neutrality field.

The **Korean Carbon Neutrality Top 100 Core Technologies** are technologies selected by the government as crucial for Korea's journey towards carbon neutrality. They indicate the direction of R&D in the field of decarbonisation, considering factors like Korea's geographical conditions, industrial structure, and technology level.

FLAGSHIP PROJECT

The Carbon Neutrality Core Technology Development Project, initiated in 2023, aims to contribute to the **green transformation of manufacturing industries** by developing technologies and conducting demonstrations to convert carbon emissions processes of the four major carbon emitting industries such as **steel, cement, petrochemicals, semi-conductors/display** to carbon-neutral processes.

Additionally, a **Carbon Neutrality Grand Consortium** will be formed to manage and share R&D information of the projects, and to support **cooperation and exchange** among institutions. This promotes the dissemination of carbon neutrality R&D achievements across the entire industry for the achievement of carbon neutrality.

[52] Strategy for Fostering the Climate Tech Industry (June 2023)

UNITED KINGDOM

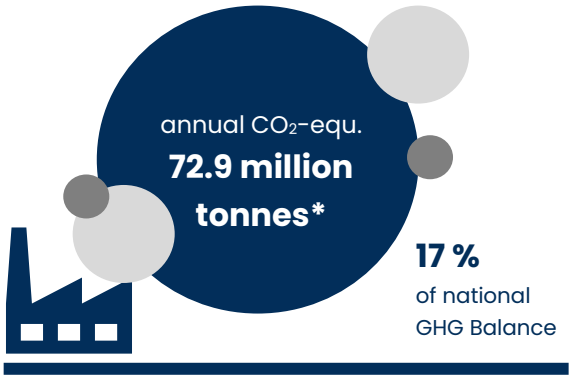
NIM - Country Insight Report **2024**

The UK's industry sector significantly contributes to the economy and employment, with efforts to reduce its greenhouse gas emissions through decarbonisation projects and funding for low-carbon technologies. Flagship projects like *Hynet NorthWest* and various funding opportunities drive these efforts, supported by the Industrial Decarbonisation Strategy and related initiatives to achieve net-zero targets.

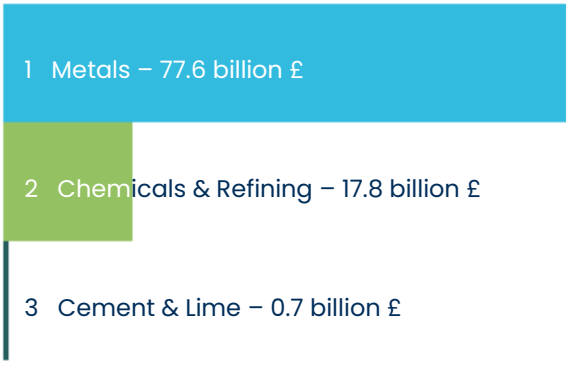
INDUSTRY GHG EMISSIONS [53]

In 2021, the UK reported **32.2 million tonnes of CO_2-equivalent emissions** in the sector **Industrial Processes and Product Use**, making it the third largest sector for greenhouse gas emissions. This represents a 60% decline since the 1990s. The main contributors to these emissions are metal production and the use of products as substitutes for ozone-depleting substances (ODS), each accounting for over 10 million tonnes.

Since 1990, emissions from the **Manufacturing Industries and Construction** sector from fuel combustion, have decreased due to reduced fuel consumption and emissions across all sub-sectors. In 2021 this sector reported a total of approximately **40.7 million tonnes CO_2-equivalent emissions.**



Greenhouse Gas Emissions of the Industry Sector 2020 of the UK. *Source: own representation with data from the UK Department for Energy Security and Net Zero (2022)*



Relevant Industry Sectors by annual net turnover
Data Sources: Country Insight Report UNITED KINGDOM

ECONOMIC RELEVANCE OF SECTORS [54]

In 2021, the UK's **Chemical and Refining** industry (SIC codes 19.2 and 20) achieved a net turnover of 77.6 billion £, providing employment for over 103,000 people.

Following this, the **Metal** sector, encompassing iron and steel production, recorded a turnover of 17.8 billion £ and produced over 7.9 million tonnes of metal (SIC code 24 – 'Manufacture of basic metal').

In 2021 the UK produced 8.4 million tonnes of **Cement and Lime**, resulting in a net turnover of 0.7 billion £ and creating job opportunities for more than 2,000 individuals (SIC code 23.5 - 'Manufacture of cement, lime, and plaster'). (SIC code 23.5 - 'Manufacture of cement, lime and plaster').

