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Sustainability Impulses from Wuppertal

An Integrated Climate-Industrial Policy as the Core of the European Green Deal

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Background

The European Union (EU) has established that the goal of achieving climate neutrality by 2050 can function as a key driver of innovation and growth for industry and the economy in the EU.[1] In addition to offering great opportunities, this also poses considerable challenges for the European economy and, for the most part, for basic industries, which are particularly emission-intensive and face strong international competition.

An integrated climate and industry strategy is of central importance to protecting the climate, since the production of steel, cement, basic chemicals, glass, paper, and other materials in the EU and worldwide accounts for roughly one fifth of total greenhouse gas emissions. Even in a greenhouse gas-neutral future, we will not be able to fully eliminate our need for these materials. At the same time, it is particularly challenging to produce these materials without creating emissions given the state of technology and the necessary infrastructures. This applies above all to the question of how large amounts of green energy, including electricity and hydrogen, can be produced at competitive prices. Analyses show that despite the considerable costs involved in process changeover, the costs of transforming the raw materials industry are acceptable to society as a whole, given that the additional costs usually only increase the price of the end products by a few percentage points. However, in the case of crude steel or cement, the price would increase by between one third and 100 per cent. Since almost all raw materials manufacturers face strong global market competition, in most cases they are ***not able to bankroll the investments in climate-neutral production and the required energy infrastructure without outside support.***

In what follows, this In Brief outlines an integrated climate industrial policy package that allows the EU to utilise its existing technological leadership in many of these industries to build a greenhouse gas-neutral raw materials industry.

1. Climate-Neutral and Circular Raw Material Value Chains as a Core Element

When it comes to transforming basic industries, the central technological challenge is optimising both use of materials and energy. It is important to link **Material Cycle Management and extensive greenhouse gas reduction initiatives to each other**. By this ecological impacts of the production and recovery of basic materials and goods ("footprint") as well as of how we use goods (*"handprint"*) can be simultaneously minimised.[2]

In addition to further improving energy efficiency, a substantial reduction in the greenhouse gas emissions produced by basic industries can be achieved by pursuing three strategies[3]:

- **Increasing the efficiency of material and product use:** Firstly, increasing **dematerialisation of society**, such as through product design or the expansion of the sharing economy, and increasing the level of recycling of important materials, which allow for major energy savings to be achieved because secondary materials are used instead of primary materials. Secondary materials in the metal sector in particular often require massively less energy to be manufactured.
- **Emissions efficiency (1):** Secondly, the use of **direct and indirect sources of renewable electricity** can make a large contribution. Many of the technologies that are required for this, including in the field of high-temperature electricity applications (electric arc furnaces, microwaves, induction ovens, etc.), have barely been developed due to the high electricity prices compared to natural gas among other factors. Uses of indirect sources of renewable power are currently being discussed primarily in the steel industry. Companies are looking to replace the coke-based blast furnace process with hydrogen-powered direct reduced iron processes. A long-term goal is to produce hydrogen through electrolysis from green electricity.[4]
- **Emissions efficiency (2):** Thirdly, **CO_2 capture and use as well as storage** and sustainable biomass can make a contribution. The two methods mentioned above reach their limits. It is not possible to completely avoid greenhouse gas emissions in the cement industry in particular. In this area, however, it can make sense to separate and capture CO_2, process it, and store it or, for example, to integrate it into products and to use it. The amounts of CO_2 that can be captured are significantly lower than the volumes that have been mentioned in previous discussions of CO_2 capture from power plant greenhouse gas emissions. This should be of crucial importance to ensure the acceptance of the technology, especially if there are no other (technically feasible) options available for industries, such as the cement industry, in the short to medium term.[5]

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1 European Commission (eds.). (2019). A European Green Deal : Stirving to be the first climate-neutral continent. Retrieved from https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

2 See Chapter 17 in Schneidewind, U. (2018). Die Große Transformation : Eine Einführung in die Kunst gesellschaftlichen Wandels. S. Fischer Verlag, Frankfurt am Main

