Agora Energiewende

# Enabling European industry to invest into a climate-neutral future before 2030

## IMPULSE

Oliver Sartor
Matthias Buck
Frank Peter

201/01-I-2021/EN
January 2021

Dear reader,

The European Council of 10 – 11 December 2020 set a new target of reducing EU greenhouse gas emissions by 55% by 2030, strengthening the current 40% target. In that context it also tasked the Commission to "propose measures that enable energy-intensive industries to develop and deploy new climate neutral technologies while maintaining their industrial competitiveness."

This requires an integrated package of policies, a "Clean Industry for Europe"-package. Unfortunately, a coherent and integrated policy package on climate neutral industry is not planned in the Commission's 2021 Work Programme, creating the risk of a fragmented approach to climate neutral industry.

Against this backdrop, this brief proposes that the European Commission should present an update of its EU industrial strategy by latest April 2021. The revised strategy should present a compelling narrative on the transition of Europe's energy-intensive industry to climate neutrality, it should set concrete and ambitious 2030 milestones for first large-scale investments into climate neutral industrial processes, and present a legislative roadmap with specific instruments for delivering the milestones.

I hope you find this report informative.

Yours sincerely,
Patrick Graichen
*Executive Director, Agora Energiewende*

## Key findings

| | |
|---|---|
| 1 | **Europe's energy intensive industry must make a significant contribution to achieving the EU's new target to reduce greenhouse gas emissions by 55% by 2030.** The $CO_2$ abatement potential of key low-carbon technologies in the steel, chemicals and cement sectors amounts to 145 Mt of $CO_2$ by 2030. The European Council of 10-11 December 2020 thus explicitly tasked the Commission to "propose measures that enable energy intensive industries to develop and *deploy* new climate neutral technologies while maintaining their industrial competitiveness". |
| 2 | **The Commission's 2021 Work Programme currently does not foresee developing a coherent and integrated policy package for climate neutral industry.** While the Commission has addressed some aspects (e.g. hydrogen strategy, ETS and carbon leakage reform), key elements are still missing, such as policies to create lead markets for low carbon basic materials or incentives for material-efficient and circular construction and manufacturing. |
| 3 | **Enabling the necessary investments at scale requires a robust and consistent framework at the European and national level well before 2030.** To this end, key elements of the "Fit for 55 package" must be connected to crucial initiatives for industrial decarbonization such as the Circular Economy Action Plan, Sustainable Products Initiatives, mandatory use of the LEVEL(s) framework or Green Public Procurement opportunities. |
| 4 | **By latest April 2021, the European Commission should present an update of its industrial strategy.** The updated strategy should: a) present a compelling and concrete *narrative* for how energy-intensive industry can transform by 2030 and 2050; b) set concrete and ambitious 2030 *milestones* for that industrial transformation; and c) include a *legislative roadmap* with specific instruments for delivering the milestones to kickstart the transition. |

# Content

## Key Messages

The EU Industrial Strategy for a Green and Digital Europe of March 2020[1] signals an important paradigm shift in describing European industry as partner in Europe's transition to climate neutrality. However, at this juncture the strategy raises more questions than it answers and excessively delegates responsibility to industry-led alliances.

Likewise, the Commission's Work Program for 2021 includes some elements to green industrial production processes without addressing the issue head-on. It remains unclear whether planned initiatives will be sufficient for kick-starting concrete investments into industry's transition to climate-neutrality in the 2020s. Vital elements identified by the Green Deal Communication – such as the need to create lead markets for low carbon products – are not featured at all. Moreover, industry-related initiatives will be taken up by the European legislator one-by-one, with potentially different timelines and no connections to each other, in the context of policy initiatives that don't primarily focus on industry decarbonization. There is thus a very real risk of industry-related elements in the EU's 2030 climate and energy framework not adding up to a robust, consistent regulatory and financing framework.

