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Germany's Industriestandort at a Crossroads

Policy Brief
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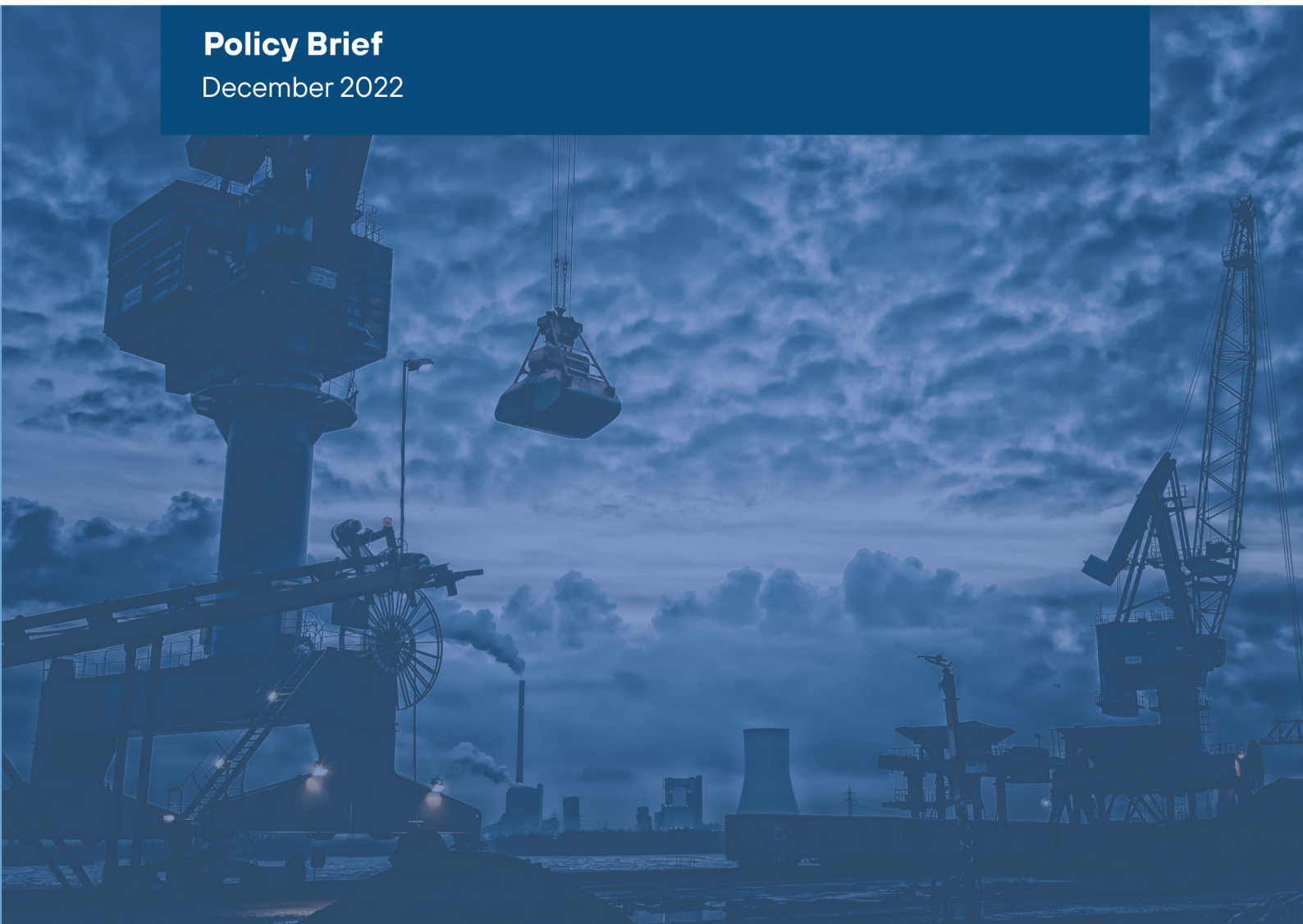

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GERMANY'S INDUSTRIESTANDORT AT A CROSSROADS – THE STRATEGIC AND ECONOMIC CASE FOR INDUSTRIAL CCS