3 E.g.: AGORA Energiewende & Wuppertal Institut (2019): Klimaneutrale Industrie : Schlüsseltechnologien und Politikoptionen für Stahl, Chemie und Zement. Berlin. Fischedick, M., Roy, J., Abdel-Aziz, A., Acquaye, A., Allwood, J. M., Ceron, J.P., ... Tanaka, K. (2014). Industry. In IPCC, Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. Geneva. Material Economics (2019). Industrial Transformation 2050 : Pathways to Net-Zero Emissions from EU Heavy Industry.

4 Lechtenböhmer, S., Nilsson, L.J., Åhman, M. & Schneider, C. (2016). Decarbonising the energy intensive basic materials industry through electrification – implications for future EU electricity demand. Energy, 115, 1623 – 1631. doi: 10.1016/j.energy.2016.07.110

5 Lechtenböhmer, S., Schneider, C., Yetano Roche, M. & Höller, S. (2015). Re-Industrialisation and Low-Carbon Economy—Can They Go Together? Results from Stakeholder-Based Scenarios for Energy-Intensive Industries in the German State of North Rhine-Westphalia. Energies, 8, 11404 – 11429. doi: 10.3390/en81011404

2. Extensive Technology and Infrastructure Investments in the Right Areas

The overview of greenhouse gas reduction options shows that, in the long term, more than gradual changes must be made in the basic materials industries in order to achieve a substantial reduction in greenhouse gases. Due to the long life spans of industrial process technologies and correspondingly long reinvestment cycles, it is crucial to ensure that solutions are *"climate neutral"* from the start. This is imperative so that companies can avoid being left with *"stranded investments"*, invest in unsustainable technologies or delay necessary reinvestments in production capacities due to unanswered questions on whether climate-neutral raw materials can be marketed competitively. Such considerations may even prompt companies to make reinvestments in countries with a less stringent climate policy.

Achieving extensive greenhouse gas reductions in the basic materials industry is more than just a technical and economic challenge. Infrastructural,[6] political and institutional challenges must also be considered. This is especially true in view of the fact that required changes are sometimes *"radical"*, such as in the case of the switch to hydrogen-based steel production, which requires new plants and large amounts of hydrogen or upstream renewable electricity that are delivered at competitive prices. In addition, due to the special characteristics of the energy-intensive industries, implementation is a challenge for regional and industrial policy. Production plants in the basic materials industry are often very large, integrated into their locations, and long-lasting. That means that demonstration plants for new technologies often require investments in the tens or even hundreds of millions, all while still being technically and commercially immature.

In addition, almost all companies in the basic materials industry face immense global price competition. The additional costs of CO_2-free basic materials that are absorbed into the price of the end product can be borne by the consumer without major problems and are often negligible: they range from a few hundred euros for a car to a few cents for a shampoo bottle. Nevertheless, the basic materials manufacturers of steel or plastic compete on the basis of world market prices, which make it difficult to implement price increases that are justified by the need to reduce greenhouse gas emissions.

Many options that can make a major contribution to reducing greenhouse gases also require extensive systemic changes. This applies to associated infrastructure requirements, such as hydrogen pipelines, power lines, renewable energy generation capacities as well as measures that aim to reduce the use of materials and increase recycling. However, these changes cannot be implemented unless there is sufficient social acceptance of them. This applies, for example, to carbon capture and storage (*CCS*), but also to the further expansion of power lines and wind farms for the development of hydrogen pipelines or other new, large energy infrastructures. The example shows that the extensive greenhouse gas reduction in the basic materials industry also represents a prioritised social objective that goes far beyond the aspects of traditional forms of technology and investment promotion.

Precisely because of the longevity of industrial processes, early and clear policy decisions must be made and integrated into a consistent target vision to ensure the climate-friendly transformation of energy-intensive industries.