This approach contrasts starkly with the gear shift in EU climate ambition agreed by EU heads of state and government at the European Council meeting of 10-11 December 2020. EU leaders set a new EU headline target of reducing EU greenhouse gas emissions by 55% by 2030. The new target requires dramatically accelerated action in all sectors of the economy. According to the Commission's own Analysis energy-intensive industry under the EU carbon marketwill need to reduce emissions by ~142Mt or 27% compared to 2019 levels.[2]

Our own analysis shows that it is possible to reduce greenhouse gas emissions from industry at this scale and in this timeframe if a portfolio of relatively mature breakthrough technologies compatible with climate neutrality is deployed.[3] However, enabling the necessary investments at scale requires a robust and consistent framework at the European and national level well before 2030.

Importantly, the December European Council Conclusions explicitly task the Commission to "propose measures that enable energy intensive industries to **develop** and **deploy** new climate neutral technologies while maintaining their industrial competitiveness"[4] (emphasis added). The need for a set of concrete and dedicated clean industry measures as part of the 55% package is also supported by industry groups, labor organizations, think tanks and NGOs.[5]

1 https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en

2 European Commission (2020): Impact Assessment Accompanying the 2030 Climate Target Plan p.213

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

4 https://www.consilium.europa.eu/en/press/press-releases/2020/12/11/european-council-conclusions-10-11-december-2020/#

5 Cf. For example, the following statements and position papers, from European Roundtable for Industry (Dec 10, 2020), The IT50 NGO Group (Feb 18th, 2020); Agora Energiewende (Nov 2020); IndustriAll (June 2020); Masterplan for a Competitive Transformation of EU Energy-intensive Industries (High Level Group for EIIs, 2019)

Against this backdrop, we propose that the European Commission should present an updated EU industrial strategy in March 2021 that:

- **presents a compelling narrative for** how Europe's energy intensive industry could transform towards climate neutrality competitively, specifically in terms of
  a) developing affordable clean energy access and infrastructure (beyond hydrogen);
  b) large-scale deployment of key climate-neutral technologies;
  c) creation of markets for low-carbon basic material products; and
  d) governance of the transition.

- **sets concrete and ambitious 2030 milestones** for the industrial transformation to be achieved in different energy-intensive sectors that match with Europe's new 55% target.

- **includes a legislative roadmap with specific instruments** for delivering the milestones. This legislative "roadmap" will enable the EU legislator to develop the robust and consistent European framework needed to enable European industry to invest into a climate-neutral future at scale well before 2030.

## 1 2030 milestones for a concrete, updated EU Industry Strategy

Concrete 2030 milestones seem essential for the European Parliament and the Council when negotiating in parallel on the different elements of the Clean Industry for Europe package. Such milestones would help all governments in Europe that plan to use public funds for kick-starting green industry investments and to plan relevant infrastructure under revised National Climate and Energy Plans. Such milestones would assure energy-intensive industry that Europe's transition to climate neutrality is starting in earnest. Ideally, the milestones would be endorsed by EU heads of state and government at a 2021 European Council meeting.

Based on our analysis (see Annex), we propose the following milestones, to be achieved *by 2030* at the level of the EU-27[6]:

- 40 Mt of primary steel produced from "climate neutrality-compatible" technologies

- 16 Mt of EU cement production linked to offshore carbon capture and storage sites

- Large-scale demonstrators for innovative biomass-to-chemicals technology

- Critical, innovative recycling technologies are established for chemicals and cement[7]

- 50% industrial steam demand at up to 200°C supplied by power-to-heat technologies

[6] The figures given strike a reasonable balance between ambition and technical feasibility. Further explanations are included in **Annex 1** to this paper.

[7] Specifically, 2 Mt HVC (5%) of chemical recycling and 15% of end-of-life cement recycled into new cement applications.

## 2 A compelling narrative for the industry transition

The European Commission has announced several policy initiatives under the European Green Deal, some of which are related to industry. For example, the Commission is pursuing policy consultations on: ETS & Innovation Fund reform, a Carbon Border Adjustment Mechanism, the Hydrogen Strategy, a new Circular Economy Action Plan 2.0, and the Sustainable Product Policy Initiative. However, this set is both incomplete and, where relevant to industry, *it remains unclear whether planned reforms will be implemented in a way that adequately reflect core needs for a robust and consistent European Clean Industry framework.*

As argued in Agora's study entitled *A Clean Industry Package for the EU*, the EU needs to unlock the key parts of the industrial value chain to adequately kickstart the transition to climate-neutral industry *before 2030*:

- **Expand access to affordable clean energy and related infrastructure:** This means prioritising hydrogen for no-regret industrial use, but it also goes *beyond simply hydrogen* and must include planning for direct electrification, biomass, CCS and recycled feedstocks for industrial clusters.

