CRACKING EUROPE'S HARDEST CLIMATE NUT

How to kick-start the zero-carbon transition of energy-intensive industries?

Policy briefing, April 2019

Executive summary

With total greenhouse gas emissions of 708 million tonnes[1] per year, resource and energy intensive industry is the third largest climate polluter in Europe[2]. The cement, chemical and steel sectors alone are responsible for almost 60% of these emissions.

Industrial emissions are regulated under the EU Emission Trading System (ETS), but the numerous exemptions and free pollution permits included in the legislation have failed to make the ETS an effective tool to drive down emissions: carbon pollution from heavy industry has not decreased since 2012 and is not predicted to do so until 2030. Moreover, under the EU ETS, energy-intensive industries receive too many free emission allowances which allows them to make substantial profits from the system that is meant to make polluters pay.

With virtually no market incentive, most energy-intensive industries are not strongly committed to investing in cleaner technologies and to making the necessary changes to decarbonise. In fact, the current long-term roadmaps presented by the industries themselves, if taken together, represent a mere 18% reduction of greenhouse gas emissions between 2016 and 2050.

However, decarbonising energy-intensive industries is possible and a plethora of solutions has already been identified. These include increasing energy savings, scaling up renewable energy deployment and applying circular economy models that, if fully adopted can put Europe's heavy industry on a Paris-compatible pathway. This is confirmed by recent in-depth analysis by the European Commission showing that it is possible to reduce Europe's emissions by 95% or above by 2050 [3].

Despite the availability of several solutions, there are bottlenecks to clear, such as the lack of large quantities of renewable energy sources, barriers that can hinder industrial symbiosis as well as the currently insufficient level of public and private funding for the necessary investments.

Increased public investments coupled with a new climate and industry policy framework, that covers the entire industrial value chain and includes demand-side measures such as public procurement as a driver of markets for zero-carbon solutions, will be essential for reaching net-zero emissions from energy-intensive industry.

Industrial decarbonisation urgently needs to deliver its share of greenhouse gas emission reductions to ensure that Europe is on a pathway to net-zero carbon emissions by 2040. This is a big challenge which will require joint effort, strategic planning and an overarching and effective industrial climate policy framework.

Key recommendations

- Develop **a climate-proof industrial strategy** for energy-intensive industries, that helps set Europe on the path to achieving net-zero carbon emissions by 2040
- Put forward **an industrial climate policy framework** that includes at least the following components:

    1. A **Paris Agreement compliance test** for environmental permitting
    2. **Increased funding** for industrial decarbonisation
    3. **Carbon performance standards** for the production and consumption of energy-intensive materials in Europe
    4. Provisions to incentivise the use of products which contain **increasing rates of recycled materials**
    5. **A phase-out of free EU ETS allowances**
    6. **Improved public procurement rules** for energy-intensive materials and products

1 Sandbag (2019), EU preliminary Emissions Trading System data release: https://sandbag.org.uk/project/ets-emissions-2018/

2 Eurostat (2018), Statistics Explained, Greenhouse gas emission statistics - emission inventories https://ec.europa.eu/eurostat/statistics-explained/pdfscache/1180.pdf

3 European Commission (2018), In-depth analysis accompanying the Communication A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy https://ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_analysis_in_support_en_0.pdf

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Introduction

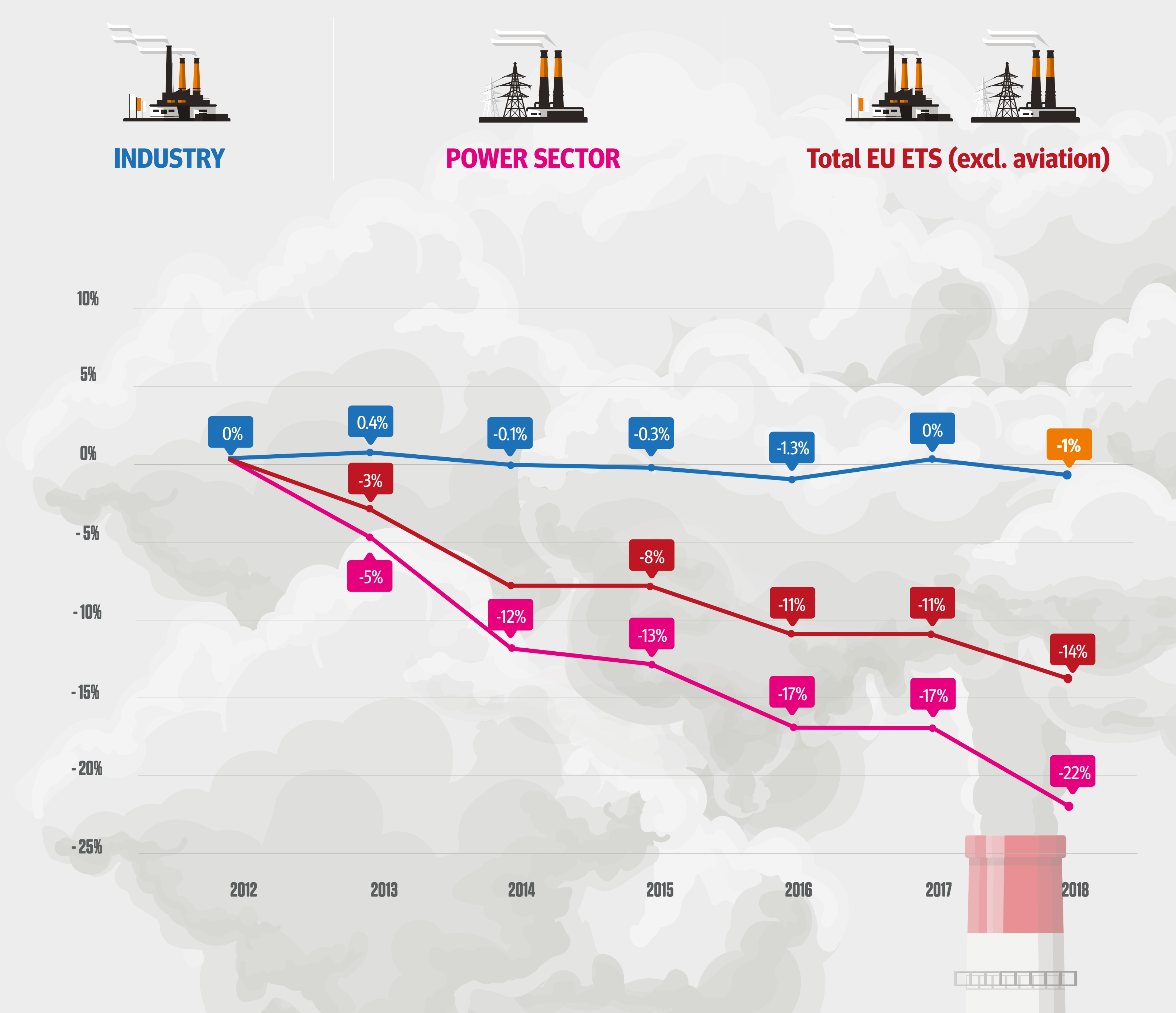
Greenhouse gas (GHG) emissions from resource and energy intensive industries currently represent 19% of total European GHG emissions, and they are not going down. To set Europe on the right path to achieving net-zero carbon emissions by 2040, industry needs to reduce its emissions drastically. This briefing provides an overview of the current challenges on the one hand and existing solutions to heavy industry decarbonisation on the other, and gives policy recommendations on the necessary steps to make it happen.

