Germany's net zero ambitions

After over a decade of steady growth, German construction demand has been dampened due to rising interest rates and high inflation. Despite the challenging conditions, the cement sector is focussing on CO_2 reduction, including the first steps towards carbon capture and storage as one of the major levers to achieving net zero emissions by 2045.

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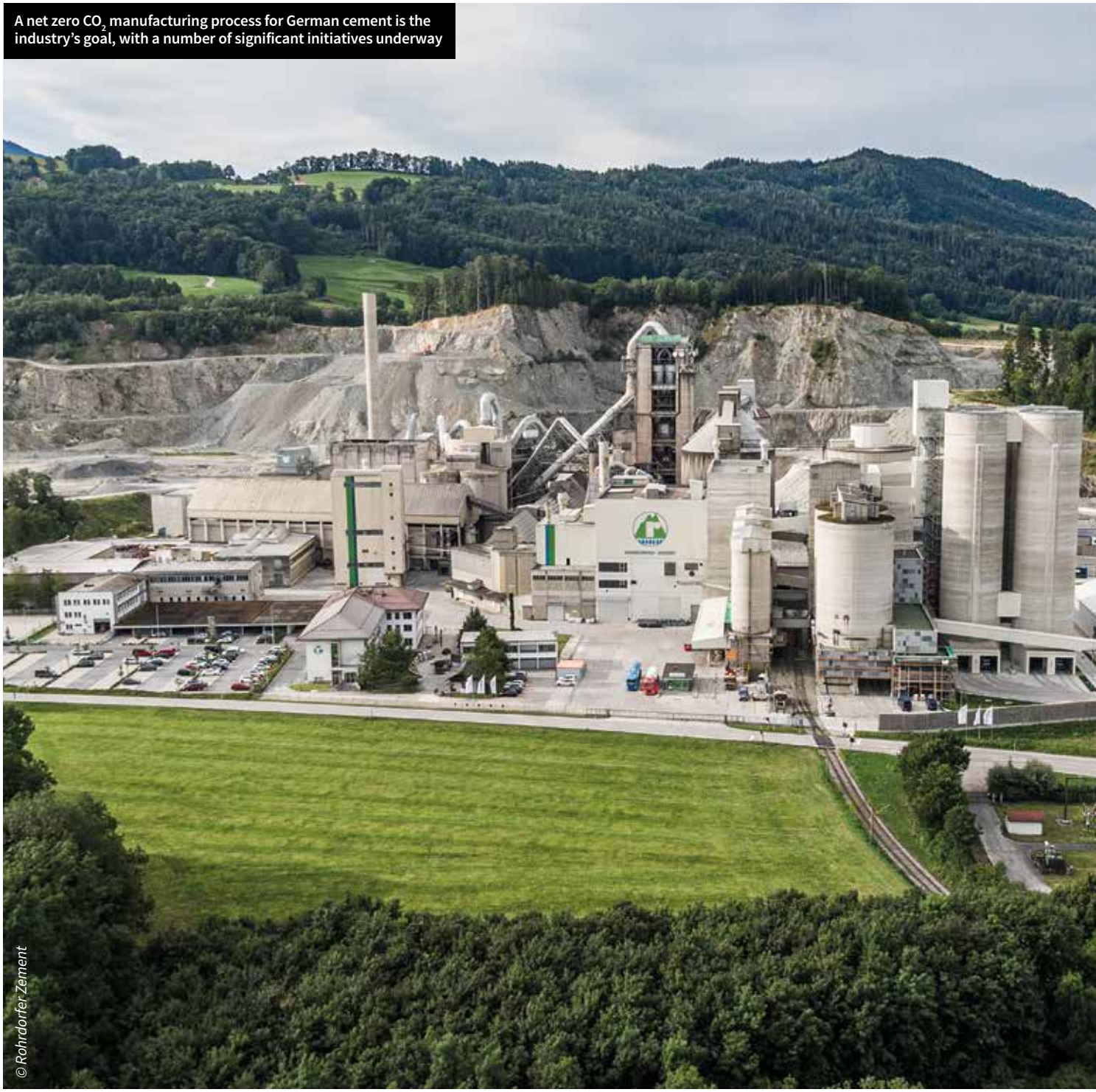

A net zero CO_2 manufacturing process for German cement is the industry's goal, with a number of significant initiatives underway

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With 21 companies, the German cement industry is represented by a mix of medium-sized, often family-owned enterprises as well as large international groups. Altogether, they operate 53 cement plants, of which 33 are integrated. With around 8000 employees and using 49Mt of raw materials, the industry produced 32.9Mt and 23.2Mt of cement and clinker, respectively, in 2022. In doing so, it generated a revenue of around EUR3.4bn (see Table 1).