- **Deploy key low-carbon and circular materials process technologies:** This requires a combination of EU funding but more importantly an enabling framework for *national* policies, such as CCfDs.

- **Create lead markets for low-carbon intermediate products:** This is essential for products like steel, cement and concrete to shift investments into ambitious and business models at scale.

- **Promote a circular and resource efficient product design** of the most basic material intensive products, especially for *buildings, public works and vehicles.*

Of course, these policy aims must be pursued while avoiding any risks of carbon leakage and be accompanied by new governance tools to ensure policy coordination and oversight of progress.

## 3 A Roadmap for an EU Clean Industry Package

We propose that the following elements be included in a legislative Roadmap annexed to a revised EU Industrial Strategy. At present, these crucial elements appear to be missing from the existing industrial strategy and the strategic orientations of the 2030 Climate Target Plan and Impact Assessment, thus raising concerns about the adequacy of the Green Deal for industry transition:

1. **Creation of an enabling framework for Carbon Contracts-for-Difference for climate-neutral technologies:** At present, the Commission has proposed to explore such measures in the Hydrogen Strategy Communication and the revision of the EU ETS Directive (Innovation Fund). While this is a welcome development, support for smooth national rollouts of such policies is also essential. To this end, soft measures will be needed, including favourable state aid guidance and technical guidance on key details, such as *additional cost evaluation* and *minimum environmental performance criteria*. Such elements are key to avoiding internal market distortions and enabling state aid approval of complementary national level policies, which will be needed in addition to EU instruments to achieve the necessary scale and geographic diversity of deployment of key technologies by 2030.

2. **Standardised $CO_2$ and environmental performance labelling for intermediate basic material products:** At present, it is not entirely clear that the EU's initiative on Environmental Claims or the Sustainable Product Initiative currently aims to create the conditions *for lead markets for*

*intermediate*[8] *basic materials* to emerge. This is an essential precondition to other support public procurement or private market initiatives, which could create demand and competition between such products. We suggest that harmonised low-carbon performance labels – akin to energy performance labelling – should be implemented as a cross-cutting element of the Sustainable Product Policy Initiative for all $CO_2$-intensive basic material (intermediate) products.

3. **Lifecycle assessments (LCAs) for embedded $CO_2$ emissions and resource use requirements for a) new construction, b) public works and c) vehicles:** These three activities account for the lion's share of the demand for highly $CO_2$ and resource intensive products. Mandatory lifecycle assessment labelling and environmental performance thresholds for embedded $CO_2$ (and other resource use) in these final products is thus an essential way to stimulate a full range of $CO_2$ and resource efficient actions downstream in the value chain. Currently, robust EU standards have been established supporting lifecycle assessment methods under Environmental Product Declaration Standards EN 15804 and EN 15978. However, the Commission's Renovation Wave Communication appears to propose an very slow rollout of such policies for construction; for example, the pledge to develop by 2023 only a roadmap for the universal application of the EU's LEVEL(s) criteria to new construction. This would be too little too late. We propose that LCA reporting should be a new requirement for all buildings, public works and vehicles produced and sold in the EU. This issue must be addressed in a horizontal and coordinated manner by the Environmental Claims Initiative, Construction Products Regulation, Eco-design, and Green Public Procurement Legislation.
4. **Enhanced recycling targets and end-of-life sorting and tracking requirements for basic materials:** The EU should set minimum recycling targets for the share of both concrete aggregate and cement binder materials recycled into new concrete and cement applications in 2030, 2035 and 2040. This could be done via the establishment of appropriate waste regulations for construction and demolition waste (CDW) under the EU Waste Framework Directive.

   In addition, minimum requirements for the use of recycled cement fines into cement applications in new public buildings and works should be set by a revision of Directive 2014/24/EU on public procurement for construction and public works. Furthermore, obligations should be created for enhanced end-of-life disassembly (not demolition), separate collection, and materials tracking for key products to limit contamination and increase the quality of circular resource use in new products.