EU carbon market emissions and free allocation - power sector vs. industry 2012-2018

Data from Sandbag 2019 , greenhouse gas emissions relative to 2012

Selected free allocation levels 2018

Chemicals	93%
Iron and steel	114%
Cement and lime	96%



Part1: The problems

1.1. Stagnant industry emissions

The European Emissions Trading System (EU ETS) has been in operation since 2005 and covers about 45% of the EU's total greenhouse gas emissions, originating from approximately 11.000 large polluting installations[4]. These emissions come mostly from the power sector (56% - coal, lignite, gas...) and industrial sectors (40% - steel, chemicals, cement,...). The remaining 4% of the greenhouse gas emissions originates from intra-European flights.

The EU ETS was designed to reduce greenhouse gas emissions by 21 % between 2005 and 2020. In 2017, the EU ETS emissions had already decreased by 26 %[5]. This decrease was mostly driven by emissions reductions in the power sector and was largely the result of changes in the type of fuels used to produce electricity and heat (i.e. less hard coal and lignite, more renewable energy sources).

However, carbon pollution from the other industrial activities covered by the EU ETS has not decreased since 2012[6]. The European Environment Agency predicts that sectors like steel, cement and chemicals will not reduce their emissions at all at least until 2030[7]. In practice, this means that almost all of the projected emission reductions will take place in the power sector, while resource and energy intensive industries are not expected to cut their carbon pollution for at least another decade.

1.2. The EU ETS failure

1.2.1. The problem of free pollution permits

Under the EU ETS, the power sector has to buy emission allowances to cover their carbon pollution. In contrast, free pollution permits are handed out to resource and energy-intensive industrial sectors that are considered to be at risk of carbon leakage (see next section). As a result, more than 90% of industrial carbon pollution is emitted without any cost to the polluting companies.

Handing out pollution permits for free as opposed to auctioning them means that governments forego revenues that could be much more wisely invested in further climate action and renewable energy transition. Even under the recently agreed EU ETS revision, governments will hand out up to 6.5 billion free emission allowances with a market value of about €165 billion between 2021 and 2030. This free pollution subsidy[8] means that in the coming decade there will be no meaningful incentive for reducing greenhouse gas pollution in steel, chemicals and cement plants across the European continent.

1.2.2. The carbon leakage myth

Carbon leakage is the hypothesis that European industrial sectors competing at international level would move their production to countries with less stringent climate policies. To date there has been no empirical evidence that the EU's climate policies would be forcing companies to move abroad, even with a complete phase-out of free pollution permits[9]. At the same time the resource and energy-intensive industries continue to make substantial profits from the EU ETS. This incentivises corporations to bend the rules of the EU ETS to increase their cash flows. They do this by using the (unproven) risk of carbon leakage as an argument to receive pollution subsidies from governments.

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4 European Commission (2016), The EU Emissions Trading System (EU ETS) factsheet: https://ec.europa.eu/clima/sites/clima/files/factsheet_ets_en.pdf

5 European Environment Agency (2018) Trends and Projections in Europe: 2018: Tracking progress towards Europe's climate and energy targets: https://www.eea.europa.eu/publications/trends-and-projections-in-europe-2018-climate-and-energy

6 Sandbag (2019), EU preliminary Emissions Trading System data release: https://sandbag.org.uk/project/ets-emissions-2018/

7 See graph on page 4

8 In total, the market value of estimated free allowances and exemptions under the ETS from 2008 to 2030, and support provided to fossil fuels through the ETS amount to almost €496 billion. Source: ODI et al. (2017) Phase-out 2020: monitoring Europe's fossil fuel subsidies https://www.odi.org/sites/odi.org.uk/files/resource-documents/11764.pdf

9 Carbon Market Watch (2015), Carbon leakage myth buster: https://carbonmarketwatch.org/publications/myth-buster/

Resource and energy intensive industries profit from the EU ETS in the following ways:

1. They generate windfall profits by letting their customers pay the price for the freely obtained carbon pollution permits, and by selling their overallocated permits for a profit in the market.
2. In several countries industries are subsidized for the hypothetical risk of “indirect carbon leakage”.

From an environmental economy perspective, these exemptions represent a market failure of the EU ETS since the external costs related to the carbon pollution (i.e. the cost of climate disruption) are not internalised in the carbon price. For European citizens, this is a very high price to pay, especially to compensate for an unproven myth of “carbon leakage”.

Dirty fingerprints on the EU ETS Directive

During the recent EU ETS revision, heavy industry lobbied hard to claim as many free EU ETS pollution permits as possible. In most cases, the majority of EU lawmakers agreed to changing the rules in their favour. This can be seen in article 10a of the post-2020 ETS directive which specifies the rules for allocating free pollution permits to heavy industries:

- In the course of the policymaking process, these rules were amended to include a provision[10] to top up the free allocations with another 3% of all allowances under the ETS if needed.
- The steel industry managed to secure a specific exemption[11] from the annual updates to the ETS benchmarks which define the reduction rate of free allocations. The reduction rate for hot metal became fixed at only 0.2% in the law-making process. For all other sectors, a fact-based comparison will determine the annual reduction rate, ranging from 0.2% to 1.6%. The rules were tailored to allow the most favorable treatment of the steel sector.
- During the negotiations of the EU ETS reform the European Parliament’s Environment Committee had struck an initial agreement on removing the cement sector from the ETS carbon leakage list[12]. After Cembureau (the EU cement industry federation) rallied other industrial sectors behind their call to remain entitled to free ETS allowances, the cement industry remained on the list of sectors that receive free pollution permits[13].

