

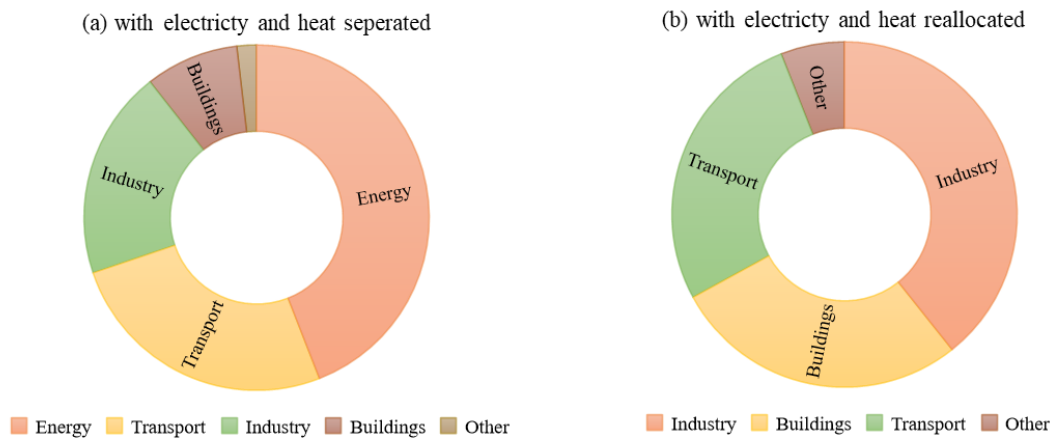
LESS MATERIAL PROJECT¹

Industrial Emissions and Material Efficiency²

by Sedat Alataş, 28 August 2022

Recent data suggest that the fossil fuel share of the industry sector's energy mix has decreased over the years, yet it is still above 65% in 2020 [1]. Therefore, a significant proportion of the global emissions can still be attributed to industrial emissions alone. Figure 1 presents the sectoral share of global emissions. As seen in panel a, emissions from the energy sector almost consist of 50% of global emissions, which is followed by the transport sector with a share of 20%. The dominance of the energy sector on CO₂ emissions shown in panel a clearly reveals why countries have so far prioritized designing more energy efficiency and renewable energy improvements as a mitigation policy [2]–[7]. On the other hand, as shown in panel b, if the energy (electricity and heat) related emissions are reallocated to other final sectors, industrial emissions take the lead with almost %40. It means that the industry sector is highly energy-intensive and thus might play a crucial role in achieving the net-zero targets [8]–[12].

Figure 1. Sectoral Share of Global CO₂ Emissions in 2019



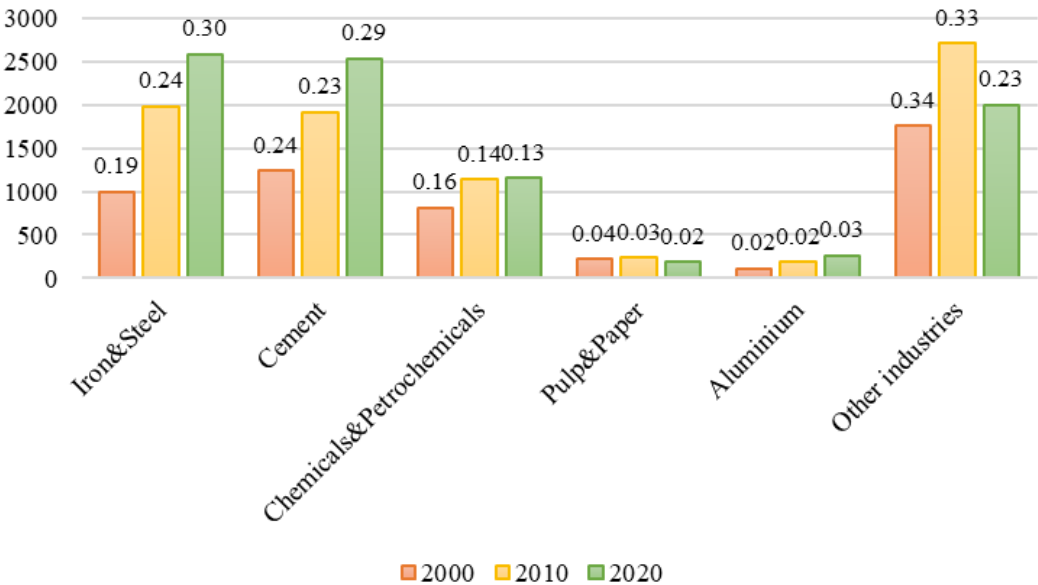
Source: [13]

¹ This project entitled “Analysing Material Demand and Material Efficiency from Sustainability Perspective: A Comparative Cross-Country Analysis and Assessments for Turkey” (Project Number: 221K081) is funded by TUBITAK (The Scientific and Technological Research Council of Turkey) “1001 – The Scientific and Technological Research Projects Funding Program”.

² This blog post is based on our paper entitled “Industrial Decarbonization: The role of Material Efficiency Strategies” (written by Burcu Hiçylmaz, Sedat Alataş, and Etem Karakaya). Please see the full paper for further information: <https://dergipark.org.tr/en/pub/csidd/issue/72150/1120787>. Sedat Alataş can be reached at sedat.alatas@adu.edu.tr.

Many different factors including carbon leakage, strong lock-in, stranded assets issue, technical and economic dependencies, price competition, or cost sensitivity, might significantly explain why emissions from the industry are now high and expected to grow in the future. However, the main factor that makes the industry sector “hard-to-abate” is indeed closely related to the production process of the sector itself. It is because the energy consumption of the industry sector is driven by the production of some specific energy-intensive materials, such as iron & steel, cement, chemicals, and pulp & paper. For example, iron & steel and cement production together consist of more than 50% of all industrial emissions, as seen in Figure 2. More importantly, as their energy requirement still heavily relies on fossil fuels both in the extraction and processing steps, and as alternative renewable energy sources and clean energy technologies do not still reliably and cost-efficiently meet their energy requirement, producing these materials are themselves a major source of emissions and make the decarbonization of the industry sector challenging. Therefore, industrial decarbonization, specifically in steel and cement subsectors, does not only require implementing immediate actions on reliable renewable energy or cost-efficient low-carbon technologies but also a dramatic transformation in the whole industrial production process [9]–[12], [14]–[16].

Figure 2. Direct CO2 Emissions of Industry Subsectors



Source: [1]

As suggested by the recently published IPCC report and many other articles [2], [4], [12], [17], one of the most important mitigation options (among energy efficiency, fuel switching, CCU-

CCS technologies, and many others) in terms of its potential contribution to net-zero in the industry is material efficiency, which is an important component of resource efficiency, along with energy and natural resources efficiency [18]–[20], and mainly refers to the reduction of material input for the same output. It is worth noting that material efficiency does not only reduce material use but also energy use as material production requires huge amounts of energy.

When compared to other low-carbon technologies, material efficiency strategies are more cost-effective and can be implemented in the short term. For example, CCU and CCS technologies are considered important climate policy actions in tackling global climate change. However, their mitigation potential is still controversial as they have not been successfully implemented on a large scale and are economically costly [20]. Therefore, it is considered that designing and implementing a green industrial strategy with a special focus on materials and material efficiency strategies is very important for a deep reduction of emissions and can significantly contribute to the circular economy efforts by affecting all production phases from the design stage to the end-of-life.

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