During 2022 cement consumption in Germany amounted to approximately 28Mt, ie, four per cent less than 2021. While the first two months of 2022 were driven by strong construction activity and favourable weather conditions, the remainder of the year was characterised by a negative demand trend. The key factor behind this development was the war in Ukraine, with tangible impacts in Europe and Germany. As with many other countries, the conflict resulted in the disruption to many supply chains, not only due to the physical destruction through the war itself, but also in the face of sanctions imposed on Russia by the EU. A survey conducted by the Association of the German Construction Industry (HDB) of its members in May 2022 revealed that almost 80 per cent of them were affected by supply bottlenecks. These mainly concerned diesel and steel, but also bitumen and asphalt, cement and concrete, timber, insulation material and sheet pilings. In addition, many construction companies highlighted rising building materials and transport prices, mainly due to enormously increased energy costs (see Figure 1). As the cost development in the energy markets was also very volatile, numerous building material suppliers were no longer able to give price assurances and could only submit offers on the basis of daily updated prices. To prevent construction companies from having to shoulder the additional costs alone within the framework of existing contracts but also new projects, Germany's federal government passed a decree that provided for the adaptation of material prices in public projects. Therefore, for selected building materials, the price dynamics could – under certain conditions – be passed on to the building owner on the basis of official indicators. In addition to material bottlenecks and price trends, a lack of labour from war-affected regions has also hampered construction activity.

A breakdown of German cement consumption shows that residential activity accounts for one-third and civil engineering represents another third. While the amount of residential building completions in 2022 was positive, the opposite was the case for non-residential buildings. Civil engineering had a slight positive impact, mostly due to improvements to railroad infrastructure which are required to meet Germany's political target of a net zero CO_2 economy by 2045.

The German cement market is experiencing challenging conditions that especially affects the construction of residential buildings

The domestic cement secotor has already started heading towards net zero CO_2 production, investing ~EUR700m in equipment over the 2019-21 period

A key priority going forward is a strategy for carbon management

Lead construction indicators for 2023 and 2024

How will German cement demand evolve in the coming years following the annual downturns after 2020? The following highlights the most important lead indicators for national construction activity and cement consumption both this year and next year.

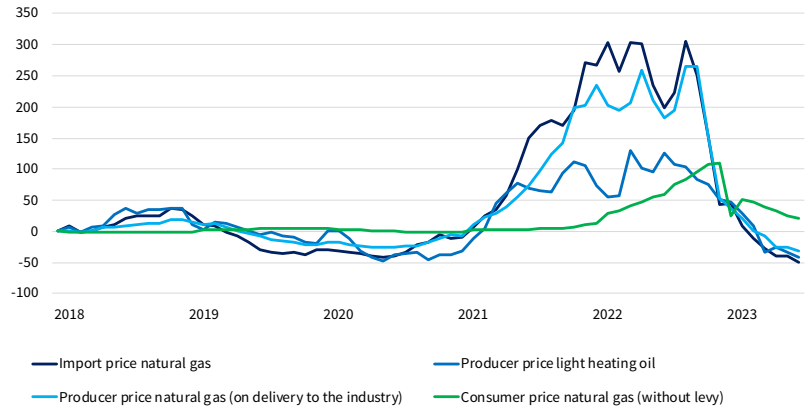
Since 2015 German cement consumption has increased, especially for housing. Many builders were able to finance new construction projects mainly because of low interest rates, which at times were below one per cent per year.

Table 1: German cement industry in figures

	2020	2021	2022
Employees	7904	7924	7973
Turnover (EURbn)	3.05	3.05	3.43
Cement consumption (Mt)	30.1	29.2	28.0
Cement production (Mt)	35.5	35.0	32.9
Clinker production (Mt)	24.7	25.2	23.2
Raw material input (Mt)	51.0	52.9	49.0
CO_2 emissions (Mt)	20.1	20.5	18.8

Sources: VDZ, Federal Statistical Office Germany (Destatis), German Emissions Trading Authority (DEHSt)

Figure 1: development of energy prices in Germany



Source: Federal Statistical Office

However, over the course of the past year the general conditions have changed significantly. Interest rates have risen to an average of almost four per cent within a short period of time and the credit volume has collapsed significantly (see Figure 2). Added to this is an inflation rate of almost eight per cent in 2022, driven by high energy and food prices, which in particular has burdened private households and lead to a high level of economic uncertainty. Today, inflation in Germany is still at a high level of around six per cent (as of July 2023).