1.3. Inadequate sectoral climate plans

Since the publication of the 2011 *Roadmap for moving to a competitive low carbon economy in 2050* by the European Commission[14], most resource and energy-intensive industrial sectors have presented their own long-term emission reduction strategies. However, these assessments are based solely on current technology pathways, business models and production processes. The result is that, if taken together, the main industry climate roadmaps represent a mere 18% reduction of greenhouse gas emissions between 2016 and 2050[15].

This stands in stark contrast with the achieved greenhouse gas emission reductions of energy-intensive industries of 36% between 1990 and 2015[16]. Their planned emission reductions towards 2050 are more than 2.5 times slower than their historical pace. It is also clear that the industrial climate plans are in no way compatible with the Paris Climate Agreement. In order to limit

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10 Paragraph 5a of article 10a of the ETS Directive: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02003L0087-20180408&qid=1555059451857&from=en

11 At the end of paragraph 2 of article 10a of the ETS Directive: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02003L0087-20180408&qid=1555059451857&from=en

12 Euractiv (2017), Carbon market reform vote puts EU cement sector in the spotlight: https://www.euractiv.com/section/climate-environment/news/carbon-market-reform-vote-puts-eu-cement-sector-in-the-spotlight/

13 Euractiv (2017), European Parliament adopts draft reform of carbon market: https://www.euractiv.com/section/climate-environment/news/european-parliament-adopts-draft-reform-of-carbon-market/

14 European Commission (2011), Roadmap for moving to a competitive low carbon economy in 2050: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011DC0112

15 Based on industry roadmaps of cement (2013), steel (2013), chemical (2013), and forest fibre and paper (2017) sectors.

16 Institute for European Studies (IES), (2018), A Bridge Towards a Carbon Neutral Europe: https://www.ies.be/files/Industrial_Value_Chain_25sept.pdf

global warming to 1.5°C, energy-intensive industries will need to update their plans if the EU is to reach net zero greenhouse gas emissions by 2040.

1.3.1. The problem of long investments cycles and the low carbon price

The European Union has established several legislative acts for the decarbonisation of the power sector under the *Clean energy for all Europeans* policy framework[17]. For example, the Energy Efficiency and Renewable Energy Directives set out goals and targets for saving energy and deploying renewable energy sources across all EU Member States. These directives reinforce the carbon price signal delivered by the EU ETS, and ensure that non-market barriers to delivering a clean energy sector are addressed.

By contrast, resource and energy-intensive industries in Europe have only the EU ETS at their disposal to steer their production processes away from using fossil fuels, and to guide clean investments. Between 2012 and 2018 the ETS carbon price signal was never higher than 10€ per tonne of CO_2 emitted. On top of this, the vast majority of ETS emission allowances are freely allocated to industrial sectors (see section 1.2.1). It is therefore no surprise that clean industrial investments are not happening at the scale required in Europe.

This is particularly problematic in energy-intensive sectors where large investments in installations only happen every few decades. In many cases, 2050 is just one investment cycle away. Under the current ETS-only policy framework, high-emitting infrastructure can still be built today and risks to lock in millions of tonnes of greenhouse gases to be emitted in the coming decades.

Part2: The solutions

2.1. Potential for heavy industry innovation

Decarbonisation of energy-intensive industries is the subject of extensive research and innovation investments aimed at finding clean and affordable solutions. While there is no "silver bullet", a plethora of solutions has already been identified and most innovations in heavy industry leading to breakthrough technologies are ready and waiting to be put to work.

2.1.1. Energy savings and renewable energy deployment

Two of the most straightforward solutions to reduce carbon emissions in the industrial sectors are increasing energy savings and scaling up renewable energy deployment. Energy efficiency improvements can reduce CO_2 emissions at a relatively low cost but they are currently not exploited to their full potential. The fact that energy cost is a major component of costs in industrial production has led to belief that industries would naturally try to reduce these costs in order to increase their profit. However, in most cases, industrial production still offers significant potential for cost-effective reduction of its energy consumption.

At global level, heavy industries have the potential to reach improvements in energy efficiency that can economically cut fuel consumption for energy use by 15 to 20 percent. Potential gains in energy efficiency will differ between sectors and facilities but generally, using less fossil energy to make industrial products will lower CO_2 emissions[18].

Electrification of industrial heat can reduce emissions from the use of fossil fuels for heat generation power, provided that the electricity is generated by renewable sources. This can be done by switching from fossil fuels to generate heat, to the use of furnaces, boilers, and heat pumps that run on renewable electricity.

Electrification of heat has shown significant potential for low temperature industrial heat. For example, heat pumps can generate heat up to 100°C and electric boilers up to 300°C. More intensive electrification is technically possible for higher temperature industrial heat but it tends to increase energy consumption and costs[19]. This is why scaling up renewable energy sources and reducing their cost are of paramount importance to achieve deep emission reductions in energy-intensive industries.