5. **Prioritization of access to clean hydrogen, power and biomass in "no regrets" industrial applications**: Agora estimates that, by 2030, greening existing hydrogen usages in industry, such as refining and ammonia, could require up to 150 TWh of clean hydrogen. New usages in the steel and chemicals sectors for methanol, chemical recycling and steel will require a further 60 TWh by 2030. In addition, other higher-temperature industrial processes that cannot be switched to more efficient direct electrification may also require certain amounts of hydrogen. Thus, the EU's Hydrogen Strategy, which envisages up to approximately 333 TWh of supply in 2030, will need to largely be dedicated to industrial usage before 2030 to meet the necessary demand from climate neutral production processes.

   The planning of clean energy infrastructure and access to affordable clean electricity and biomass

[8] Outside of energy use, the production of basic materials products such as cement, steel, aluminium and basic chemical products (plastic, etc.) typically represents the most $CO_2$, energy and resource intensive parts of the value chain of many products.

will also be essential for member states to succeed in the transition to climate-neutral industry. For many applications (such as chemicals and steel), biomass will be essential as a fossil-free carbon feedstock, while direct electrification can also reduce pressure on resource-intensive solutions such as hydrogen. Thus, a set of *enabling conditions for the broader opening of access to clean power and biomass to industry and prioritization of "no regrets" resource allocations should thus be created under the Renewable Energy Directive revision.*

## Annex: Justification for proposed 2030 milestones

### 1. "40 Mt steel production in 2030 using climate-neutrality compatible technologies"

By 2030, roughly 50% of the EU steel industry's primary annual production capacity will reach the end of its technical lifetime and require reinvestment to sustain current production levels. These reinvestment windows are an opportunity to kick-start the transformation towards a climate-neutral steel sector. By 2030, 33% of primary steel production (approx. 32 Mt of steel)[9] should be produced via the Direct Reduced Iron (DRI) route using a mix of natural gas and hydrogen instead of coking coal (-60% to -90% of emissions reductions) and at least 8Mt of increase in the share of secondary to primary steel. DRI technology is already technologically mature and market-ready and can begin to be deployed before 2025, conditional on regulatory clarity and support, as evidenced by several recent company announcements (see Table 1). Until enough clean hydrogen becomes available, DRI plants can run on natural gas, with hydrogen being gradually phased in.

**Table 1: Overview of EU steel companies' plans for the deployment and commercialization of DRI**

| Project, Site | Country | Company | Status | Fuel | Timeline |
|---|---|---|---|---|---|
| Hybrit, Lulea | SE | SSAB | Started pilot operation with clean hydrogen in 2020 (TRL 4-5) | Clean $H_2$ | 2020: pilot<br>2026: commercial |
| DRI, Galati | RO | Liberty Steel | MoU signed with Romanian government to build large-scale DRI plant within 3-5 years<br>Capacity: 2.5 Mt/DRI/year | N-gas, then $H_2$ | 2023–2025: commercial |
| tkH2Steel, Duisburg | DE | Thyssenkrupp | Plan to produce 0.4 Mt green steel with green hydrogen by 2025, 3 Mt of green steel by 2030 | Clean $H_2$ | 2025: commercial |
| SALCOS, Wilhelmshaven | DE | Salzgitter | Feasibility study to build DRI plant in Wilhelmshaven | Likely Clean $H_2$ | n.a. |
| H-DRI Project | DE | Arcelor-Mittal | Planned construction of an $H_2$-DRI demo plant to produce 0.1 Mt DRI/year (TRL 6-7) | Grey $H_2$ initially, Then green $H_2$ | 2023: demo plant |
| DRI, Taranto | IT | Arcelor-Mittal | Plans to build DRI plant, ongoing negatiations with Italian government | n.a. | n.a. |
| IGAR DRI/BF, Dunkirk | FR | Arcelor-Mittal | Plans to start hybid DRI/BF plant and scale up as H2 becomes available | Natural gas then green H2 | 2020s: Commercial |

Source: Agora Energiewende. 2021

### 2. "10% of today's EU cement production (16 Mt cement) should use CCS technologies"

Currently, EU cement companies are operating or building several CCS pilot and demonstration plants. With appropriate cost support, the technology can be commercialized before 2030 (see Table 2). By then, the required offshore storage sites in the North Sea and the $CO_2$ infrastructure in coastal areas of the Netherlands, the UK and Norway can already be developed – indeed, the sites are looking for additional

[9] In 2017, 95 Mt of primary steel was produced in EU27.

