European Climate Neutrality Observatory

Briefing:

Towards a Green Industry Deal

Avoiding blind spots and enabling industrial transformation

1. Introduction

To achieve climate neutrality by 2050, the EU economy needs to undergo deep transformation. This includes EU industry – a sector which over the last centuries spurred a surge in the consumption of fossil fuels, contributing substantially to the human-induced climate change we observe today.

The industrial sector, defined here as the manufacturing and construction industries[i], remains today an important element of the EU economy. It contributes to about 20% of the EU gross domestic product (GDP). Industry's direct greenhouse gas (GHG) emissions also constitute a significant portion of the EU total, amounting to 23% in 2021[ii].

Meanwhile, the European Climate Neutrality Observatory (ECNO), which tracks progress towards net zero emissions across thirteen critical 'building blocks of a climate neutral future' with deep scientific rigor, has assessed that changes in the area of industry are moving **far too slow** to be compatible with a climate-neutral path for the EU[iii].

To reduce the sector's emissions in line with the EU's climate targets, the bloc's industry has to undergo two crucial changes:

- transform production processes in traditional industrial branches,
- start producing new cleantech products at scale.

The urgency to speed up the increase in cleantech manufacturing capacity has gained a lot of attention from EU policymakers recently. As a result, new dedicated policy measures have been proposed to speed up the increase in cleantech manufacturing capacity (such as the Net Zero Industry Act which sets a cleantech manufacturing target), although significant gaps in this area remain[iv]. However, there was no comparable policy push for the transformation of existing industry – this area remains a blind spot of the European road to net zero, and is therefore the focus of this policy brief.

The following sections will use the results of ECNO's analysis of the recent progress in the industry sector, to help explain the still far too slow pace of GHG emissions reduction in industry, and to define clear conclusions regarding recommended policies to accelerate its transition.

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[i] This definition is consistent with UNFCCC classification of the GHG inventories.
[ii] EEA, Dataset - net greenhouse gas emissions.
[iii] ECNO, State of EU progress to climate neutrality, 2023.
[iv] ECNO, Is European cleantech on track for net zero? A question of finance, 2023.

2. Specific challenge of reducing industrial emissions

Reducing industrial GHG emissions constitutes a very complex challenge. That is because these emissions consist of both combustion and process emissions[v].

Combustion emissions in industry arise while burning fossil fuels to generate energy – particularly for generating heat at varying temperature levels. These emissions can be reduced by changing the energy source to a zero-emission one, for instance by replacing gas with solar panels, a heat pump or sustainable biomass to generate the heat needed for the industrial process.

Meanwhile, process emissions are created by industrial processes involving chemical transformations other than combustion[vi]. The characteristics of these industrial processes determine which type of technology and energy carrier can be used in the production process. Examples include processes such as calcination in cement manufacturing, CO_2 emissions from catalytic cracking in petrochemical processing, or Perfluorinated Chemicals (PFCs) emissions from aluminium smelting.

Some process emissions can be abated with the use of alternative production methods, but many of them are still in the early stages of development, and are currently too costly or not efficient enough to allow for their large-scale deployment[vii]. That is why some industry branches, which depend on technologies that result in process emissions, are called hard-to-abate. Prominent examples include manufacturing of steel, cement and petrochemicals.

Given the complexities associated with transforming the EU industry to make it sustainable in the long run, while simultaneously retaining its international competitiveness, the EU policymakers need to act now, to make sure that the progress in the area of industry is fast enough to be compatible with EU medium- and long-term climate targets.

[v] Specifically, industrial emissions arise from energy use (UNFCCC category 1.A.2) and from industrial processes and product use (UNFCCC category 2); only industrial energy use and processes are the focus of this paper.
[vi] IPCC Guidelines for National Greenhouse Gas Inventories, 2006.
[vii] IEA, The challenge of reaching zero emissions in heavy industry, 2020.