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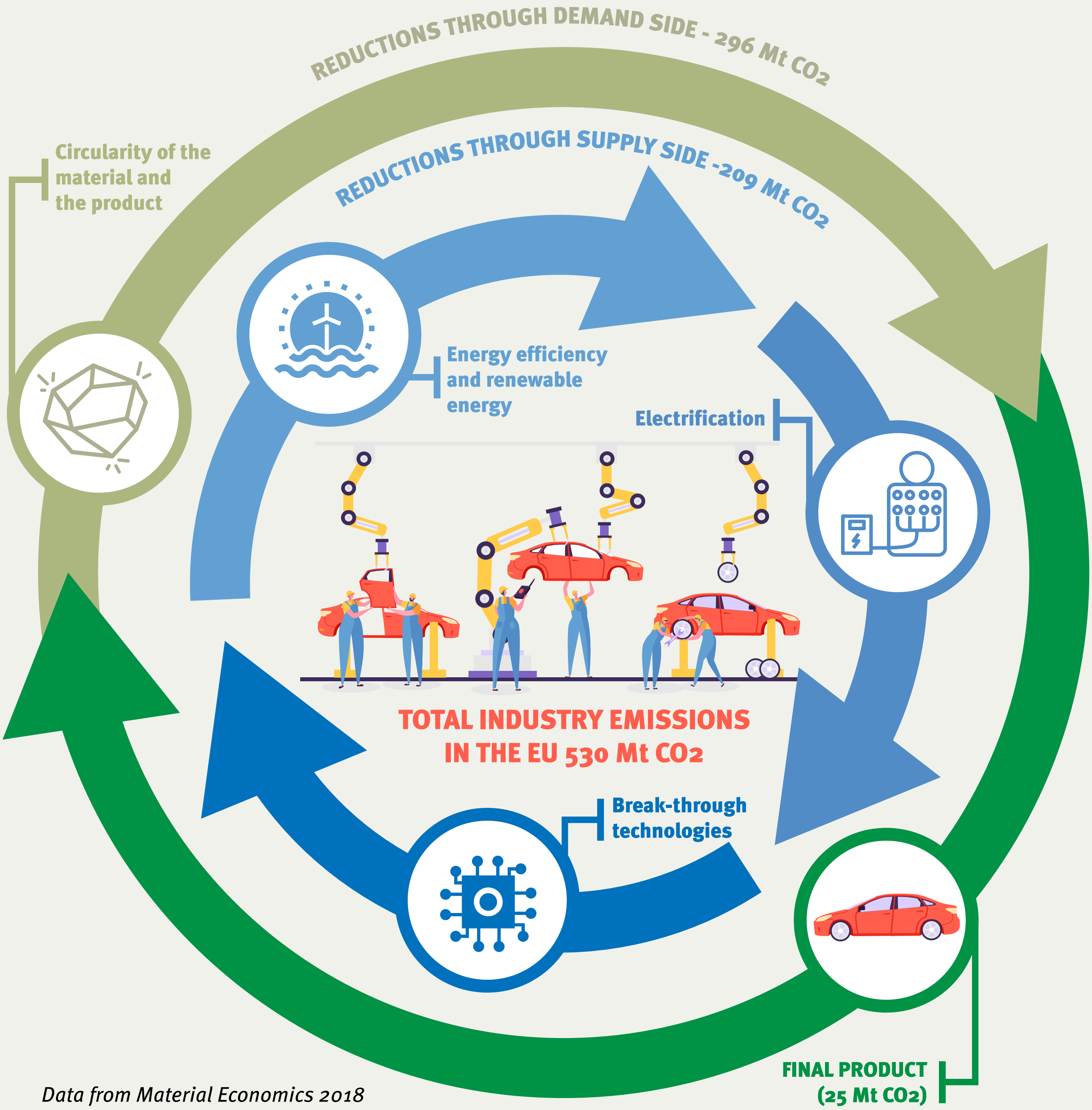
17 European Commission - website, accessed on April 19, 2019: https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-all-europeans

18 McKinsey & Company (2018), How industry can move toward a low-carbon future: https://www.mckinsey.com/business-functions/sustainability/our-insights/how-industry-can-move-toward-a-low-carbon-future

19 Institute for European Studies (IES), (2018), A Bridge Towards a Carbon Neutral Europe (pg. 37): https://www.ies.be/files/Industrial_Value_Chain_25sept.pdf

The role of demand- and supply-side measures in decarbonising materials production



Data from Material Economics 2018

2.1.2. Circularity

In a circular economy, the value of products and materials is maintained for as long as possible. Waste and resource use are minimised, and when a product reaches the end of its life, it is used again to create further value. This principle is applicable to energy intensive industries as well. Industrial circularity helps reduce emissions and energy use, maintain security of supply, and enhance production while reducing costs.

Energy-intensive sectors like steel, plastics, aluminium or cement, have the potential to reduce European emissions by 56% (300 $MtCO_2$) annually until 2050, if they adopted fully circular economy models. This represents potentially the second biggest lever for CO_2 emissions reduction after clean electrification[20].

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20 Material Economics (2018) , The Circular Economy - a Powerful Force for Climate Mitigation: http://materialeconomics.com/latest-updates/the-circular-economy

Most energy-intensive industries have already fairly high levels of circularity but these can still be improved and would bring about even further CO_2 emission reductions. For example, less than 40% of the current EU steel production is based on recycled steel. Increasing the share of recycled steel can cut emissions by 90% if using largely decarbonised electricity[21].

Unlike steel, plastic (a main product from the chemical industry) has a much lower recycling rate. Today, only 10% of new plastic demand is met with recycled plastic products. However, there is a much greater potential that should be exploited in plastic recycling by the chemical industry. It is estimated that emissions from both plastics production and end-of-life incineration could be further reduced by 56% through a combination of different solutions such as increasing plastics reuse, increasing mechanical recycling, and developing chemical recycling to recycle types of plastics that cannot be effectively recycled through mechanical recycling[22].

Cement and concrete are harder materials to recycle, the main difficulty being the quality of the waste material. Partnerships between cement producers and demolition companies have proven efficient in encouraging[23] the waste provider to give a pure source of raw material to the cement plant (without a mix of plaster or brick). Almost all of the waste (90%) from the construction sector can be revalorised but is largely downgraded into low-value applications. A radical shift in construction culture is essential for increasing the recycling rate: the material of an artefact at the end of life should no longer be considered as waste, but as valuable resource that, if well sorted, can be economically interesting to trade.

2.1.3. Carbon Capture and Storage (CCS) - last resort

Industrial carbon capture and storage, or CCS, is a process used to capture CO_2 from the emissions stream of industrial facilities. To keep CO_2 out of the atmosphere, it is captured from industry, transported, and stored underground. This technology has been conceptualised in the power sector as a way to abate CO_2 emissions produced by burning fossil fuels. However, it could also be applied to process-related emissions in industry, which are the by-product of the conversion of raw material into various products such as metals, minerals and chemicals.

Industrial CCS can be considered a last resort end-of-pipe mitigation option for unavoidable process related CO_2 emissions only. In practice, it will be applicable mostly for large point sources (+ 1 Mt CO_2) or clusters of large point sources of CO_2 emissions, in particular, for process emissions with a high CO_2 concentration, for example in cement and lime, steel and chemicals manufacturing[24]. For the CCS process to work in a cost-effective manner, it would need to be applied to industrial process emissions with a large CO_2 concentration in exhaust gas streams. The lower the percentage of CO_2 in an exhaust-gas stream, the more it costs to extract.

The total cost of CCS can range from € 22/ton CO_2 to € 168/ton CO_2[25] and includes the costs of capturing CO_2 from exhaust gases, transporting captured CO_2 to a storage site, and storing it[26]. Over the past years important initiatives have been launched in the EU to develop the technology further in the cement, lime and steel sectors, but to date CCS is not a mature, deployed technology.

Carbon Capture and Utilization (CCU) is a process where CO_2 is separated from exhaust gases released by an industrial plant and chemically converted to other substances. These include in particular methane (natural gas), fuels (petrol, diesel, kerosene), synthetic gas and other base chemicals.