* Including Emissions from Energy – Stationary Combustion: Manufacturing Industries and Construction & Industrial Processes & Product Use

[53] UK Department for Energy Security and Net Zero (2022) – UK Greenhouse Gas Inventory, 1990 to 2021, Annual Report for Submission under the Framework Convention on Climate Change
[54] Office for National Statistics (2021), Non-financial business economy, UK: Sections A to S. Detailed sources on next page.

CHEMICALS & REFINING [55, 56]

Annual net turnover (2021): **77.6 billion £**

Number of employees (2021): **103,000**

Export value (2021): **41.8 billion £**

Biggest companies based on turnover: **Croda International, Johnson Matthey, Exxon Mobil**

METALS INCLUDING IRON AND STEEL [55, 59]

Annual net turnover (2021): **17.8 billion £**

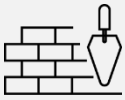
Number of employees (2021): **71,000**

Export value (2021): **27.7 billion £**

Biggest companies based on turnover: **Tata steel, British Steel**

Industrial areas: **Port Talbot, Scunthorpe**

Main export markets: **Europe (43%)**



CEMENT & LIME [55, 57]

Annual net turnover (2021): **0.7 billion £**

Number of employees (2021): in Great Britain – **2,000**

Export value (2021): **0.1 billion £**

Biggest companies based on turnover: UK-owned - **Breedon cement, Cemcor** International - **Cemez, Tarmac, Heidelberg Materials, Aggregate Industries**

FLAGSHIP PROJECT

The Hynet NorthWest cluster is an impressive flagship project, which focuses on a **CO_2-pipeline** and **offshore transport and storage system**, as well as the deployment of **hydrogen infrastructure** across North West England and North Wales.

This includes the **production of low-carbon hydrogen** and the **transport and storage of CO_2** generated during hydrogen production.

The Hynet NorthWest Cluster Plan project, completed in March 2023, outlined a roadmap for a multi-vector energy system that integrates **renewables, hydrogen, carbon capture and storage (CCUS), nuclear energy, and smart grids** to promote clean growth in the region.

[55] Office for National Statistics (2021) – Non-financial business economy, UK | Trade in goods: CPA (08) exports and imports, UK
[56] Office for National Statistics (2021) – JOBS03: Employee jobs by industry
[57] Office for National Statistics (2021) – NOMIS, official census and labour market statistics

DECARBONISING THE UK'S INDUSTRY – FUNDING OPPORTUNITIES

The Net Zero Innovation Portfolio **(NZIP)** provides Research & Innovation funding for low carbon technologies and systems. Until June 2023 around 150 million £ were granted for industry projects between TRL 4-7, including feasibility & demonstration. Included are following Accelerators:

- Industrial Energy Efficiency Accelerator
  Funding volume: 10 million £
- Industrial fuel switching
  21 feasibility + 13 demo projects on H_2, biofuel and electrification
  Funding volume: 57.5 million £
- Industrial Hydrogen Accelerator
  9 feasibilities + 3 demos
  Funding volume: 20 million £
- Accelerating CCUS Technologies (ACT) 3rd call
  accelerating and maturing CCS technologies
  Funding volume: 5 million £

The government is increasing budget for the Green Industries Growth Accelerator **(GIGA)** to further support expansion of low carbon manufacturing supply chains across the UK.

Total funding volume:

- 390 million £ for offshore wind & electricity networks
- 390 million £ for CCUS and hydrogen
- 300 million £ for nuclear fuels

The Industrial Energy Transformation Fund **(IETF)** is designed to help businesses with high energy use to cut their energy bills and carbon emissions through investing in energy efficiency and low carbon technologies, such as the feasibility of CCUS, or recovering waste heat.

Total funding volume: launched in 2020, in 3 phases with £500 million of funding available up until 2028.

Other funding opportunities include:
The Industrial Decarbonisation Challenge (IDC) (ended 2024; funding volume: 210 million £)
Transforming foundation industries (funding volume: 141 million £)

RELEVANT POLICIES & ROADMAPS

The main strategy document is the Industrial Decarbonisation Strategy, published in 2021. It outlines that industrial emissions represent 1/6th of UK's territorial emissions. Local Industrial Decarbonisation Plans aim to initiate decarbonisation at dispersed sites.

The Carbon border adjustment mechanism (CBAM) and 'demand-side' policy measures such as mandatory and voluntary product standards, labelling, and green public procurement.

KNOWLEDGE SHARING, RESEARCH & DEMONSTRATION SUPPORT

The Industrial Decarbonisation Research and Innovation Centre **(IDRIC)** was founded at Heriot-Watt University. The center encompasses a variety of research projects and includes a Knowledge Hub.

The Department for Energy Security and Net Zero **(DESNZ)** can answer questions concerning research and fundig

NET-ZERO INDUSTRIES
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