3. Recent trends in industrial GHG emissions

In 2021, GHG emissions from the EU's industrial sector were 36% lower than in 1990[viii]. The rate of decline of these emissions has not been steady over time and it slowed down recently: in the last decade on record, industrial emissions fell at the average annual rate of -0,5%, while between 2000 and 2010 this rate was equal to -1,7%. Historically, the largest drops happened during the early 90s and after 2009. They were associated with more general processes affecting the whole economy, such as the systemic transformation in Central and Eastern European countries and the Great Recession of 2008-2009, which had a lasting impact on the industrial sector[ix]. Consequently, comparing the current GHG emissions levels to the ones from 1990 (a reference year for overall EU targets) or 2005 (introduction of the EU ETS system) does not allow for a reliable assessment of the current situation.

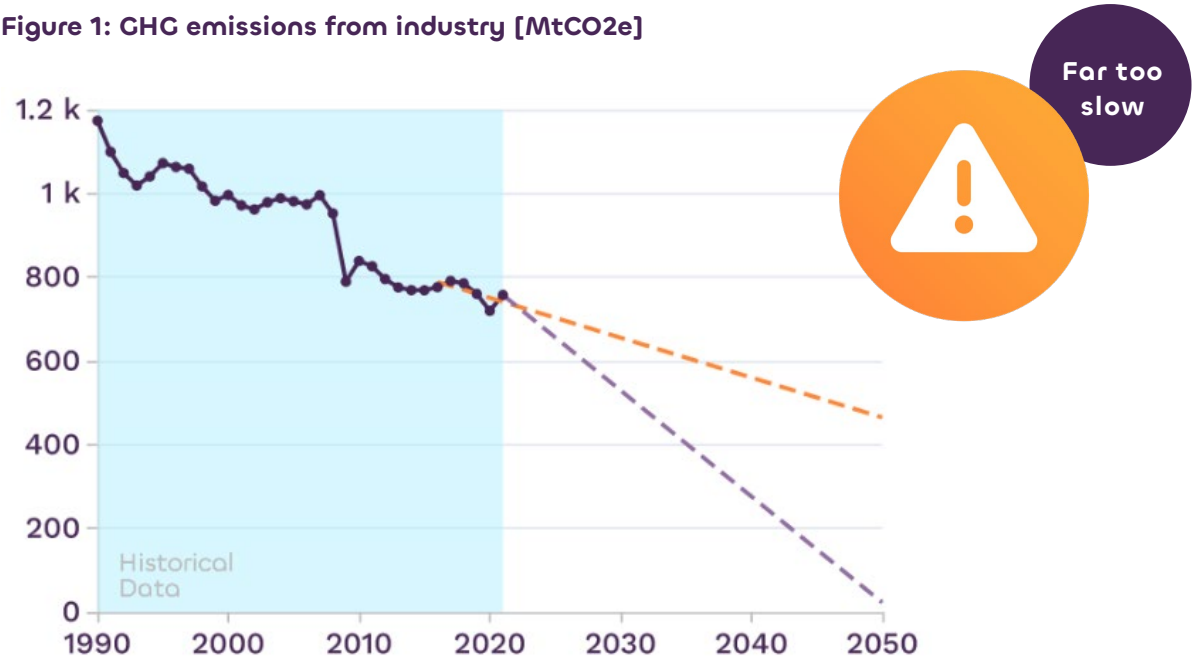
When looking closer at what drives the emission dynamics, it is clear that many of the factors that contributed to past progress will no longer affect the industrial emissions. That includes the modernisation of the post-soviet industrial system, the shift from coal and oil to natural gas and biomass, and the structural changes in the EU economy: between 1995 and 2009, the contribution of the services sector to the EU GDP increased, while the share of energy-intensive industry in GDP fell. After 2010, the share stabilized, implying that the structural economic changes no longer contributed to relatively lower activity in industry. Similarly, the modernisation of the industrial system was also mostly completed by 2010. That means that over the last three decades, emissions reduction in the EU industry were caused to a large extent by the external economic shocks and incremental shifts within fossil-fuel-dependent technologies, and not a structural shift towards decarbonised production.

[viii] EEA, Dataset - net greenhouse gas emissions.
[ix] EEA, Trends and drivers of EU greenhouse gas emissions, 2020.

The European Commission's assessment of progress towards climate neutrality, published in October 2023, did not mention industry among the sectors that need urgent acceleration of progress[x]. This is because it looked at the drop of industrial emissions compared to 1990 in absolute numbers only. Failing to also consider the nuances of the underlying trends, the Commission's assessment did not acknowledge the considerable slowdown in the pace of emissions reduction in the sector that took place in the last five years, which in turn signals insufficient progress on the structural enablers of the change required in the next decade and towards 2050.