In principle, CCU could help reduce CO_2 emissions but only if used in a fully closed carbon cycle where no additional CO_2 is released in the atmosphere. This is not the case for example if CCU is used to produce synthetic fuel for transport or gas to heat residential buildings. It is also important to keep in mind that if the electricity required for the CCU process is generated with fossil fuels, CCU is not a climate-neutral option[27].

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21 ibid.

22 Energy Transition Commission, (2018), Mission possible: http://www.energy-transitions.org/sites/default/files/ETC_MissionPossible_FullReport.pdf

23 ETH Zürich, Swiss Federal Institute of Technology (EPFL), (2018).A sustainable future for the European cement and concrete industry: https://europeanclimate.org/wp-content/uploads/2018/10/AB_SP_Decarbonisation_report.pdf

24 Institute for European Studies (IES), (2018), A Bridge Towards a Carbon Neutral Europe (pg. 43): https://www.ies.be/files/Industrial_Value_Chain_25sept.pdf

25 Exchanged into Euros at current exchange rate from USD 25/ton CO2 to USD 190/ton CO2

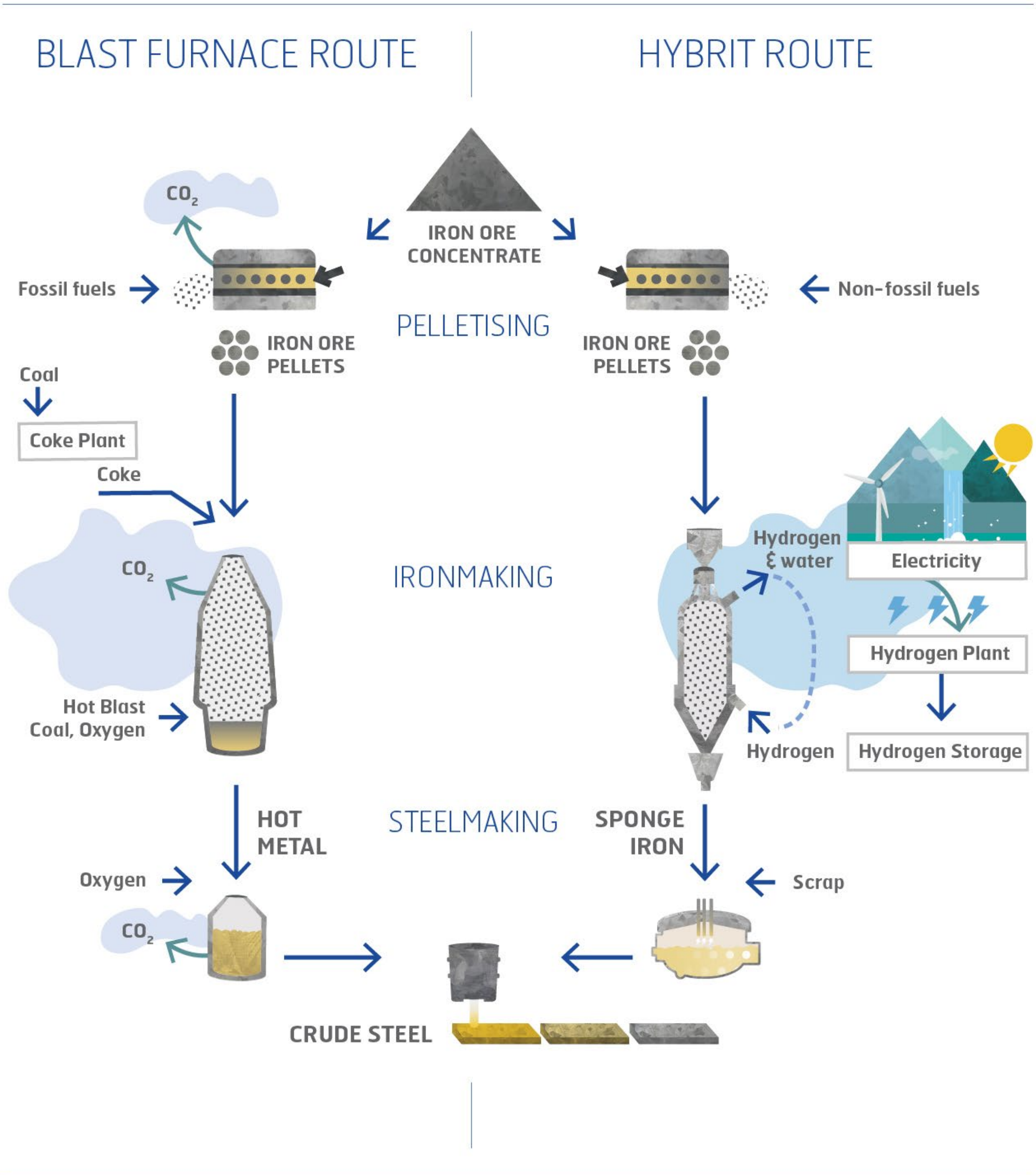
26 Institute for European Studies (IES), (2018), A Bridge Towards a Carbon Neutral Europe (pg. 44): https://www.ies.be/files/Industrial_Value_Chain_25sept.pdf

27 WWF Germany (2019), Position on CCU: https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF-CCU-Final.pdf

2.1.4. Breakthrough technologies

More and more examples of low or zero carbon production in heavy industries are being developed by either forward-looking incumbent companies or incoming innovators. For example, in the iron and steel industry renewable hydrogen can be used for the direct reduction of crude steel. Hydrogen replaces the carbon from fossil fuels (coal and coke) in the metallurgical process, making it essentially a CO_2 free process[28]. If the needed electricity is produced from renewable energy sources, this process is completely carbon-free.

In the cement industry, new binders based on alternative raw materials substituting limestone can significantly reduce CO_2 emissions. Such new binders reduce both process-related and energy-related emissions compared to conventional cement(-clinker) production.



Infographic by Hybrit Development AB

28 SET-Nav (2018) - Low carbon transition of EU Industry by 2050: http://www.set-nav.eu/sites/default/files/common_files/deliverables/wp5/Issue%20Paper%20on%20low-carbon%20transition%20of%20EU%20industry%20by%202050.pdf

In the chemical industry, the use of hydrogen made with renewable energy is an innovative mitigation option to reduce CO2 emissions from the production of basic chemicals. In the cases of ammonia and methanol, large quantities of renewable electricity are needed for hydrogen synthesis to substitute the conventional fossil combustion reaction.

