ZERO EMISSIONS Ze Me METAL PRODUCTION

Decarbonising the Norwegian metallurgical industry

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Norwegian Centre
for Environmentfriendly
Energy Research

SINTEF is one of Europe's largest independent research organisations

€3 billion
Revenues

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SINTEF: Process metallurgy and raw materials group

Raw Materials

- Waste minimization
- Waste to value
- Characterisation
- Micronizing
- Agglomeration

Pyrometallurgy

- Gas-liquid-solid reactions
- Slag processes
- Vacuum metallurgy
- Thermodynamics

Energy and climate gas reduction

- Energy and climate gas efficient processes
- Use of biocarbon
- Use of natural gas and hydrogen in metal production

Emissions

- Improvement of the working environment through reduced emissions and smart ventilation
- Emissions of polluting gasses (NOx, SOx, PAH, dioxins, etc…)
- Particle emissions
- High temperature measurements expertise

Modelling

- Atomistic scale modelling
- Single and multiphase flow modelling with and without reactions
- Thermodynamic modelling

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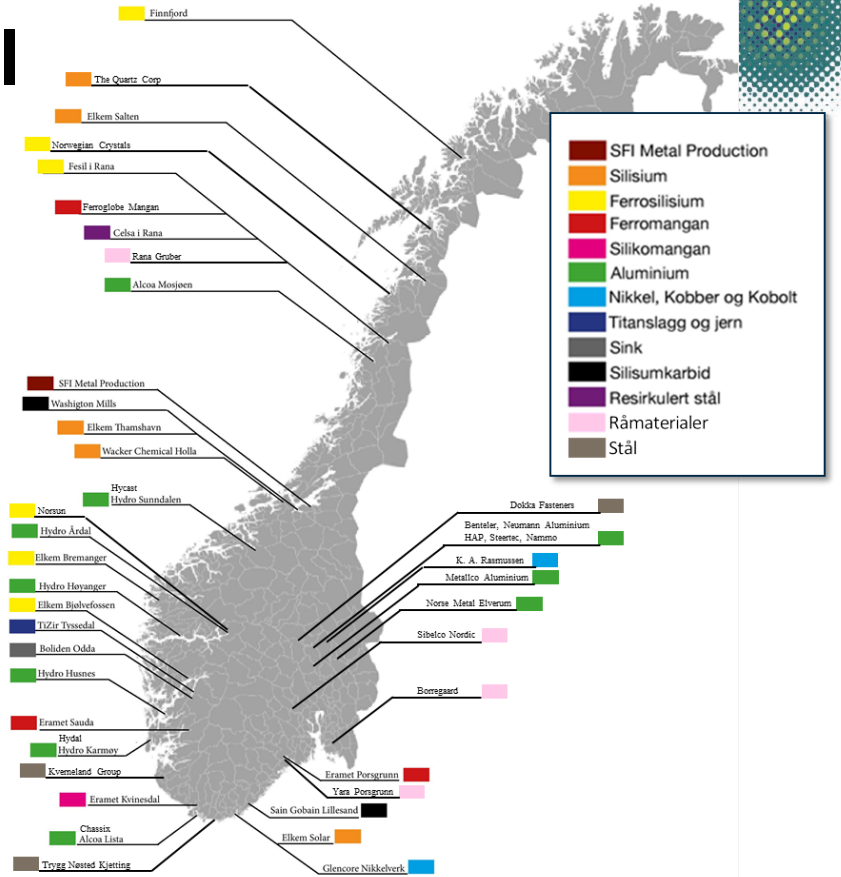
Norwegian metallurgical industry

- Silicon:
  - Elkem, Wacker and Finnfjord
- Aluminium:
  - Hydro and Alcoa
- Manganese:
  - Ferroglobe and Eramet