Germany's industrial sector generates about a quarter of the country's GDP and is responsible for about a fifth of Germany's greenhouse gas emissions. The three largest industrial emitters alone – the chemical, steel and cement industries – emit about 100 million tons of CO_2[1]: as much as the entire lignite-fired power generation in Germany.[2] Emissions from each of these sectors come from both their high energy use and processes. At the same time, these three industries employ more than half a million people directly and generate a turnover of almost 450 million Euros. Millions of indirect jobs exist along the value chain that these industries supply, of which 3 million alone are steel-intensive.[3] **Ensuring these industries have the tools available to decarbonise is therefore not just critical for the climate, but also critical for society and the economy.**

CLIMATE ACTION IN INDUSTRY HAS FINALLY MADE IT ON THE AGENDA

Pioneering decarbonisation projects, together with national support frameworks both in Europe and abroad, are clear signals of accelerating climate action within heavy industry. Growing CO_2 price pressures, also through the added floor pricing mechanisms to the ETS in several EU countries, including Germany, are providing additional incentives. However, framework conditions differ significantly between countries and yet are critical for the commercialisation and security of a project. The recent US Inflation Reduction Act (IRA) has been widely recognised as a generous incentives package that will spur industry investments into green projects, and with it, also potentially away from Europe. Thus, Europe and Germany's response to the IRA bill needs to provide a clear incentive for investments within the EU, with careful diplomatic manoeuvring. This is particularly important given the energy and gas crisis due to the Russian invasion of Ukraine that is putting additional pressure on industry and their plans to decarbonise.

For Germany in particular, these challenges are severe. Access to resources, such as coal and iron ore, had been the drivers of the industrial revolution two centuries ago. Today, the drivers of the green industrial

1 https://langfristszenarien.de/enertile-explorer-wAssets/docs/LFSIII_Webinar16.11.2022_Industrie_final.pdf

2 https://static.agora-energiewende.de/fileadmin/Projekte/2021/2021_11_DE-JAW2021/A-EW_247_Energiewende-Deutschland-Stand-2021_WEB.pdf

3 https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Industrie-Verarbeitendes-Gewerbe/Tabellen/kennzahlen-verarbeitendes-gewerbe.html

transformation are access to technologies, infrastructures, and the provision of the new climate resources and feedstocks, particularly renewable electricity, CO_2 storage and hydrogen. However, Germany is rather poorly endowed with renewable energy compared to expected needs of the world's fourth largest industrial nation.[4] A fact further aggravated by the consequences of a sluggish *Energiewende.* With the falling away of the much-relied on natural gas bridge as a cost-effective, somewhat less carbon intensive alternative energy source to coal, the challenge for an electricity and renewable hydrogen-based decarbonisation pathway has been exacerbated. Because of a very slow grappling with CO_2 infrastructures and Carbon Capture and Storage (CCS) as a critical decarbonisation tool for industry, **the competitive advantage of the German** *Industriestandort* **is no longer guaranteed.**

THE NEED FOR QUICK ACTION

To ensure that Germany can reach its climate targets and retain its domestic industry base by becoming a pioneer for the future carbon neutral industrial processes and products, policy makers must act quickly. Greenhouse gas emissions from industry in Germany have effectively stagnated over the past decade (see Figure 1). Based on the German Climate Law (2021), the industry sector needs to cut about 35% of current emissions within the next seven years and reach effective neutrality in slightly more than two decades. The challenge to do so lies in the emissions sources.