Fossil-free steelmaking process - the HYBRIT project

Launched in 2016 in Sweden, 'Hydrogen Breakthrough Ironmaking Technology' (HYBRIT) is a joint venture between the steel producer SSAB, iron ore extractor LAB and state-owned electricity company Vattenfall. The goal of HYBRIT is to de-velop a zero-carbon steelmaking process based on hydrogen reduction of iron, instead of coal and coke. In conventional steelmaking, iron ore is either reduced with coke in a blast furnace or reduced with natural gas in solid sponge iron and then melted in electric arc furnace. In the case of HYBRIT, iron metal is produced by using hydrogen gas as the main reductant: hydrogen reacts with iron oxides to form water instead of carbon dioxide. Hydrogen gas (H2) is produced by electrolysis of water using fossil-free electricity. The project is now past the research phase and in 2018 work started on the construction of the first pilot plant, which is expected to be completed by 2020. The objective of the venture is to have a solution for fossil-free steel by 2035. If successful, HYBRIT aims to reduce Sweden's CO_2 emissions by 10% and Finland's by 7%[29].

2.2. Bottlenecks to clear

2.2.1. Renewable energy to power the transition

One of the main barriers to achieving zero-carbon production processes lies in the availability of large quantities of renewable energy sources. In a recent report published by the European power sector federation Eurelectric, a scenario where energy emissions are reduced by 95% by 2050, sees a 50% increase in total industrial electrification. An indicative estimate based on sector studies and calculations gives a range of 2980 TWh to 4430 TWh aggregated possible future electricity demand from energy intensive industries following the wide-scale deployment of low-CO_2 processes[30].

According to Eurelectric, this is achievable with an average 2,6% year-on-year growth of electricity supply between now and 2050 whilst at the same time reducing the total energy consumption by 1.3% per year through energy efficiency improvements.

Due to cost decreases in renewables in recent years, the expected cost of wholesale electric supply (excl. taxes and levies) in a fully decarbonised system ranges between 70 and 75 EUR/ MWh including storage, which is much lower than previously estimated 105 EUR/MWh[31]. This makes the deep electrification needed for a carbon-neutral industry more affordable than previously thought. Moreover, further decrease in the prices of renewable sources coupled with smart demand side management will make electrification even more competitive for the industry.

Adequate infrastructure development will be key to obtaining such an increase in electricity supply. Higher levels of electrification might need strengthening of high voltage networks close to industrial installations. Smarter and reinforced distribution grids will play a crucial role in creating the conditions for intense electrification through renewable energy sources, integrating new market participants, and ensuring the security of supply and grid resilience[32].

Distribution grids bring about some inherent challenges that will have to be carefully considered and will require large investments up to 2050, including for the integration of more decentralised resources, digitalisation through smart metering, and access to local flexibility resources.

29 Hybrit Development AB website, accessed on April 19, 2019: http://www.hybritdevelopment.com/

30 Institute for European Studies (IES), (2018), A Bridge Towards a Carbon Neutral Europe (pg. 13): https://www.ies.be/files/Industrial_Value_Chain_25sept.pdf

31 Eurelectric (2018), Decarbonisation pathways (report): https://cdn.eurelectric.org/media/3457/decarbonisation-pathways-h-5A25D8D1.pdf

32 Eurelectric (2018) Decarbonisation pathways (full study): https://cdn.eurelectric.org/media/3558/decarbonisation-pathways-all-slideslinks-29112018-h-4484BB0C.pdf

Good example: an aluminium producer investing in a wind farm

A growing number of resource and energy intensive industries are investing in renewable energy. One example is Norsk Hydro[33], one of the biggest aluminium producers globally. Norsk Hydro has recently invested in the development of a wind farm to power its aluminium smelters for the next 29 years. This represents a clear signal - heavy industry needs renewable energy to reduce its emissions and can play a major role in the development of renewables. Developing renewable energy projects and investing in their own renewable energy production is a smart and effective way for industry to move forward.

2.2.2. Industrial symbiosis and new business models

Industrial symbiosis is the process by which waste streams or by products from an industry or industrial process become the raw materials for another. The application of this concept allows materials to be used in a more sustainable way and contributes to the creation of a circular economy. In turn, this represents a good option for optimising the use of resources and thereby reducing emissions.

Several examples of industrial symbiosis can already be found in complementary industries such as the refining sector and petrochemical industry, which are even physically integrated through large process installations[34]. Other industrial symbiosis opportunities occur in heavy industrial installations but are not fully exploited yet. For example, waste products from steel production can become a resource for the production of chemicals (from waste gases) and cement (from steel slag). The pulp and paper and chemical sectors will likely collaborate to develop forest fibre derived bio-based products, becoming a resource for various chemical products

One of the main barriers to industrial symbiosis stems from the geographical location of industrial installations. Industrial symbiosis should be prioritised for industrial sites that are located close to each other, as this facilitates the exchange of material and resources.

2.2.3. More funding for the clean industry transition

Large investments in industrial equipment and changes in the energy system will be required to decarbonize industrial sectors. McKinsey has analysed three levels of electricity prices and estimated that the decarbonization of energy intensive sectors (steel, cement, ammonia and ethylene) could cost between USD 11 trillion and USD 21 trillion through to 2050 globally, an amount equivalent to between 0.4 and 0.8 percent of the global GDP (USD 78 trillion) per year. About 50 to 60 percent of that consists of operating expenses, and the remainder consists of capital expenditures[35].

The European Commission estimates that investments in energy systems need to rise to the level of EUR 520-575 billion annually, or 2.8 % of the EU GDP, to achieve a net-zero greenhouse gas economy. Additional investments compared to the baseline are as large as EUR 175-290 billion a year[36].

It is therefore clear that the current public and private funding is insufficient to effectively drive the clean energy transition in the industrial sectors. Public investments in R&D, innovation and clean energy has slowly increased over the past years but it can still be increased further.

Between 2014 and 2017, public investment in research and innovation for clean energy amounted to around EUR 5.3 billion a year[37]. The private sector has also contributed to clean research and innovation, providing around 75% of the EU investments.

Europe needs to pick up the pace, and public funding can help further accelerate the transition. Public funding will continue to

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33 Financial Times (2019), Heavy industry turns to renewables in drive to go green https://www.ft.com/content/90628748-8c21-11e8-bf9e-8771d5404543

34 Institute for European Studies (IES), (2018), A Bridge Towards a Carbon Neutral Europe (pg. 48): https://www.ies.be/files/Industrial_Value_Chain_25sept.pdf

35 McKinsey & Company, (2018), How industry can move toward a low-carbon future: https://www.mckinsey.com/business-functions/sustainability/our-insights/how-industry-can-move-toward-a-low-carbon-future

36 Council of the European Union (2019), The High Level Working Group on Competitiveness and Growth, paper: https://data.consilium.europa.eu/doc/document/ST-7994-2019-INIT/en/pdf?utm_source=POLITICO.EU&utm_campaign=65e81e7c28-EMAIL_CAMPAIGN_2019_04_10_06_09&utm_medium=email&utm_term=0_10959edeb5-65e81e7c28-189872549

37 European Commission (2019), Fourth report State of the Energy Union: https://ec.europa.eu/commission/sites/beta-political/files/fourth-report-state-of-energy-union-april2019_en_0.pdf

play a key role in coordinating research and steering private investment, help bridge the gap from research to commercial deployment and attract new private investments by de-risking technologies.

