

# PROJECT PROGRESS

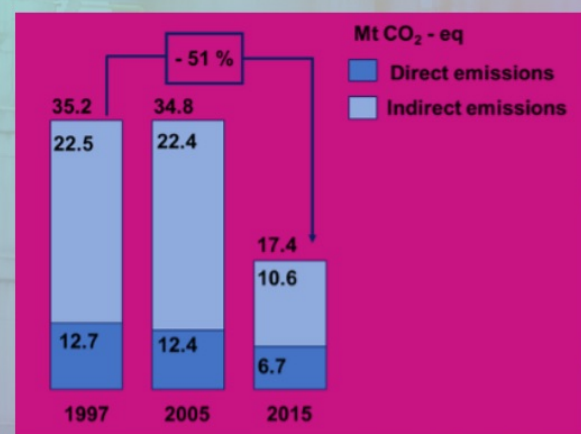
## Non-ferrous metals

Non-ferrous metals are metals that do not contain iron (ferrite) in appreciable amounts. They are widely used due to their high corrosion resistance, great electrical and thermal conductivity, low density, and non-magnetic properties that make them desirable in many applications, such as in buildings, transport, electronics, strategic sectors, as well as almost every other economic sector. They are particularly indispensable and irreplaceable in the production of low-carbon technologies and are worth EUR 120 billion.

The non-ferrous metals industry is the most electrified of all EIs, with a 58% share of electricity use in its overall energy consumption. As a result, the industry is 5 times more sensitive to higher electricity prices than other manufacturing industries. On the other hand, a significant characteristic of non-ferrous metals is their ability to be recycled. A strong emphasis on the circularity principle as well as the lack of indigenous resources has made Europe a leader in recycling non-ferrous metals, with an estimated of more than 50% of domestic supplies coming from recycled sources. The EU non-ferrous metal industry has already achieved to reduce its absolute emissions by 61% since 1990, the highest reduction achieved worldwide and retaining the potential of reducing GHG emissions by more than 90% until 2050.

**Aluminium** is an essential material for modern manufacturing. It is a lightweight, high-strength, corrosion-resistant metal with high electrical and thermal conductivity. The European sector consists of more than 600 plants, with an annual turnover of ~EUR 40 billion. Primary production of aluminium stands at 4 % (2016) of global total primary production. However, secondary aluminium production in the EU stands for 29.73% of global production.

Notably, recycling 1 kg of aluminium saves up to 8 kg of bauxite ore and 4 kg of other chemical products. Between 1997 and 2015 the total GHG emissions from aluminium production in the EU were reduced by 51% because of the almost full elimination of PFCs emissions. At the same time, emissions from anode consumption decreased 19% between 1997 and 2015.



**Figure.1** Evolution of GHG emissions from EU28+EFTA aluminium production



There is a high research interest in the sector. The most prospective technologies and pilot applications are **wettable cathodes** (15-20% of potential energy savings) and **inert anodes** with 10-30% lower capital cost. The **high-temperature carbothermic reduction** of alumina has lower (50%) capital costs and **Kaolin** as raw material in aluminium production would be 12-46% more efficient. Lastly, Karmøy Technology's **new generation electrolysis technology** can save 15% of aluminium production energy.

**Copper** is the second largest non-ferrous, base metal sector in the EU with an estimated turnover of about EUR 45 billion. In 2016, primary copper production in the EU stood at 13.1% of global total primary production and secondary copper production was almost 50%. Copper and copper alloys are widely used in diverse applications moreover, copper will be a crucial metal for the energy transition. Between 1990 and 2015 the emissions from copper production in the EU decreased by 15% although copper production increased by 40%. Further decarburization solutions are looked up under “**oxygen flash technique**”, “**copper extraction using electrolysis**” and “**waste heat recovery**” techniques.