When taking a deeper look into the breakdown of emission reductions, the proportions between fuel combustion and process emissions in the EU industry are now quite balanced, with 42% of the sector's emissions coming from industrial processes and product use, according to 2021 data. This signals progress on the combustion emissions front. Process emissions however are proving persistent, especially in the hard-to-abate sectors (such as steel, cement, and chemicals). Focused efforts to address process emissions – alongside transition to using zero-emission energy sources – will thus be key for the EU to deliver its own climate targets.

Figure 1: GHG emissions from industry [MtCO2e]



Source: ECNO

[x]More information on the strengths and weaknesses of the EC assessment can be found in ECNO's Next steps in setting up: EU progress monitoring for climate neutrality: A review of the European Commission's assessment of progress towards climate neutrality, 2024

While overall, emissions in industry have continued to fall (even if at a too slow pace still), the transition to fully decarbonised energy sources hit a plateau – their share in total energy use has even marginally decreased in the last five years. That trend - in combination with a drop in the amount of total emissions – shows that in the medium term, some reductions in industrial emissions can be achieved even without improvement in the energy mix, and can instead be generated by factors such as changes in business structure, or improved energy efficiency.

However, such changes do not lay the necessary foundations for reaching net-zero emissions by 2050 the latest. Achieving climate neutrality requires deep transformation of the energy and feedstock mix for the sector, with direct use of fossil fuels in industry dropping to less than 20% by 2050[xi]. A failure in transitioning to fully decarbonised energy sources may lead to fossil fuel lock-in. This means that investment and policy decisions related to the use of carbon-intensive technologies in industry would be made for a longer time than assumed in the pathway compatible with net-zero, thus prolonging life cycle of these technologies and the time horizon in which they generate CO_2 emissions. A fossil fuel lock-in in the industry sector would not only hinder the transition of industry, but also of the whole economy, because even if other sectors decarbonise faster and manage to achieve negative emissions, their amount is still very unlikely to balance out any excessive GHG emissions.

[xi] Tsiropoulos et al., Towards net-zero emissions in the EU energy system by 2050: insights from scenarios in line with the 2030 and 2050 ambitions of the European Green Deal, 2020.

4. Progress with conditions enabling the transition

Zero-carbon energy carriers and infrastructure

To make industrial production less carbon-intensive, companies in the sector need to have access to sufficient amounts of zero-carbon energy carriers and infrastructure. The transition of industry will require mostly carriers such as electricity, ambient heat, biomass, hydrogen and synthetic fuels[xii]. For hard-to-abate sectors where some emissions are unavoidable, Carbon Capture and Storage (CCS) technologies could provide a way to achieve deep decarbonisation. An example is steel production, where switching from traditional methods to hydrogen-based "green steel" production would result in significant GHG emissions reduction, with the remaining emissions being managed by CCS technologies.

The availability of zero-carbon energy sources and infrastructure is thus a necessary condition to enable further GHG emissions reductions in industry. Unfortunately, for now it is impossible to reliably assess the current state of development and progress in this area, or to accurately plan how to bridge the existing gaps. That is because the value of many of the crucial indicators (such as the annual production of renewable hydrogen for industrial use, CO_2 injection capacity, capacity of CO_2 transport network and capacity of the hydrogen transport network, annual production and use of sustainable biomass in industry) is now too insignificant to be tracked by the EU's current monitoring framework for zero-carbon energy sources and infrastructure. While these aspects of industrial transition need development, the EU should still collect the data during the built-up to be aware of the progress. Inclusion of the targets[xiii] for renewable hydrogen and CO_2 injection capacity in the Net-Zero Industry Act (2023) and REPowerEU (2022) could be a sign that such statistics will be launched soon. Similarly, the launch of the European Hydrogen Bank could stimulate production of renewable hydrogen in the EU and contribute to the improvement of data availability. European Hydrogen Bank, launched in 2022, is a financing

[xii] Tsiropoulos et al., Towards net-zero emissions in the EU energy system by 2050: insights from scenarios in line with the 2030 and 2050 ambitions of the European Green Deal, 2020.
[xiii] Target for annual injection capacity in 2030 is equal to 50 MtCO2e, while target for the amount of renewable hydrogen produced annually in the EU is equal to 10 Mt.

instrument whose role is to accelerate private investments in hydrogen value chains. Thus it provides support also for domestic projects aiming at producing renewable fuel of non-biological origin (RFNBO) hydrogen, with the scale of available resources dependent on the intended size of production.

