

CLIMATE NEUTRAL INDUSTRY IN EUROPE



KEY MESSAGE

- **Industry** accounts for **20 percent of greenhouse gases** (GHG) emissions today.
- To be in line with the EU 2050 climate neutrality target, we need to reduce industrial **energy** emissions by about **95 percent** and industrial **process** emissions by about **75 percent**. Overall, this implies a **90 percent reduction of GHG emissions by 2050 for industry**.
- **Steel, cement, chemicals and aluminium** are basic materials feeding into Europe's industrial value chains and essential for the European economy and prosperity. These 4 basic materials account for **over half of industrial emissions**.
- Reducing emissions for these 4 basic materials industries requires using **green energy, new processes, material efficiency and circularity**.
- As these industries **need to reinvest heavily by 2030**, and productive assets have a long financial lifespan (from 20 to 30 years), **it is crucial investments kick-start the necessary industry transformation now**.



OVERVIEW

The keys to decarbonising industry are:

- **direct electrification** of all **low, medium and some high temperature heat sources** in industry, from a **renewable-based** energy sector;
- **replacement of fossil hydrogen or coking coal** in steel and chemicals production by **clean hydrogen**;
- development and deployment of **climate-neutral process technologies** for key products like **steel, chemicals, aluminium and cement**;
- more **efficient use** of CO₂-intensive materials (e.g. through longer product lives, eco-design);
- enhanced and increased **recycling** of CO₂-intensive materials;
- **substitution** to materials that store carbon (e.g. bio-based materials for construction); and
- **carbon capture and storage for residual emissions or capture and storage of bio-based emissions** (negative emissions).

Co-benefits of industrial transformation:

- **safeguards industrial jobs** by making production processes resilient to consumer environmental concerns;
- **reduces local pollution** (e.g. from landfill, waste incineration, plastic in waterways, dumping of uncollected product waste);
- **creates new economic value** through innovation, new markets, material productivity and circular value chains; and
- **reduces exposure of value chains to material shortages or material security concerns** by using circular materials and products.



AIMS & TARGETS

From slow-to-abate to direct electrification and circular basic materials industries, with hydrogen for hard-to-electrify segments and as feed-stock.

A full set of emission abatement levers need to be used to achieve a climate neutral industry:

1. maximise material efficiency;
2. maximise material recirculation and substitution;
3. switch to decarbonised energy for heat;
4. develop new process technologies;
5. use carbon capture and storage/use (CCS/CCU) for remaining unavoidable emissions; and
6. create negative emissions through bio-based materials and bio-CCS/U (carbon capture and storage/use).

In order to make full use of these levers, 6 key conditions are necessary across the value chain:

- Upstream:
 1. Clean energy, biomaterials and CO₂ infrastructure
- Midstream
 2. Commercial competitiveness of climate-neutral process technologies
 3. Switch to zero emissions heat sources
- Downstream
 4. Material-efficient and circular product design and manufacture
 5. Lead markets and scalable demand for climate-neutral materials and final products
- Closing the loop
 6. Infrastructure and incentives for enhanced materials reuse, high quality recycling and substitution

To kick-start this transformation in Europe, we need to:

- deploy **infrastructure** for industrial hydrogen use and carbon capture and storage (CCS) systems;
- create incentives and requirements for value chains to enhance the **quantity and quality of the recycling of secondary raw materials** and initiate a **circular economy**;
- revise **product standards** for key products to allow new **circular and material efficient solutions** (e.g. new cement types) to come to market;
- create **lead markets** for low-carbon and circular materials;
- **incentivise competition** between alternative low-CO₂, circular and CO₂-negative materials;
- **support commercial-scale deployment** of climate-neutral technologies for the first wave of industrial refurbishment to 2030; and
- Prioritise and incentivise the deployment of **clean hydrogen** for **no-regret applications and biomass in industry**.



POLICY INSTRUMENTS

In order to benefit from all 6 decarbonisation levers and build the enabling framework for businesses, a **comprehensive and integrated policy package is necessary**. The policy package needs to cover all key parts of the value chain: upstream, mid-stream and downstream, so as to close the materials loop and initiate a climate-neutral industry.

Upstream

- Incentives to scale up clean and decarbonised hydrogen in **no-regret** industrial applications
- **Prioritisation** of clean hydrogen and biomass for industrial and material uses
- Hydrogen **sustainability criteria** that are 2050 compatible and workable for rapid scale-up
- Expansion of renewable energy supply and power purchase agreement options for **direct electrification** of industry

Midstream

- **Carbon contract for difference (CCfD)** to support commercial deployment of breakthrough technologies
- **Removal of free allocation** of emission allowances as part of the EU ETS (Emission Trading Scheme) and replacement by a **CBAM** (Carbon Border Adjustment Mechanism)
- Use of new **auction revenues** for industrial sectors to **fund CCfDs** in industry

Downstream

- Green material CO₂ rating **labels** to support public procurement and private lead markets
- Limits on the **embedded CO₂** in final products
- Recycled material content **quotas** in material-intensive products (buildings, vehicles, packaging)

Source

Agora Industry and Material Economics:

Making Circular Economy work to decarbonise heavy industry in Europe (forthcoming, January 2021).