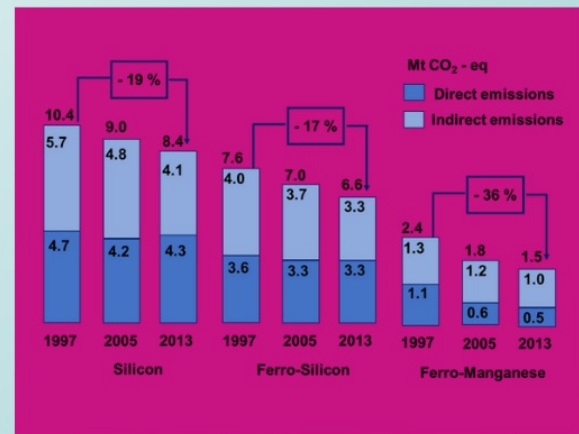
**Nickel** is a vital metal for industrialized societies but it is also vital to climate neutrality because is an essential enabler for a low-carbon economy. The sector in Europe is relatively small, it has an annual output of EUR 9.2 billion. Primary nickel production in Europe (including Norway) is 9.6% of global total primary production for 2018. Secondary nickel production in Europe amounts to 29.2% of the global secondary nickel production. Between 2011 and 2016, the emissions from nickel production remained stable. A significant fact worth mentioning is that most of the nickel produced in Europe is high purity.

**Zinc** is the fourth-most used metal with good abrasive resistance, corrosion resistance, castability, and room temperature mechanical properties and can be made into various alloys with many other metals and it has a great range of applications. The zinc industry in Europe has a turnover of EUR 5 billion approximately and only a small share (5.44%) of the global zinc ores. It can be assumed that more efficient equipment will become available over the next 40 years, in such a case the CO<sub>2</sub> emissions could be reduced by 50%, representing less than a 1% reduction of the total CO<sub>2</sub> level of 1990.





**Ferroalloys** production is a key supplier to the steel sector. Silicon and ferroalloys production have a Gross Value Added of € 480 million in the EU and are key enablers for a low-carbon economy in Europe. Ferroalloy and silicon production are electro-intensive processes. Silicon production requires 12.4 MWh/t of electricity, Ferro-silicon 8.7 MWh/t and Ferro-Manganese 3 MWh/t.



**Figure.2** Specific direct and indirect CO<sub>2</sub> emissions for Silicon, Ferrosilicon and Ferromanganese. (Source: Euroalliances)

It is estimated that total CO<sub>2</sub> emissions from silicon in the EU were 1.6 Mt in 2013 and 0.4 and 1.5 Mt for Ferromanganese and Ferro-silicon, respectively. Specific CO<sub>2</sub> emissions for silicon production were reduced by 19% between 1997 and 2013, 17% for Ferrosilicon and 36% for Ferro-Manganese. Significant efforts have been made in the industry to achieve energy efficiency to further reduce their environmental footprint. Such an example is the recent project of the installation of an **Organic Rankine Cycle**, the **Carbon Capture and Utilization algae project** and the **Carbon Capture Storage**.

## Challenges and potential measures

The non-ferrous metals industry in Europe is placed at the forefront of the transition to climate neutrality by 2050. The sector is extremely sensitive to **electricity price** fluctuations, which affect its economic performance and **competitiveness**. **Regulatory** and **other interventions** have an important impact on production costs, due to the sector struggling against a background of barely sustainable and unfair **international competition** for that reason along with price stability, state support is necessary. For this transition and in light of neutrality, it is important to start using **RES** with greater intensity and extended use of renewable **PPAs**. Another solution for industries is the concept of "**negative emissions**", which may provide solutions for mitigating process GHG emissions. Supporting the development of climate-friendly technologies by investing in improved and cost-efficient techniques will enhance the recovery of metals and alloys from secondary raw material streams. Regarding industrial process innovation, it will be important for companies to have a smooth and reliable **innovation support process** from basic R&D to commercialization over different innovation support instruments.