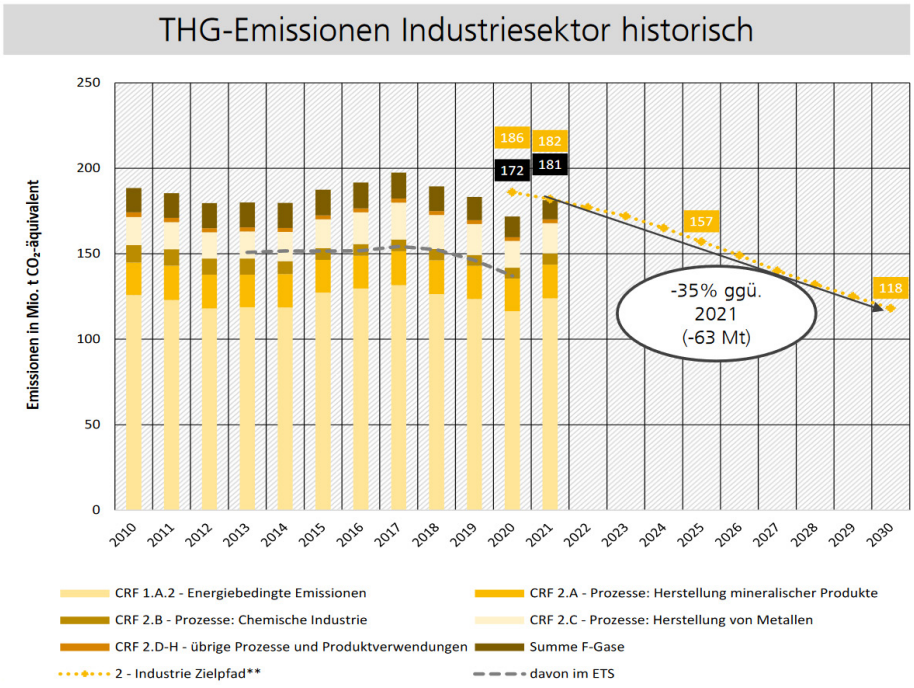

Figure 1 Historic GHG Emissions German Industry & 2030 reduction targets, Source: https://langfristszenarien.de/enertile-explorer-wAssets/docs/LFSIII_Webinar16.11.2022_Industrie_final.pdf

There are effectively four major applications across the steel, cement, chemical and other industries that generate emissions.

4 https://www.ffe.de/veroeffentlichungen/info-electrification-vs-vres-potentials-in-europe-is-the-potential-for-variable-renewable-energy-sources-sufficient-to-cover-post-electrification-electricity-demand/

1. High temperature ovens requiring high energy density fuels, predominantly coal based.
2. Steam generation processes, largely natural gas based.
3. Process emissions that occur as part of chemical reactions.
4. Processes that rely on carbon as feedstock, particularly in the chemical industry.

About one-third of the current approximatively 180 $MtCO_2$ equivalent of German industrial emissions are from feedstocks. The remaining two-thirds are energy related, a significant amount of which in high temperature heat that cannot be directly electrified with available technologies.

CCS HAS A KEY ROLE TO PLAY IN ACHIEVING DECARBONISATION

There are several reasons for the strategic importance of the deployment of CCS and its associated CO_2 infrastructures in Germany as part of a robust decarbonisation strategy for industry, climate action and society

1. *CCS AS A CRITICAL DECARBONISATION TOOL FOR PROCESS EMISSIONS*

A significant amount of CO_2 in the process industry is emitted as part of chemical reactions of feedstocks. These so-called process emissions would either require a complete transformation of the chemical reaction, for example substituting coal with hydrogen in steel, or are considered "unavoidable", as in cement, lime and waste incineration. The notion of "unavoidable" is however deceptive. It solely relates to the inherent generation of CO_2 from the process. Through the application of carbon capture, such CO_2 can be prevented from reaching the atmosphere. The emission of CO_2 is therefore indeed avoidable also from these industries – and it is a relevant application for CCS. While it can be expected that the amount of production output from the cement, lime and waste incineration sectors will be reduced through material efficiency and sufficiency gains, a full disappearance of these industries, and therefore their emissions, is neither likely nor desirable.

2. *CCS AS A BRIDGE & INNOVATION DRIVER*

A successful transformation of industry hinges on:

a. Commercial viability - climate action in industry is generally considered expensive. Many existing plants cannot be retrofitted with new technologies, instead requiring a complete rebuilding of the plant, increasing significantly both capital expenditures and barriers for the final investment decision. Moreover, these new plants need to be serviced by a new infrastructural network, which will need to steadily supply new feedstocks and energy sources. The lack of infrastructure availability reduces benefits of pre-existing industrial sites. Crucially, these new feedstocks and energy sources need to enable a competitive business case for operations. These joint factors may in fact lead to a relocation of industrial sites to ensure the requirements for future business cases are met.
b. Scale - both new inputs into industrial processes and their ability to mitigate CO_2 need to be at sufficient scale. Questions over security of supply, for example of renewable hydrogen, remain critical obstacles preventing investment decisions today. At the same time, technologies need to prove that they can reduce emissions. The feasibility of some pathways to effectively contribute to climate action

is restricted by low technology readiness of many potentially transformative processes on the one hand. On the other hand, scope 2 and scope 3 emissions may not be abated, for instance with carbon intense electricity generation or waste management.

c. Pace - scaling is particularly important, given the limited timeframe for action to reach net-zero emissions. Pace is therefore the third key factor. The ambition level for reducing emissions has been growing steeper, while in many cases emissions have stagnated or even grown – at least on a global scale. Increased pressures therefore have a clear temporal impact, making it critical to reduce CO_2 emissions at a massive scale, as fast as possible, across the system.