Conclusions from ECNO's recent assessment[xiv] of the transparency and internal consistency of EU Member States' draft National Energy and Climate Plans (conducted for five documents, presented by Hungary, Italy, the Netherlands, Spain and Sweden), indicate that national strategies for the advancement of renewable hydrogen production, consumption and trade, electrification of industry, and long-term geological storage of CO_2 are currently not detailed and consistent enough.

The analysis also found the Plans (NECPs) to focus heavily on developing renewable hydrogen for industry decarbonisation, while seemingly neglecting strong measures for the electrification of industry. This bears the risk of overreliance on one specific technology for industrial transition, which is relatively expensive and comes with high energy and additional infrastructure needs.

The quality and availability of data related to long-term geological storage of CO_2 was low, which is a sign that plans regarding deployment of CCS/CCU are not well developed in investigated member states overall.

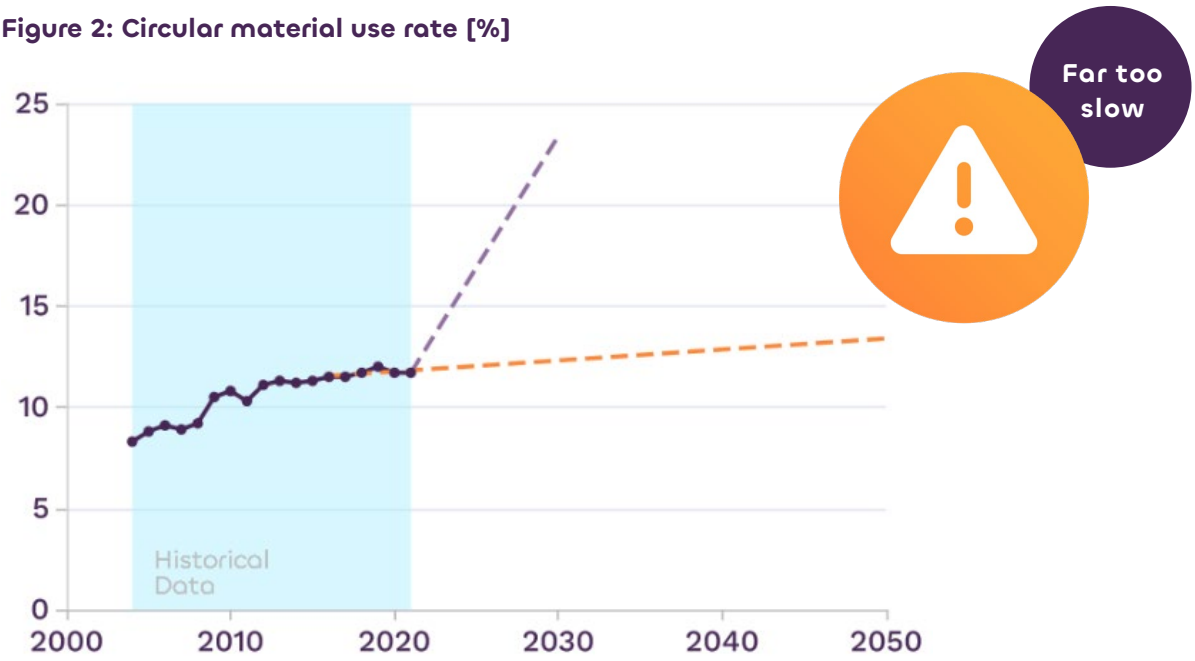
Circular economy

The second key to facilitating the next level of emissions reductions in industry is the increased application of circular economy principles. Industrial production designed in line with these principles leads to reduction of demand for raw materials whenever it is possible, and maximises reusing and recycling of the raw materials and components used in the production process. Thus, circularity allows to extend the life cycle of products, minimise waste and create further value for the products. Implementation of the circular economy standards could also contribute to lowering the cost of industrial transition, as most of the circularity measures imply lower upstream emissions and lower overall energy and feedstock input.