The potential for exploiting synergies between funds and for increasing public funding is considerable. For example, the EU ETS Innovation Fund (successor of NER300) has now expanded its scope beyond renewable technologies and CCS to include funding for innovative low-carbon technologies and processes in energy-intensive industries. The fund will allocate 10 billion euros spread over 10 years (2021-2030) derived from the auctioning of 450 million ETS allowances.

An average of 1 billion euros a year is a start but not enough to fully support a clean energy transition. Synergies should be exploited between the Innovation Fund and other EU funds for research and innovation, such as Horizon Europe, as well as with Member States' national auctioning revenues.

Member States' national revenues generated through the auctioning of EU ETS allowances can also be used to support innovative clean technologies in the industrial sector. In 2017, Member States earned EUR 5.6 billion from the auctioning of EU ETS allowances[38]. This amount is likely to rise significantly in 2018 due to the higher carbon price registered in 2018. If such a yearly budget were used to complement public investments in clean energy, funding would be more effective and Europe could accelerate its progress towards a carbon neutral industry. A crucial tool for the Member States to plan and report on their investments needs and levels, including on research and innovation, are the National Energy and Climate Plans (NECPs). These plans provide an opportunity for the Member States to lay out detailed strategies and to make use of their revenues for clean energy and climate objectives.

Other public funds can be used to complement the Innovation Fund in its efforts to drive clean energy projects.

Horizon Europe (Horizon 2020 successor) is a perfect example of such synergy: while Horizon Europe could finance projects at a lower technology readiness level, the Innovation Fund could support the demonstration phase of eligible projects that may have received the support from Horizon Europe.

In a similar fashion, additional complementarity can be found between the Innovation Fund and instruments such as InvestEU for investment support, as well as with the Connecting Europe Facility, the EU ETS Modernisation Fund and the Cohesion Fund for the roll-out of key infrastructure.

Part3: Conclusions and policy recommendations

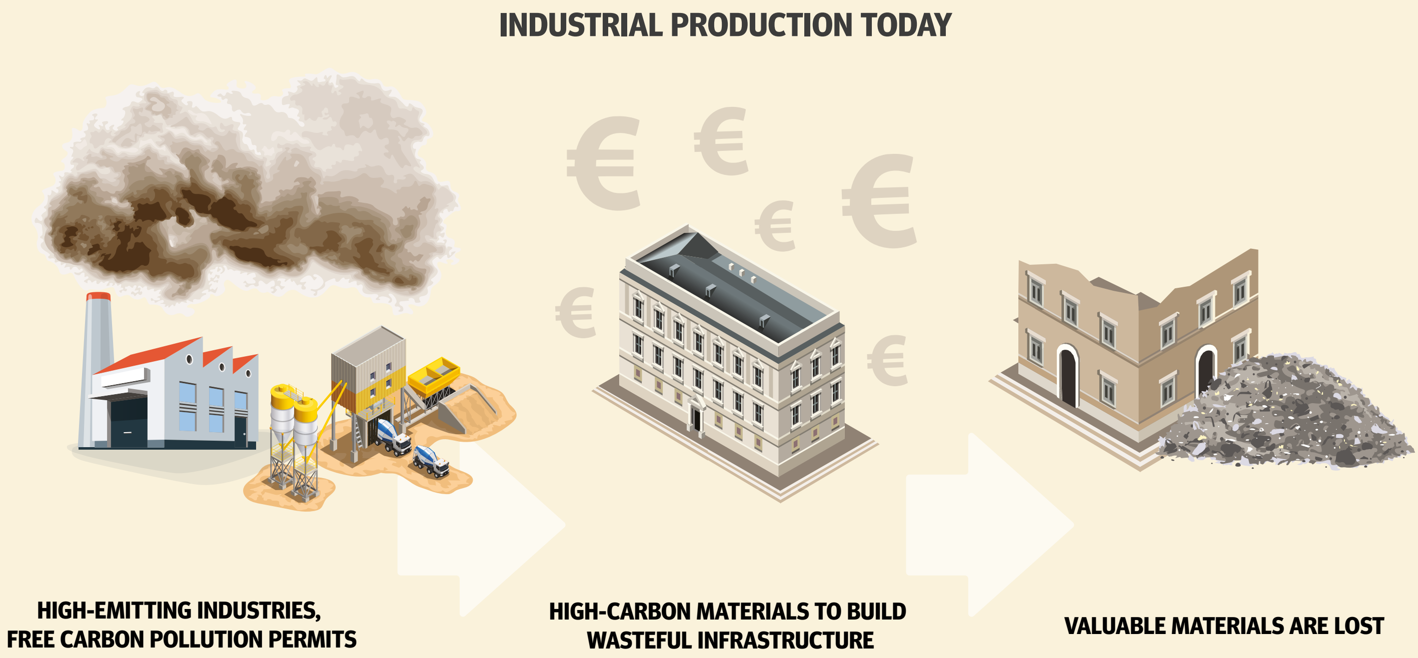
Reaching net-zero emissions from energy-intensive industry is possible but will require both large investments and a new policy framework. **A climate-proof industrial strategy** will be an essential component in this transition. The key ingredients are already outlined in the recently launched EU long-term decarbonisation strategy "A Clean Planet for All" by the European Commission, which includes pathways and solutions for heavy industries. It is of utmost importance that the Member States and the European Parliament show full commitment to this vision and turn the strategy into concrete policy measures in order to set Europe on the right path to achieving net-zero carbon emissions by 2040.