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[6] see e.g. project INFRA-NEEDS: https://wupperinst.org/en/p/wi/p/s/pd/818/

3. Combined Policy Strategies Across the Stages of the Value Chain

It is immediately clear that companies by themselves cannot overcome the presented challenges, which are associated with achieving a climate neutral basic materials industry. Broad-based support from society and the adoption of an active and integrated policy are required. In order to formulate the necessary measures (*see Figure 1*), we focus on the (circular) value chain of basic materials. Such a holistic approach determines **the five key aspects of an integrated climate and industrial policy**:

- **1.** It must **support the development of an energy supply infrastructure that utilises renewable energy in quantities that can satisfy the needs of the basic materials industry** with the goal of providing energy that is free of greenhouse gases at competitive prices and high levels of supply reliability. Compared to current policy, this approach requires a speeding up of renewable energy production as well as far more active support of the planning and construction of the relevant infrastructures. This applies to the further development of the electricity transport and distribution system and to the establishment of hydrogen infrastructures. Some of the suitable instruments can be found in the EU-defined "Integrated Projects of Common European Interest".

- **2.** To provide clear long-term economic incentives enabling climate-neutral investments by the energy and industry sector, the **European Emissions Trading System** needs to be improved. Therefore, we propose to establish a learning system which reflects, amongst others, the effects of the market stability reserve. A minimum CO_2 price may be part of such a solution. For basic industries competing on global markets however, this mechanism has to be combined with appropriate compensation measures, such as free allocation of greenhouse gas emission rights, as long as no functioning border tax adjustment is in place.

- **3.** With a view to introducing mechanisms to minimise carbon output in production itself, it is important **to effectively promote the development of new technologies and, even more importantly, to ensure that they make it to market**. This affects not only the implementation of step-by-step improvements, but also and especially of *"breakthrough"* innovations. Adequate measures, such as the establishment of *"green product markets"* that provide permanent incentives, must be taken to make the additional investments needed for pilot and demonstration plants as well as the market launch of products on a commercial scale affordable for investors. In addition to the adoption of a research and innovation policy, which should be even more strategically targeted (based on greenhouse gas emissions), such instruments as the innovation fund that is fed from the greenhouse gas emissions trading system at the EU level and project-related *"contracts for difference"* are examples of other conceivable measures that may be adopted (*see Figure 1*).

- **4.** At the same time, it is necessary **to create** corresponding **markets for greenhouse gas-neutral basic materials** (e.g., CO_2-free steel) **and products** in order to stimulate market dynamics in the industry sector. Quotas or standards for the proportion of *"green"* materials, for example in cars, packaging or (public) construction projects, could be suitable instruments for this. In addition, bonus systems, product-related taxes and public procurement help to create markets for basic materials produced in a greenhouse gas-neutral manner. The adoption of public procurement measures can act as an important lever, not least because public-sector infrastructure investments represent an important market for steel and cement. But industry itself can also play a major role in this area. Volkswagen's announcement that the company plans to manufacture zero emission vehicles in the future is an important step, which will have an impact on the extensive supply chains in many sectors of the entire supplier industry right through to the steel industry. Thanks to the company's significant market power, many other companies are encouraged to work actively on achieving greenhouse gas neutrality in their own production. A systematic comparison and a comprehensive discussion with the involved stakeholders must be conducted in order to identify which of the above-mentioned instruments is best suited for establishing green product markets.