$CO_2$ sources to justify their business model. As a first step, $CO_2$ from cement sites in coastal areas or close to navigable rivers can be transported by ship to the offshore storage sites in the North Sea. The development of a CCS infrastructure will also pave the way for negative emission technologies such as Bioenergy and CCS (BECCS). We estimate that cement plants that use more than 25% biomass in their fuel mix and sequester that biogenic $CO_2$ via CCS have negative emissions.

**Table 2: Overview of EU cement companies' planned CCS projects before 2030**

| Project, Site | Country | Company | Status | Timeline |
|---|---|---|---|---|
| ECRA-CCS project, various sites | EU | Various | Project in Phase IV to develop a demonstration plant | 2020–23: demonstration plant |
| Cement-CCS, Brevik | NO | Norcem/ Heidlelberg | Final investment decision has been made. | 2023–34: Commercial |
| Catch4climate, Mergelstetten | DE | Various | Plans to build large demonstration Oxyfuel-CCS cement plant (TRL 6-7) | 2021: construction to begin |
| LEILAC I, Lixhe | BE | Heidelberg | Pilot Plant in operation (low volumes) | 2019: Pilot plant operating |
| LEILAC II, Hamburg | DE | Heildelberg | Planned construction of demonstration plant | 2021: Demonstration plant |

Source: Agora Energiewende. 2021

### 3. "Development of a portfolio of large-scale demonstration projects for biomass to chemicals"

Fostering the resilience and biodiversity of Europe's forests, as well as their function as a carbon sink, requires sound sustainable forest management and the economically and environmentally efficient use of the harvested wood. As the same time, the transition of industries such as the chemical sector needs substitutes for fossil fuel-based production feedstocks. To explore the full potential of these different technological pathways, the EU must establish a sound program to support the technological development, piloting, and support for the development of large-scale demonstration plants before 2030. The guiding principle of the program must be to optimize the combination of sustainable forest management strategies with innovative value chains that use sustainable biomass for the production of high-value chemicals and materials with uses and strategies for final disposal that represent a climate-positive lifecycle effect.

### 4. "Critical recycling technologies are established for cement and chemicals", specifically: 2Mt HVC (5%) of chemical recycling, and 15% of end-of-life cement recycled into new cement applications"

#### Chemicals

The European petrochemical industry will be affected by a decrease of their feedstock supply from refineries when e-mobility picks up. Consequently, by 2030, some share of its feedstock should already come from alternative sources such as chemical recycling of waste plastics. By 2030, 5% of the EU production of high value chemicals (2 Mt HVC production) could feasibly come from chemical recycling

processes of plastic waste streams not suitable for mechanical recycling. To date, several pilot and demonstration plants for alternative petrochemical production routes exist across Europe, and the technology can be ready for deployment well before 2030 (see Table 3). However, the EU and member states will need to put in place the regulatory incentives and infrastructure to create supply and demand for chemical recycling. Moreover, given its higher environmental footprint, chemical recycling must complement rather than compete with high-value mechanical recycling. An enhanced 'waste hierarchy' approach from the EU is therefore essential.