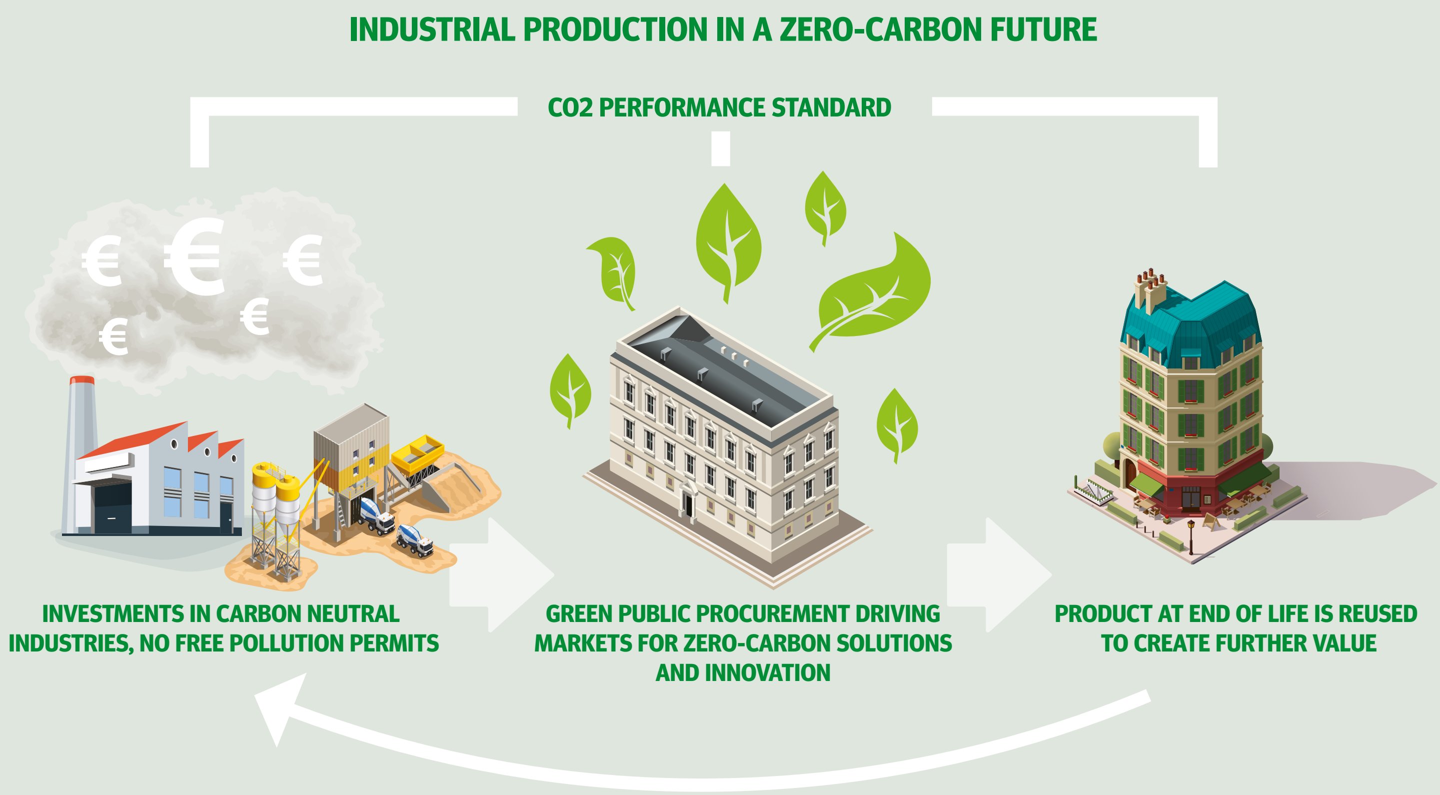
Therefore, EU lawmakers must propose and adopt an **industrial climate policy framework**. This framework should support and incentivise the full decarbonisation of resource and energy-intensive industry sectors well before 2050. An effective policy framework will cover the entire industrial value chain and include different measures, financial and regulatory. The fundamental components of such a policy framework are outlined below.

38 European Commission (2018), Report on the functioning of the European carbon market: https://ec.europa.eu/clima/sites/clima/files/ets/docs/com_2018_842_final_en.pdf

1. A first task will be to ensure that all new major investments in industrial installations can be demonstrated to be compatible with a pathway to net-zero greenhouse gas emissions. This can be achieved by introducing a **Paris Agreement compliance test** for new industrial investments and major refurbishments in environmental permitting. This measure would avoid a lock-in of investments into high emitting infrastructure.
2. Industrial transition will require major investments in innovation and deployment programmes. It is therefore crucial to **increase funding** for industrial decarbonisation and avoid high-carbon lock-ins. This can be achieved by climate mainstreaming public funding to exclude investments in fossil fuels. At the same time, the design of pricing incentives for investments in zero carbon solutions must be improved, such as a stronger EU ETS price flanked by carbon taxes. Synergies should be exploited between specific funding programmes such as the ETS Innovation Fund and other EU funds for research and innovation, such as Horizon Europe.
3. Emission performance requirements should also be applied at material and product level. CO2 **performance standards** and **ecodesign** can impose minimum performance standards on the production and consumption of energy-intensive materials. This will ensure greater uptake of zero-carbon and energy efficient solutions on the European single market. Acting across the value chain, these policies would enhance the circular use of materials. The Industrial Emissions Directive (IED) must be reviewed to include greenhouse gas performance standards and introduce binding energy efficiency standards based on the best-in-class solutions within a given industrial activity.
4. Another instrument that would help ensure the preservation of material value and increase circularity is a recycling target. Introducing an obligation for all semi-finished and finished products to contain a certain **percentage of recycled materials**, and targets to avoid contamination of waste streams (e.g. copper in steel scrap) would help reduce the quantity of raw material used and consequently reduce emissions.
5. In order to incentivise the uptake of clean technologies, it is essential that energy-intensive industries start to fully internalise the cost of polluting and that this cost becomes high enough to make clean solutions more profitable. In the current structure of the EU ETS where allowances to almost all industrial installations are granted for free, there is no incentive for industry to invest in clean energy. The new policy framework should therefore **phase out free ETS allowances**. The collected auctioning revenues must be spent smartly on climate action and to trigger larger investments in clean industrial processes.
6. Finally, a comprehensive policy framework must also include demand-side measures. Every year, public authorities in the EU spend around 14% of GDP on the purchase of services, works and supplies. **Public procurement** could therefore drive the markets for zero-carbon solutions and innovation in Europe, for example in the construction industry. Infrastructure assets are the largest area of public spending and their carbon impact is significant during all stages of their lifecycle. Public investments in zero-carbon assets could effectively increase the uptake and deployment of low-carbon technologies across the whole value chain. In order for this to happen, public procurement processes must focus on value-for-money across the lifecycle of the asset in question. In addition, public procurement should include guidelines and mandatory performance standards in the selection criteria with regard to GHG emissions and material efficiency.

INDUSTRIAL CLIMATE STRATEGY IN PRACTICE





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