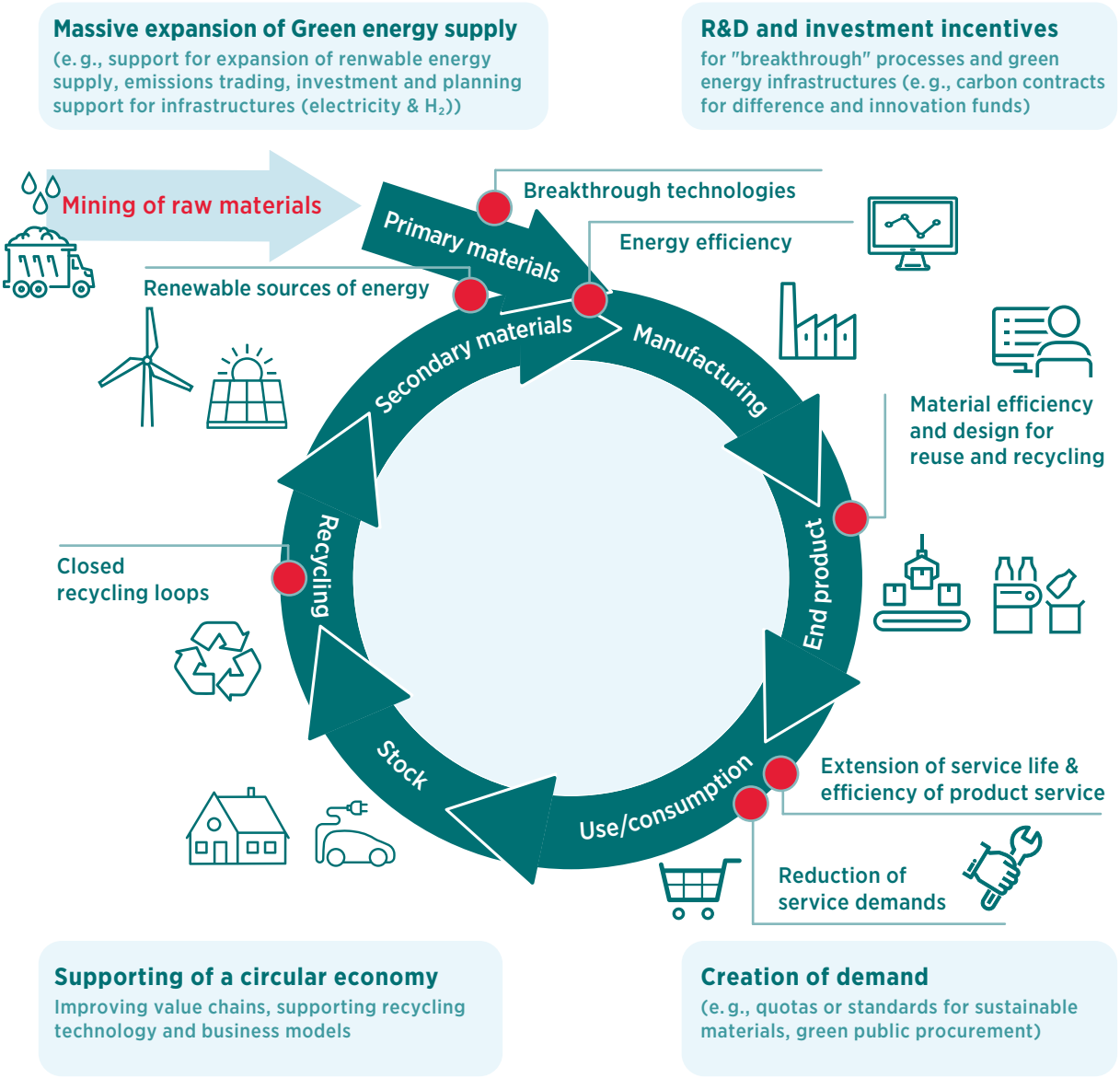

Figure 1: Creating Strategic Bundles of Instruments for Climate-Neutral Products Across Value Chains

Source: Wuppertal Institute

- **5.** Finally, in parallel to this, it is important **to develop innovative concepts and instruments** to promote the use of fewer materials and increased recycling of materials. In this area in particular, long-term changes in the value chains and corresponding new business models are conceivable, and these can contribute both to lower levels of environmental pollution and to the opening up of new economic potential and business opportunities for industry.

