Contribution to the Round Table discussion of the Parliamentary Committee for Climate and Green Growth "Toekomst van de Nederlandse industrie richting 2050", Thursday 4th of September 2025

By the World Resources Institute (WRI)

Introduction

Europe is heating twice as fast as other parts of the world. Heat, droughts, wildfires and floods – already evident – will intensify even under the most optimistic climate scenarios, undermining living conditions on the European continent. Meanwhile, emissions from industry have grown by more than 70% since 1990 and have increased faster than in any other sector. Industrial decarbonization, including decarbonizing its energy mix, will be key to cutting emissions and curbing further global warming. Supply chain security and geopolitical turbulence have rapidly become defining factors in industrial competitiveness. At the same time, technological changes across the sector are starting to take hold. In response, a coherent decarbonization strategy, including the material footprint (long overlooked) should be developed. Such a strategy should bring together incentives for the energy transition, based on an assessment of the materials needed and their supply (including circular economy), as well as the transition of feedstocks. In greening industrial production, potential trade-offs with other sectors-, policies- or countries need to be factored in with care.

This paper gives a brief outline of the challenges, sketches potential solutions, and points to some pitfalls to be avoided.

Materials for the Energy Transition

Europe, and the Netherlands, face a critical challenge related to materials needed for the energy transition. For industry to decarbonize, a rapid scale up of investments in clean energy technologies such as wind turbines, solar PV, electrolyzes, and grids is key. The actual mix of investments should be connected to an optimized approach of industrial direct electrification, hydrogen use, energy efficiency, and targeted grid investments. These are all material-intensive, with dependencies that extend far beyond European borders. Without a plan to meet the material footprint of this transition, execution will face increasing challenges, as all economies scramble for these resources to secure their independence and strengthen their economic resilience.

Over the next 10 to 15 years, the International Energy Agency (IEA) has alerted that, particularly for a narrow set of critical raw materials (CRMs) including copper, lithium, nickel and cobalt, demand is projected to far outstrip supply. To meet climate goals, this could mean a sixfold increase in mineral demand by 2040, with specific materials like lithium having an increased demand of more than forty times compared to today's levels (IEA, 2021).

At the same time, mining and processing are highly concentrated outside of Europe – particularly in China, Africa and South America. This concentration creates serious geopolitical and supply chain risks for Europe, particularly given the current global landscape of resource nationalism, trade tensions and strategic competition (IEA, 2025). Without urgent and targeted action, the challenges in raw material supply will slow down the energy transition and undermine Europe's resilience. As a recent TNO study demonstrates, when it comes to processing of CRMs, Dutch capacity will remain marginal and vulnerable (TNO, 2024).

Copper illustrates the scale of the challenge. While not yet in crisis, demand is expected to grow steeply as renewable power, electrification but also (AI- related) data centres boom (IEA, 2025). At the same time, copper supply faces multiple pressures: declining ore grades, long lead times for new mines (often 15–20 years), insufficient recycling capacity and geopolitical risks in major producing countries (S&P Global, 2022). Together, these trends mean that supply shortages and uncertainty of availability for the energy-transition are inevitable without a stronger strategy. WRI's ongoing work on copper underscores the need to accelerate end-of-life copper recycling alongside demand reduction and substitution (WRI, 2025).

To address this crux, Europe and the Netherlands need to change how materials are used, focusing on efficiency, circularity, and substitution (innovation). A key change to current policies is the need to take a systems approach spanning industrial, energy and circular economy strategies, and develop the governance mechanisms for efficient decision-making across sectors and layers of government.

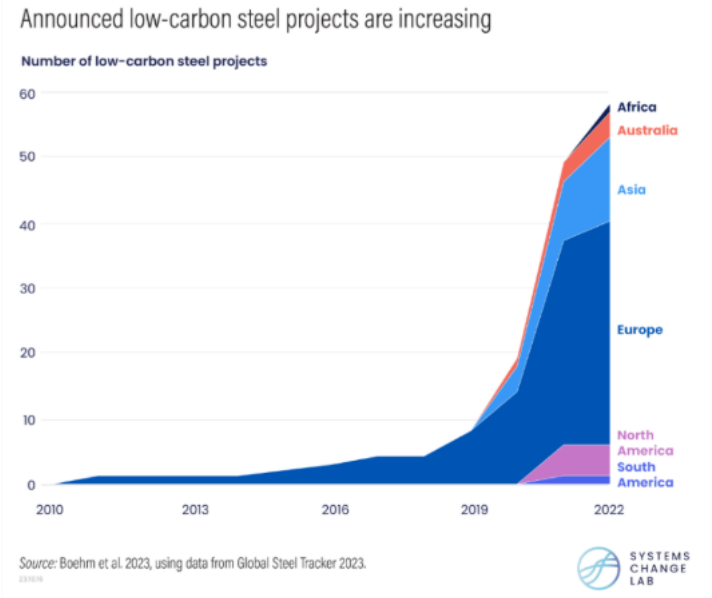
Decarbonising Industry – global developments