[xiv] ECNO, Net zero risk in European climate planning: A snapshot of the transparency and internal consistency of Member States' NECPs, 2024

The measure of circularity for which the EU has set a target is the 'circular material use rate', which is defined as the share of material recycled and fed back into the economy. The target, mentioned in the Circular Economy Action Plan (2020), determines that the EU should aim to double the value of the indicator by 2030 (relative to 2020). That would be consistent with a value of roughly 23%. However, the two readings of the indicator since the target was announced were even marginally lower than the 2020 value. The ECNO analysis thus shows that the current dynamics is far too slow for the target to be met.

Figure 2: Circular material use rate [%]



Source: ECNO

Another important indicator for circularity is resource productivity. It is defined as the ratio of gross domestic product (GDP) over domestic raw material consumption, and thus measures the relation between the total amount of materials directly used by an economy and the achieved GDP. It can be used to analyse if economic growth is decoupling from the use of natural resources.

The EU's progress on resource productivity is slowing down. Its average annual rate of increase for the whole period since 2000 was 3.2%, but more recently, in the period 2016-2021, it fell to 2.0%. While the general direction of change in this indicator's value is a positive development, the recent slowdown could be a sign that the potential for improvements that can be achieved without additional policy stimulus is running out.

The overall slow progress in the area of circularity is a concerning finding. However, given that the effects of EU policies implemented in the last three years under the Circular Economy Action Plan (such as Ecodesign Regulation proposal), are not yet reflected in the data, there is a potential for faster improvement of circularity indicators in the future.

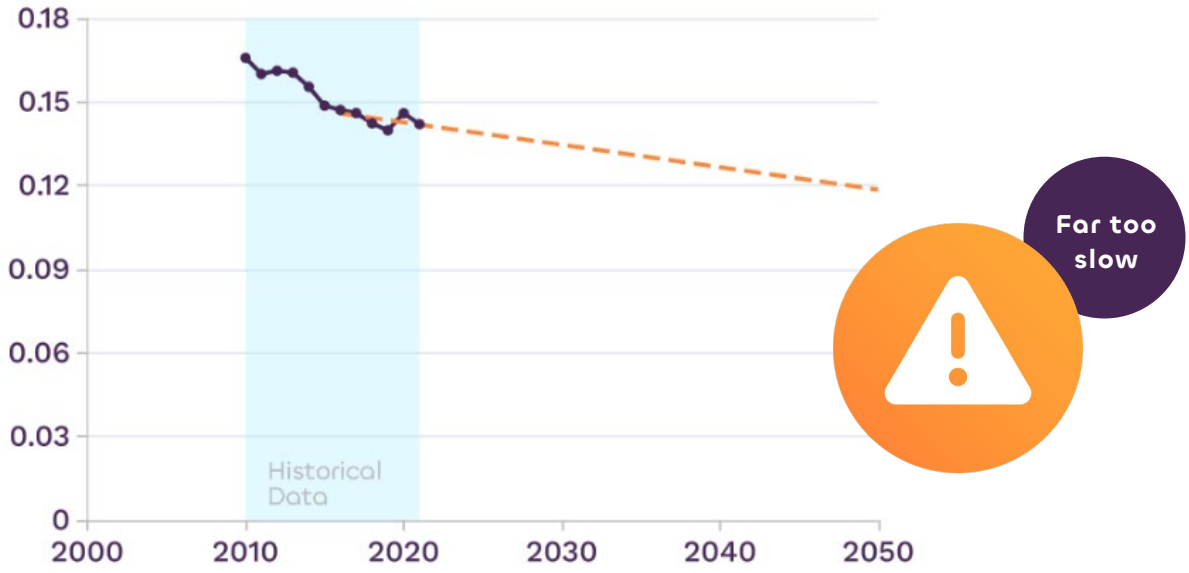
Energy efficiency of industrial processes

The third key to supporting reductions of GHG emissions in industry is the energy efficiency of industrial processes. That is because lowering overall energy needs of the sector would also lead to lowering its fossil fuel use - even without transforming production technology or cutting down fossil fuel use specifically. Higher energy efficiency of industrial processes can be also associated with saving affordable zero-carbon energy carriers that could be potentially used for decarbonisation of other economic sectors.