University of Cambridge Institute for Sustainability Leadership (CISL) and Agora Energiewende. (2021).

Tomorrow's markets today: Scaling up demand for climate-neutral basic materials and products. CLG Europe

Retrieved from <https://www.agora-energiewende.de/en/publications/tomorrows-markets-today/>

Agora Energiewende and Wuppertal Institute (2020):

Breakthrough strategies for climate-neutral industry in Europe (summary): Policy and technology pathways for raising EU climate ambition.

Retrieved from <https://www.agora-energiewende.de/en/publications/breakthrough-strategies-for-climate-neutral-industry-in-europe-summary/>

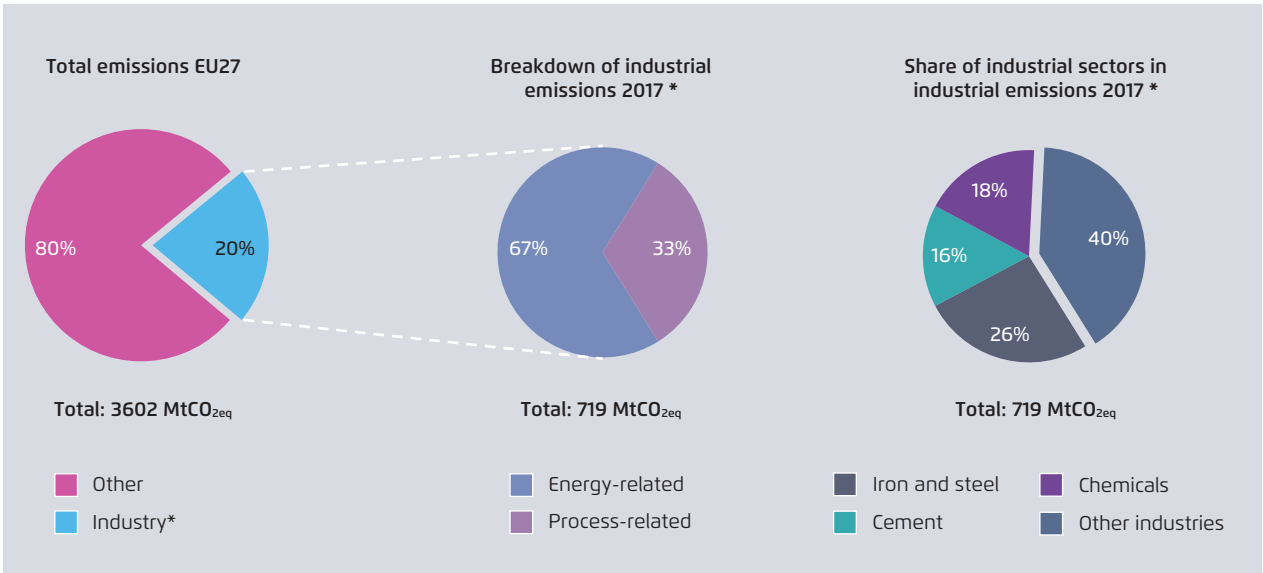
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Greenhouse gas emissions of the EU27 industrial sector in 2017 in MtCO_{2eq}