Since 2000, GHG emissions from industry — encompassing the production of materials like cement, steel and chemicals, as well as the construction of roads, bridges and other infrastructure — have increased faster than in any other sector. Production of heat for industrial processes is responsible for 18% of global GHG emissions (WBCSD, 2025). An overview of developments:

- Mitigating this sector's emissions globally will require: improving energy efficiency across industrial processes, especially energy-intense sectors such as steel and cement, electrifying those that rely on low- and medium-temperature heat; developing new solutions and product innovation like novel chemistries for cement and green hydrogen for cleaner steel making processes when they cannot be easily electrified, more circular use and lowering average consumption of energy-intense products in advanced economies and lowering the rate of growth in their demand in emerging economies.
- Globally, the share of electricity in the industry sector's final energy demand, the carbon intensity of global cement production, and green hydrogen production are headed in the right direction, albeit at an insufficient pace. For instance, the carbon intensity of cement needs to decline four times faster to reach the 1.5°C-aligned benchmark of 360–370 kgCO2/t by 2030 (*State of Climate Action 2025, forthcoming*). For now, with the rapid growth in emerging economies, the carbon intensity of steel is headed in the wrong direction.
- Some positive news is emerging, as policy momentum for industrial decarbonization has picked up in key producing countries over the last few years. In March 2025, China announced plans to expand its national emissions trading system to include steel, cement, and aluminum. And, earlier this year, India finalized the mechanism governing its carbon trading system, which includes heavy industries. Turkey has also released draft regulation for a national emissions trading system including high-emitters, and, in 2024, Brazil launched a national policy to decarbonize 11 of its industrial sectors, including cement and steel.
- WRI site assessments have found industrial heating can be up to 70% of a manufacturing facility's emissions. Clean heat generation technologies, such as heat pumps, are already available in sectors reliant on light and medium heat (up to 400°C), such as clothing & apparel, food & beverage, infotech, and pulp & paper manufacturing, among others. These sectors account for more than half of global industrial heat demand (WRI, 2025, forthcoming).
- Recent years have also seen a surge in announced projects to deploy decarbonization technologies across cement and steel and for green hydrogen production, see figure 1.

- Even though global green hydrogen production increased rapidly in recent years, the pace is far from sufficient to meet short-term goals. Global annual production in 2020 was only 0.03% of what is required to achieve the 2030 target of 81 Mt (IEA, 2024 and here) In accordance with the EU's plans, hydrogen demand in the EU is expected to surge from 8 megatons (Mt) to over 45 Mt per year by 2050 (SciencesPo, 2025). Scaling up green hydrogen in the EU will require significant quantities of materials, especially for electrolyzers, renewables (solar and wind), and associated infrastructure (pipelines, storage), which will drive up demand for materials. As an illustration: If Germany's steel industry would fully decarbonize its annual production of 42 million tons of steel, it would require around 100 TWh of renewable energy, leading to a 20% increase in renewable electricity production (C. Kurrer, 2020).

Figure 1 Clean steel development per region (source: Systems Change Lab / WRI)



Trade-offs between sectors- the need for a cross sectoral approach.

Similar to trade-offs with regard to critical minerals, there are trade-offs associated with the use of biomass to replace non-renewable materials and energy, which underscore the need for a sectoral systems approach. The use of biomass for industrial decarbonization in the EU will add to the already increasing demands on land for food, wood, paper, transport and nature, both domestically and abroad, which already outstretch the availability of land (European Environmental Agency, 2023). For this reason, it will be key to gradually phase out the least efficient uses of biomass - notably bioenergy, and prioritise the renewable energy source with highest efficiency, climate benefits and added value.

Developing a circular and resilient economy will help reduce pressure on land by stimulating multiple uses of biomass streams across sectors, thereby reducing the demand for primary biomass (crops and wood), maximising resource efficiency and minimising waste generation, while creating quality jobs and progressing towards the decarbonisation of industrial sectors (McKinsey, Material Economics, 2021).