**Table 3: Selected EU chemical recycling projects in the pipeline**

| Project, Site | Country | Company | Status | | Timeline |
|---|---|---|---|---|---|
| Cleaning of pyrolysis oil, Geleen | NL | Sabic | Semi-commercial plant for cleaning 15kt of pyrolysis oil/yr from chemical recycling | Waste plastics | 2021: start of production |
| Waste to chemicals, Rotterdam | NL | Airliquide, Shell, Nourvon, Enerkem | Production of methanol from residual waste; 220 kt of methanol production capacity per year | Residual waste | 2020: start of construction |
| ChemCycling, Various locations | DE | BASF, Reymondis | Production of pyrolysis oil from waste plastics in pilot plant | Waste plastics | 2019: pilot started |
| PYRECOL, Litvinov | CZ | Unipetrol | Chemical Recycling: construction of pilot pyrolytic unit to convert waste plastics (TRL 4-5). | Waste plastics | 2020: construction of pilot plant |
| Carbon4PUR project, Marseille Fos | FR | Covestro, ArcelorMittal, Recticel | CCU in long-lived products: pilot plant to convert smelting gases of steel production to polyurethane (TRL 4-5). | Waste gases | 2020: construction of pilot plant |
| Rheticus project, Marl | DE | Evonik, Siemens | Electrochemical process: Pilot plant with a capacity of 20,000 t per year for the conversion of waste gases to specialty chemicals (TRL 4-5). | Solar-driven electrochemical reduction | 2020: pilot plant started operation |
| Cracker of the Future, three-country cooperation | DE, BE, NL | BASF, Borealis, BP, Sabic,Total, Lyondell-Basell | Electrified steam cracker: Conducting research on operating electric steam crackers (TRL 1-3). | Electricity | Commercialization likely past 2030 |

Source: Agora Energiewende, 2021

## Cement recycling

End-of-life concrete (and embedded cement) waste constitutes an enormous potential resource for recycling of $CO_2$- and resource-intensive materials. Indeed, construction waste, which is mostly concrete, represents over one third of EU waste every year. Today, most concrete waste, if not put into landfill or illegally dumped, is recycled in low-value applications such as backfiller, e.g. for stabilizing road subsurfaces. In many cases, cement and concrete used in backfiller could be replaced by lower-value (and less $CO_2$-intensive) crushed rubble, freeing concrete and in particular unhydrated or recarbonated cement fines – the most $CO_2$-intensive part of concrete – to be recycled either into new construction grade cement as clinker substitute or re-used as cement substitute in recycled concrete. Moreover, innovative EU-based cement recycling projects[10] have now firmly established recycled concrete and cement

[10] Cf. For example, the RecyBéton project in France conducted between 2010 and 2019: https://www.infociments.fr/reduire-les-emissions-de-$CO_2$/le-projet-national-recybeton-livre-ses-recommandations-pour-le-recyclage-du-beton-dans-le-beton

fines can be reused either as aggregate or clinker substitutes without loss of mechanical resistance or durability to weathering. However, modifications to certain EU norms will be required to facilitate wider industrial application.

### 5. "50% industrial steam demand at up to 200°C supplied by power-to-heat technologies"

Given that an EU 2030 climate target of 55% will require an accelerated coal phase-out that, in turn, will significantly lower emissions from electricity, Power-to-Heat will become an attractive option across the EU. Moreover, constraints on the availability of clean hydrogen for industrial applications will make direct electrification essential as a parallel solution, especially for lower and medium-temperature heat. Technically speaking, electric solutions to providing low temperature steam, such as e-boilers and industrial heat pumps, can quickly be phased in over the next 5 to 10 years.

Where abundant low-carbon electricity is available from the grid, they can run all year at full load. However, in other cases where the grid is not fully decarbonized or where peak-load hours have high marginal $CO_2$ intensity, they can be run in parallel with existing natural gas boilers to arbitrage based on power costs and the strain on the grid – thus providing flexibility and demand response. Over time, however, these solutions can be expanded for increasing shares of load hours. However, adopting such solutions will likely require a combination of policy tools, including carbon pricing on non-ETS industrial energy use, regulatory incentives to adopt electrified solutions, and investment support to prioritize uptake in certain cases. Smart grid infrastructure and dynamic tariffs can be adopted for non-energy-intensive industrial consumers, allowing demand response measures to optimally curtail power consumption from the grid at relevant times.

**Agora Energiewende**
Anna-Louisa-Karsch-Strasse 2 | 10178 Berlin
P +49 (0) 30 700 14 35-000
F +49 (0) 30 700 14 35-129
www.agora-energiewende.de
mailto:info@agora-energiewende.de

Agora Energiewende is a joint initiative of the Mercator Foundation and the European Climate Foundation.