The observed pace of reduction of final energy consumed by industry is, however, far too slow to meaningfully support GHG emissions reduction in industry. Data shows that in the last decade on record, there was no clear trend in the amount of final energy consumed by industry, and its minor changes amounted to an average annual decrease of 0.01% between 2016 and 2021. This pace is far too slow to reach the target implied by the impact assessment of the 2030 Climate Target Plan, which outlines that the final energy consumption in industry should be 22-28% lower in 2030 and 22-30% lower in 2050 relative to 2005.

Another measure in this field – the energy intensity of output in industry – can help to distinguish between lower energy consumption resulting from lower economic activity in the sector, and reductions resulting for other reasons. If the indicator decreases along with the final energy consumed by industry, it means that the same unit of output could be produced using less energy than before. This effect can be a result of enhancement of energy efficiency across the industry or by structural changes in the economy – e.g. the increase in the share of production coming from the lower energy-intensive industries relative to the high energy-intensive ones.

Figure 3: Energy intensity of output [Mtoe/EUR]



Source: ECNO

In the last five years, the value of the indicator 'energy intensity of output' has been falling slowly, with an average annual decrease of 0.6% between 2016 and 2021. Research suggests that historically for the EU the dominant driver of the change in the indicator's dynamics was the structural factor[xv], but the decomposition analysis of the more recent datapoints is missing. It is worth noting though, that the potential for long-term improvement of the indicator based on the structural readjustments is limited if the EU economy is to continue to provide basic amounts of goods produced in energy-intensive sectors.

[xv] Astrov V., et al., Energy Efficiency and EU Industrial Competitiveness: Energy Costs and their Impact on Manufacturing Activity, 2015

5. Industrial transition in Fit for 55

Some policy measures that are included in Fit For 55 package, and have already been adopted by the EU institutions since 2021, constitute an accurate response to industrial transition challenges by strengthening the carbon pricing mechanisms and providing further incentive for uptake of decarbonised energy sources:

a) Phasing out free ETS allowances and introduction of the Carbon Border Adjustment Mechanism (CBAM):

The revision of the EU ETS system introduced a plan for gradual phase out of free emission allowances in many industrial sectors in the period of 2026-2034. This action is expected to drive up the carbon price in industry and provide stimulus for businesses in the sector to reduce their emissions. The free allowances phase-out is aligned with the introduction of the CBAM, which role is to ensure that the carbon price of products imported to the EU is equivalent to the carbon price of domestic production. CBAM will help to provide a level playing field for both EU and non-EU industrial enterprises, and to avoid the carbon leakage.

b) Introduction of targets for renewable fuels of non-biological origin in industry

The update of the RED II Directive included a target for the percentage of renewable hydrogen used by industry by 2030. This percentage was defined as 42% in 2030, rising to 60% by 2035. Member states are also obligated to increase the share of renewable sources in the amount of energy sources used for final energy and non-energy purposes in the industry sector by an indicative average increase of at least 1.6 percentage points per year. Introduction of these targets should contribute to upscaling the use of renewable hydrogen and accelerate the shift towards zero-carbon energy sources in industry.

c) Inclusion of small and less energy-intensive industries into the strategic planning

Although the EU needs to continue to focus on energy-intensive industries, significant GHG emission reductions can be achieved also by the consideration of the needs and barriers to decarbonisation of smaller and less energy-intensive industries. Including these industries into EU ETS 2 is a relevant first step towards triggering these reductions.

The key factor to successfully deliver the positive outcomes that these policies can potentially trigger will be their effective implementation. However, this issue remains open to question, as draft updated NECPs are characterized by insufficient data and ambiguity concerning challenges that are crucial from the point of view of industrial transformation, such as green hydrogen accessibility, industrial electrification, or planned efforts in the area of industrial carbon management[xvi]. Moreover, the EU missed a chance to provide additional EU-level funding within Green Deal Industrial Plan, which would help accelerate wide-scale deployment of zero carbon technologies.