Given the limitations in readiness of technologies, availability of feedstocks as well as dependence on other parts of the system to be decarbonised, achieving scale within the needed timeframe is the fundamental challenge of the industrial transformation. Particularly, those industries that rely on renewable electricity and its derivatives for their transition are facing uncertainty over availability and price, as well as stiff competition. The result of this is the current reluctance of moving from planning projects to implementing them.

CCS' ability to be retrofitted to existing installations, and approximate carbon neutrality, makes it a comparatively affordable technology and a potential bridge for industries not already reliant on it.[5] The provision of CCS as a decarbonisation tool for industry enables emitters to deeply decarbonise, allowing for stricter sector targets rather than settling for partial emission reductions. As such the choice is no longer between inaction, another fossil fuel bridge or mitigation, but between different paths of mitigation. Given the not insignificant investment needs also for carbon capture installations, CCS may indeed act as an innovator for investments and activity in other pathways. When the choice is between business as usual and inaction, one company's indecision may lead to another not acting either, creating a stalemate of excuses. Through ensuring at least one decarbonisation pathway is available while others are being developed, the choice becomes one of different pathways of action, where one company's choice may drive another to push for a different path. Rather than the perfect being the enemy of the good, here the good becomes the driver of the perfect.

3. *CCS AS A GROUND BREAKER FOR CIRCULARITY AND NEGATIVE EMISSIONS*

The development of a CO_2 infrastructure is not merely a necessity for ensuring CO_2 mitigation in industrial sites today. It also paves the way for the utilisation of CO_2 (CCU) as an alternative resource path for those industries requiring carbon for their product chains, for example in the chemical industry. CCU is first and foremost an alternative resource path for a time of reduced fossil carbon sources. Being part of a net-zero economy, however, requires the tackling of scope 2 and 3 emissions. As an energy intensive process, CCU at scale will rely on a full decarbonisation of the electricity supply to be sustainable. Since much of the used CO_2 is embodied in the product, and therefore released upon use or end-of-life, ensuring a closed loop is essential; either in form of atmospheric CO_2 being used initially, or by capturing CO_2 at the final emission point. Global trade and product tracing are particular challenges for the latter. As such, CCU is unlikely to play a significant role in the near future, yet the provision of CO_2 infrastructures and advances in CO_2 capture technologies will benefit its roll-out by the middle of this century.

Equally, CCS is laying the foundation for technical negative emissions that are an important component of reaching climate targets. Removing carbon dioxide from the atmosphere through direct air capture (DAC) or

5 https://web-assets.bcg.com/f2/de/1fd134914bfaa34c51e07718709b/klimapfade2-gesamtstudie-vorabversion-de.pdf

targeted use of sustainable biomass in industrial processes fitted with carbon capture (such as cement) is key to achieving net-removal of CO_2 and beginning the reversing of damage caused by anthropogenic climate change.

4. *CCS AS A FAILSAFE*

The provision of CO_2 infrastructure and therefore access to CCS as a general decarbonisation option delivers a crucial component to the wider net-zero transformation: optionality. Current scenarios and industrial roadmaps are heavily relying on the availability of renewable electricity and renewable hydrogen, either produced locally or as imports. While this might be a more sustainable pathway overall, its requirements and challenges can become inhibitors of immediate action. Question marks remain on the pace of domestic grid decarbonisation, the meeting of needs of direct electrification in sectors such as heat and mobility, as well as the development of a global hydrogen economy in a just and democratic way that still delivers hydrogen at a competitive cost for industrial applications in Germany. As climate action is a global endeavour, the ability to generate negative emissions as part of Germany's net-zero and possibly net-negative economy can become essential to prevent the worst consequences of climate change.

The current energy crisis has shown that the diversification of options can become an important security factor, also for reaching climate targets to ensure we have the tools available to achieve net-zero as soon as possible in Germany and Europe.