4. An Integrated Climate-Industrial Policy as a Central Component of the European Green Deal

In order to put together a corresponding **integrated and powerful policy package**, we need to develop a socially broad-based image of what a **sustainable industry** is, in which it is not perceived as part of the problem, but **as an important part of the solution**. This applies also, and especially, against the background that many products of the energy-intensive industry, such as thermal insulation and lightweight construction materials, can contribute elsewhere in the value chain to the achievement of energy savings and thus a reduction in the level of emissions.

For business actors, this means emphasising the social added value that they provide and how they can best use their skills to deal with key global problems. A policy should be adopted that can specifically support endeavours to ensure that industrial companies are credibly focused on providing added social value, where such an orientation should not have to be at the expense of business success. Initiatives such as *IN4climate.NRW* [7], which are supported by the state government, industries, and research institutes of North Rhine-Westphalia, are clear examples of such a policy. What is needed is to ensure that companies are much more transparent to social actors, ranging from trade unions to consumers and environmental associations.[8] Because only if it succeeds developing a broad-based social narrative will industry be able to transform its production to a greenhouse gas-neutral basis and become an exporter of solutions.

The last point in particular refers to the great economic opportunities that such a fundamental change in the self-image as well as in the production processes and value chains of industry may produce. Ultimately, all countries worldwide face similar challenges, and they have no choice but to address them. The rapid expansion of electric vehicles in China is an example of this: The People's Republic has long recognised that the future lies in green products and more sustainable production. According to analyses, if this trend continues, there is much evidence to suggest that the central transformation processes in the future will be shaped primarily by Chinese or American technology, which is a change from what has been true in the past.[9]

Given these factors, the European Green Deal initiated by the EU is extremely important. If the integrated climate-industrial policy outlined in this In Brief can be implemented as a central component of the Green Deal, the **EU will have the chance to maintain its leading role in the area of clean and climate-friendly technologies and can thus make a central contribution to** both the initiative to protect the world's climate and resources as well as to boosting the competitiveness of their industry and thus securing prosperity and employment opportunities in their industrial regions. The year 2020 offers the (perhaps last) great opportunity to achieve this goal. With the development of a European industrial strategy in the context of the Green Deal and the discussion to increase climate protection goals at the EU level, the long-term course will be set in 2020. The EU's Multiannual Financial Framework allows for the achievement of important framework conditions and criteria for the design of the future European funding regime, and it thus lays the basis for the making of investment decisions, such as in infrastructures and projects that are of strategic importance for Europe.

5. Conclusion

Despite the recently growing awareness that industrial policy needs to gain a more strategic orientation, existing approaches and considerations still come up short and overlook the need for more integration between industrial and climate policy. However, they also misjudge the opportunities that are associated with this. **After all, climate change is the central driver of innovation for European industry** apart from digitalisation. **Therefore, it presents not only a central challenge, but above all an opportunity.**

The integrated climate industrial policy package presented here can enable the EU to leverage its existing technological leadership in many of these industries in a targeted manner and build up a greenhouse gas-neutral basic materials industry. This package should become a key element in the implementation of the European Green Deal. Thanks to the continuing development of sustainable and resource-conserving value chains, the EU will not only be able to make a significant contribution to achieving greenhouse gas neutrality and remaining competitive, but it will be able to unlock opportunities to successfully establish itself in the growing global climate protection markets. It also creates starting points to make the transformation process fair at the regional level.

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7 Initiative IN4climate.NRW: www.in4climate.nrw

8 Corresponding concepts have been discussed under the keyword Business Sustainability 3.0. See Schneidewind, U. (2018). Die Große Transformation: Eine Einführung in die Kunst gesellschaftlichen Wandels. S. Fischer Verlag, Frankfurt am Main

9 Goldthau, A., Westphal, K., Bazilian, M. & Bradshaw, M. (2019). How the energy transition will reshape geopolitics. Nature, 569, 29 – 31

Therefore, this In Brief proposes the following **four key points**:

- **Climate-neutral and circular raw material value chains** as a core element
- **Coherent political direction** for major technology and infrastructure investments
- **Combined policy strategies** across the stages of the value chain
- **An integrated climate-industrial policy** as a central component of the European Green Deal

Further references from the Wuppertal Institute

Industrial transformation is a key topic at the Wuppertal Institute. Here are some selected projects on the topic:

- *CCIRIT – Operation of the Secretariat of the Platform for Coal and Carbon-intensive Regions in Transition*
- *INFRA-NEEDS – Infrastructure Needs of an EU Industrial Transformation towards Deep Decarbonisation*
- *SCI4climate.NRW Scientific Competence in Industry*
- *KoVI SGW Competence Centre Virtual Institute Power to Gas and Heat*
- *InComp2030 Industrial Competitiveness in Times of Climate Change – How the Transformation to a Low-Emission Economy can Succeed*
- *Re-Industrialise: Supporting the Transition of High-Emitting Regions to Low-Carbon Innovation Hotspots*
- *FlexTherm Thermal Flexibility of Aluminum Electrolysis*
- *Low-Carbon Infrastructure NRW – Deep Decarbonisation of Energy-Intensive Industries*
- *PoR Transport – Possible Future Developments in the European Transport Sector and their Implications for Transport and Business Activities in the Port of Rotterdam Area until 2050*
- *Drivers of Industrial Innovations to Promote Low-Carbon and Energy Transition Goals*
- *REINVENT – Realising Innovation in Transition for Decarbonisation*
- *Implementing the German Energy Transition in the Field of Sustainable and Competitive Economic and Industrial Structures in North-Rhine Westphalia*
- *Potentials of Regional Industrial Innovations to Promote Low-Carbon and Energy Transition Goals*
- *Decarbonization Pathways for the Port of Rotterdam Region*

Selected Publications on this Subject

- *Schneider, C., Lechtenböhmer, S. & Samadi, S. (2019). Risks and opportunities associated with decarbonising Rotterdam's industrial cluster. Environmental Innovation and Societal Transitions. doi: 10.1016/j.eist.2019.05.004*
- *Bataille, C., Åhman C., Neuhoff, K., Nilsson, L.J., Fischedick, M., Lechtenböhmer, S., Solano-Rodriquez, B., … Rahbar, S. (2018). A review of technology and policy deep decarbonization pathway options for making energy-intensive industry production consistent with the Paris Agreement. Journal of Cleaner Production, 187, 960 – 973. doi: 10.1016/j.jclepro.2018.03.107*
- *Wesseling, J.H., Lechtenböhmer, S., Åhman, M., Nilsson, L.J., Worrell, E. & Coenen, L. (2017). The transition of energy intensive processing industries towards deep decarbonization : Characteristics and implications for future research. Renewable and Sustainable Energy Reviews, 79, 1303–1313. doi: 10.1016/j.rser.2017.05.156*
- *Lechtenböhmer S., Nilsson L.J., Åhman, M. & Schneider, C. (2016). Decarbonising the energy intensive basic materials industry through electrification: Implications for future EU electricity demand. Energy. doi: 10.1016/j.energy.2016.07.110*
- *Wesseling, J., Lechtenböhmer, S., Åhman, M., Nilsson, L. J., Worell, E., & Coenen, L. (2016). How to decarbonise energy-intensive processing industries? Survey and conceptualisation of their specific innovation systems. In Proceedings from ECEEE Industrial Efficiency; (pp. 1–16). [Paper ID# 4-088-16] ECEEE.*
- *Lechtenböhmer, S., Nilsson, L.J., Åhman, M. & Schneider, C. (2015). Decarbonising the energy intensive basic materials industry through electrification – implications for future EU electricity demand. In Proceedings of the 10th Conference on Sustainable Development of Energy, Water and Environment Systems, SDEWES2015.0694; 27 September – 02 October 2015, Dubrovnik, Croatia; (pp. 1–16).*

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