Another factor that can potentially hinder the process of reaching the expected effects of industrial policy included in Fit For 55 package is slower progress in the area of reforms outlined in the Circular Economy Action Plan, especially those that promote new, more effective ways of channelling recycling and reuse.

[xvi] ECNO, Net zero risk in European climate planning: A snapshot of the transparency and internal consistency of Member States' NECPs, 2024

6. Conclusions

The industrial sector remains an indispensable element of the EU economy, which contributes significantly to the bloc's economic growth, job creation, innovativeness, and economic security. However, the industry's long-term international competitiveness and sustainability of industrial production will very much depend on the sector's ability to modernise and adapt to global market trends, including the transition to net zero emissions.

So far, the EU industry has been reducing its GHG emissions at a pace that is far too slow to meet EU climate targets. Moreover, the pace of emissions reduction has recently been slowing, as the potential for cuts resulting from structural economic changes has been largely exhausted, and there is no evidence for an increasing share of fully decarbonised energy sources in industry in the last five years.

Furthermore, the analysis of data regarding the enabling factors for industrial transition points to an unfavourable environment for future changes: progress on circularity and energy efficiency is still very slow, and while the current monitoring framework is insufficient to track progress on zero-carbon energy carriers and infrastructure, anecdotal evidence points to a sluggish pace of changes also in this area.

The EU's industry's slow progress towards reducing GHG emissions could preclude it from gaining clear benefits associated with the transition: driving global innovation in clean processes and strengthening its position on international markets. Moreover, if the current dynamic of changes in industry persists, the EU could not achieve its 2030 and 2050 climate targets. The EU policymakers should therefore take more decisive policy action to speed up the transition in industry. As shown by the ECNO assessment, this can be effectively done by addressing the industry transition's current blind spots:

1. **Promoting further circularity and energy efficiency in industry,**

2. **Improving quality and transparency of planning for development of zero-carbon energy sources and critical infrastructure.**

Some of the most important policy measures aiming to stimulate industrial transition were proposed in 2021 and accepted already, as part of the Fit For 55 package. They either remove barriers to deployment of zero-carbon energy development in industry (i.e. low-cost effectiveness) or and stimulate their uptake (both increase in scale and scope). The main recommendation following from this analysis for the EU policymakers is thus to focus now on the effective implementation of these policies.

Further action that should be taken to facilitate the successful implementation of policies supporting deployment of zero-carbon energy sources and infrastructure is the revision of the current monitoring framework. Including more indicators related to this area will allow for a systematic, reliable evaluation of progress and enhance the quality of planning. It will also help assess the effectiveness of the policies put in place, enabling their fast review in case of underperformance. Prompt **improvement of draft NECPs**, which are currently weak on issues related to industrial transition, is another measure necessary to boost strategic planning.

Careful monitoring of the effects of the implementation of policies outlined in the **Circular Economy Action Plan** (2020) (and their prompt revision in case of low effectiveness) is recommended to help enhance the uptake of circularity.

Addressing the blind spots in the transition of European industry will require ample dedicated funding for investment in zero-carbon technologies and changes in the production processes. Given that the phase-out of free allowances in industry is expected to create additional cost pressures for industrial enterprises in the medium term, it is worth revisiting the idea of a **common fund for the EU industrial transition**. The funding should be dedicated not only to the cleantech value chain, but also to enabling infrastructure (including grid upgrades for industrial electrification, hydrogen and CCS infrastructure), with the potential addition of stronger planning requirements tied to the new funds.

The final recommendation concerns employing the still missing tool for speeding up the GHG emissions reductions in industry: **green public procurement**. The creation of common, ambitious, and legally binding standards for green public procurement could generate significant additional demand for zero-carbon products, given that governments spend approx. 14% of the whole EU's GDP.

In spite of all the current challenges related to the transformation of the EU industry, the sector can become compatible with climate-neutral economy.

However, in order to enact necessary changes on time to meet the 2050 target, industrial transformation needs to accelerate significantly. That requires some additional policy action in the crucial areas, identified in this brief, followed by effective implementation of the outlined measures. Inaction or a slow response to industrial challenges will be associated with a risk of derailing the EU's progress towards carbon neutrality by 2050 and loss of the EU industry's competitive advantage.

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