GERMAN INDUSTRY AND CCS POLICY OUTLOOK AT THE END OF 2022

Fortunately, after one year in power, the new German government has already made some key steps toward breaking through the inaction on industrial decarbonisation of previous years. While the announced "Rapid Climate Protection Programme" *(Klimaschutzsofortprogramm)* has become something of an "Eventual Climate Protection Programme" in the wake of the war in Ukraine and internal coalition disagreement, this delay breeds opportunity for more careful planning and policy design. Its postponed summer package of 2022 is now expected to come in smaller parcels in 2023, starting with a system of Carbon Contracts for Difference (CCfDs) for industry as early as January 2023. This will cover the use of hydrogen and application of carbon capture.

CCS' return to the political agenda has been enabled by the coalition agreement's commitment to deliver "technical negative emissions" and the announced strategy development to address about 5% residual emissions of the economy. This opening, together with similar endeavours kicking off in Norway, the Netherlands, and Denmark, led to private sector plans on the provision of a CO_2 infrastructure connecting Germany's industrial clusters with CO_2 hubs on the coast for shipping and storage in the North Sea. When seen on paper, this map differs little from Bellona's sketched one on an internationally shared CO_2 network from 2018 - which indeed appears to have been the blueprint for current strategic developments of CCS around the North Sea. As such, CCS has begun to embody the clear message that climate action is about collaboration and shared measures, rather than national *Alleingänge* (solo efforts).

Yet in 2022, these initiatives were not accompanied by strong government coordination and regulation; crucial aspects to ensure the deployment of CCS fulfils its previously outlined role and potentials. Government leadership will be particularly essential around the provision of a CO_2 infrastructure in a systemically planned,

and open access, modular approach, possibly under government ownership models. Regulatory frameworks to target the application of CCS, such as selective financial support instruments or capacity limitations as seen in the Netherlands are additional important components to utilise CCS as an innovator. Further technical obstacles and the need for consequent policy for the deployment of CCS and CCU in Germany were identified earlier this year through an analysis by BBH, commissioned by Bellona Deutschland. Critically, these obstacles include permitting processes of installations, lacking funding instruments and international adjustment of modular transport modalities as part of the ETS, as well as the ratification of Art. 6 of the London Protocol to allow the shared use of offshore CO_2 storage locations with European partners.

But more fundamental regulatory guidance and framing will be needed as well. This has become all the clearer particularly in the growing conversations that are blurring the line between CCS as a mitigation tool in industry, and its ability to deliver negative emissions – the initial hook in the coalition agreement. As shown in another Bellona-commissioned BBH analysis, a separation of CCS from Carbon Dioxide Removals (CDR) – both in terms of separate target setting and financing – needs to be part of the German Climate Law. This is to ensure mitigation is not impeded by the deployment of CO_2 removals. A crucial aspect also for the targeted application of CCS and other innovations for mitigation purposes.

The basis for future government position is the current evaluation of the German CO_2 Storage Law (*Kohlendioxid-Speicherungsgesetz*, KSpG), expected to be published in December 2022 and to lay out the rapprochement plan by the German government with CCS. A key role has been assigned to the announced Carbon Management Strategy. Crucially, its development in the first half of 2023 will involve a broad stakeholder dialogue – something that Bellona Deutschland has repeatedly pushed for and is looking forward to being a part of. Such a dialogue will be essential to both develop a shared understanding of the role of CCS, CCU, and CDR across different political and private actors, and bring some much-needed clarification on the application and regulation of each of these technologies.

To support this process, Bellona Deutschland has initiated a CCS Forum to complement and accelerate these processes and to ensure a resulting constructive, actionable approach to the rapid provision of CO_2 infrastructures for the implementation of CCS at scale in industry.

MOVING CCS FROM PROJECT TO IMPLEMENTATION

CCS stands out as a crucial climate technology to ensure a future for the German industrial base. By providing Germany with a tool that is deployable without needing massive renewable resource that are scarce on the German territory, CCS represents an option to complement other existing decarbonisation pathways. Moreover, because of its possibility to be installed on existing plants, CCS can often be deployed at a lower capital investment and faster pace than competing decarbonisation technologies. However, for CCS to be deployed at scale an enabling regulatory framework needs to be provided. The steps taken by the current German government are finally indicating a will to move in the right direction. Bellona is focusing on capitalising on and accelerating this momentum in order to move from project to implementation.

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Bellona Europa is an independent, non-profit organisation that meets environmental and climate challenges head-on. We are result-oriented and have a comprehensive and cross-sectoral approach to assess the economics, climate impacts and technical feasibility of necessary climate solutions. To do this, we work with civil society, academia, governments and polluting industries.