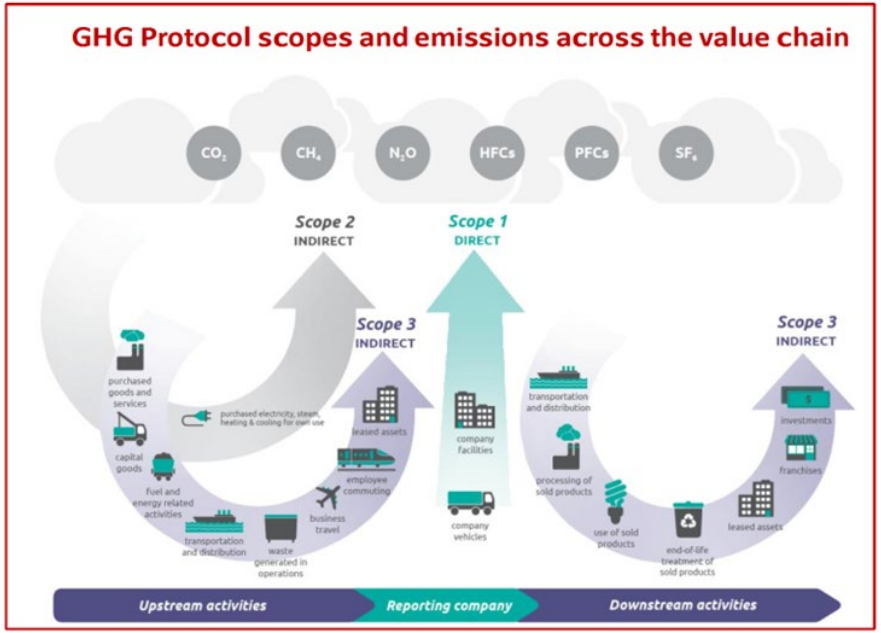


How can we decarbonise a metallurgical process

- Substitute the carbon with another element
- Substitute fossil carbon with carbon from biological resources.
- Capture or use the CO_2
- Loop the carbon back into the process

Calculating CO_2 emissions

- **Scope 1:** Direct greenhouse gas emissions from sources owned or controlled by an organization, e.g., carbon used in a metallurgical process.
- **Scope 2:** Indirect emissions from purchased energy, e.g., electricity.
- **Scope 3:** All other indirect emissions in the organization's value chain, e.g., business travel, supply chain, product use, and waste disposal.



GreenhouseGasProtocol.Org

Aluminium decarbonisation

Use carbon-free, renewable electricity

Capture CO_2

Inert anodes or biocarbon in anodes

Carbon looping

EUROPEAN COMMISSION

EU Policies for Green Metals

Brussels, 19.3.2025
COM(2025) 125 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

A European Steel and Metals Action Plan

Key Objectives:

- Achieve climate neutrality by 2050 under the European Green Deal, with at least 55% emissions reduction by 2030 compared to 1990 levels.
- Focus on decarbonizing steel, aluminum and other metals through targeted action plans and regulations.

Major Policies:

- **European Green Deal**: Comprehensive strategy integrating climate action, industrial competitiveness and sustainable finance to transition to low-carbon production.
- **Steel and Metals Action Plan (SMAP)**: Six-pillar framework addressing clean energy access, carbon leakage prevention, EU standards protection, demand boosting for clean metals, recycling promotion and innovation support.
- **EU Emissions Trading System (ETS):** Market-based mechanism that caps greenhouse gas emissions and prices carbon, encouraging industries to adopt low-emission technologies

Incentives and Mechanisms to Develop Markets

Financial and Funding incentives:

- **Innovation Fund:** €40 billion program funding up to 60% of costs for innovative low-carbon technologies, including first-of-a-kind projects in metals and industry decarbonization.
- **State Aid and Subsidies:** for steel decarbonization projects, supporting green transitions in EU member states.

Market and Trade Mechanisms:

- **Carbon Border Adjustment Mechanism (CBAM):** Imposes carbon pricing on imports of high-emission goods like steel and aluminum, leveling the playing field and incentivizing global low-carbon production for EU markets.
- **Demand-Boosting Tools:** Public procurement preferences for green metals, EU standards for low-carbon products, and recycling initiatives to create domestic markets.

Thank you for your attention

www.ntnu.edu/fmezeme

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