Figure 1



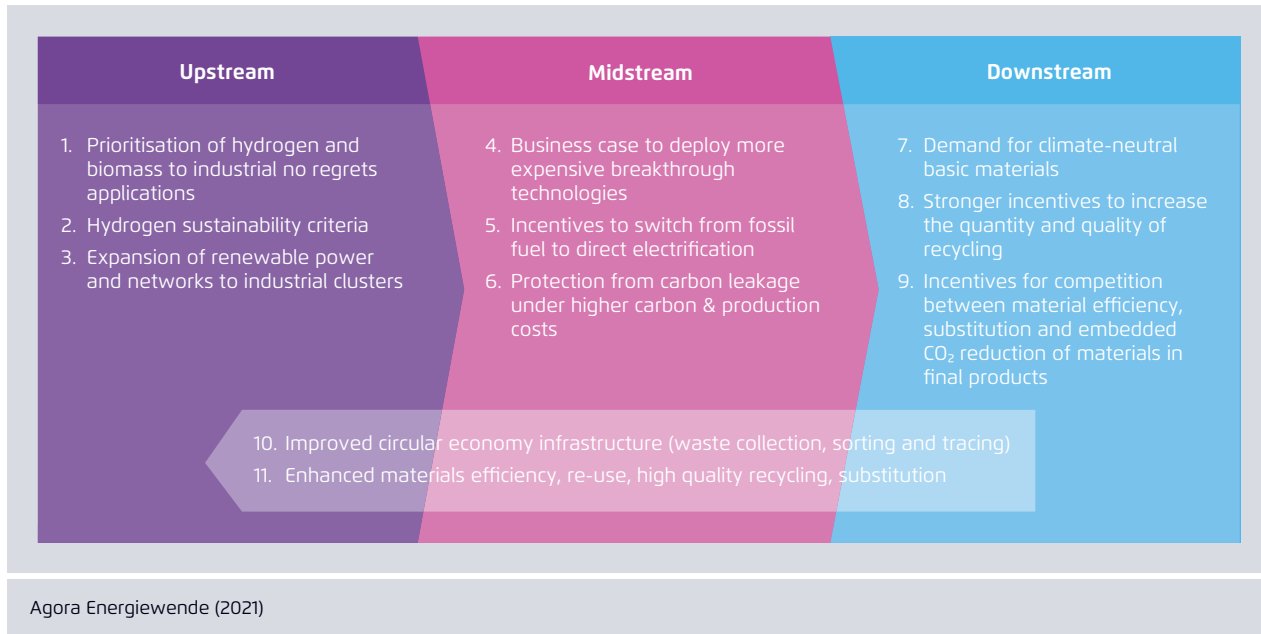
Agora Energiewende and Wuppertal Institute (2021): Breakthrough Strategies for Climate-Neutral Industry in Europe: Policy and Technology Pathways for Raising EU Climate Ambition.

Based on EEA GHG inventory data, 2021, and E-PRTR database, n.d.

* This includes the energy-related and process-related emissions of the iron and steel industry as specified in the EEA database. In addition to that, based on our own estimates another 35 MtCO_{2eq} for the production of coking coal and the power plants of the steel industry in the EU27 were added. Depending on who operates the coking plant and the power plant, these emissions are accounted under the categories 'Public Electricity and Heat production' and 'Manufacture of Solid Fuels and Other Energy Industries'. As they are directly linked to the iron and steel industry, we included them here.

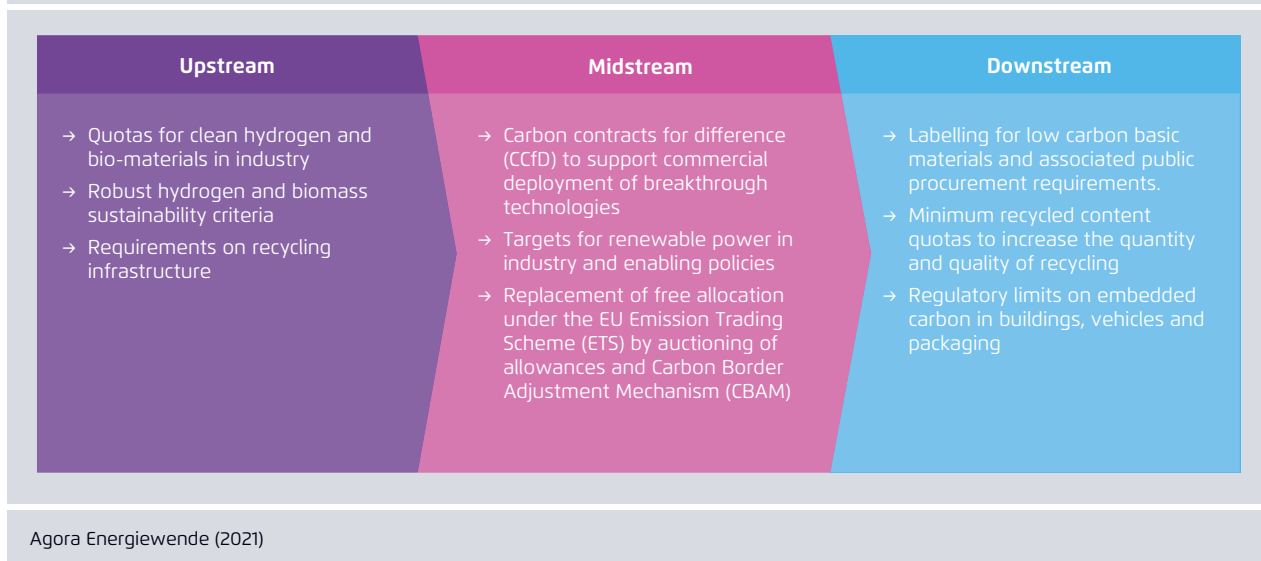
11 essential conditions for industry to transition to climate neutral products, processes and business models

Figure 2



Key policies for industry to transition to climate neutral products, processes and business models

Figure 3



Learn more:

www.agora-energytransition.org/success-stories



242/07-DO-2021/EN

November 2021, Version: 1.0

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