Areas of focus

Despite the current challenges for the cement and concrete value chain, the need for construction in Germany remains at a high level. The federal government has three particular areas of focus.

Firstly, the restructuring of energy infrastructure, which has gained additional importance over the past year. For example, legal conditions have been created to accelerate the expansion of wind power and the construction of liquefied natural gas terminals, including the corresponding infrastructure. The decarbonisation of industry also requires infrastructure for electricity, hydrogen and CO_2.

Equally, more attention is being paid to the expansion of transport infrastructure, especially in the area of the rail network. Another focus is the modernisation of bridges. While currently less than 200 bridges are modernised per year, this number is targeted to grow to 400 by 2026.

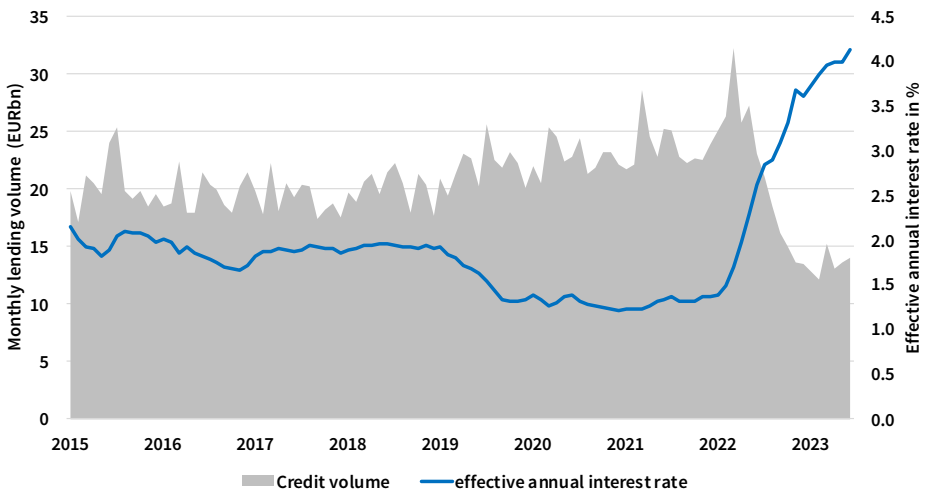
Finally, housing construction remains of particular importance. There is still a lack of affordable housing, particularly in urban areas.

For the German cement market, this multitude of measures should result in new demand impulses in the medium-term. However, in the short-term, cement demand is likely to decline significantly in 2023. A recovery is not expected in 2024 either, against a background of high inflation and the European Central Bank's recent increase in its key interest rate by a further 0.25 percentage points to 4.25 per cent, which will initially further inhibit construction investments.

The road to a carbon neutral cement production

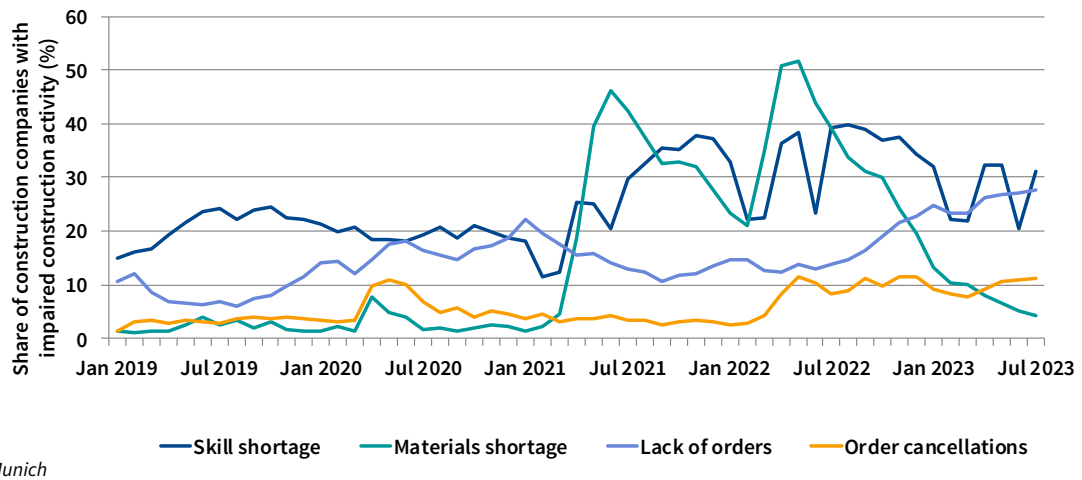
Despite the challenging market conditions, the German cement industry is focussing on CO_2 reduction projects. A net zero CO_2 manufacturing process for cement is the industry's goal, which is to be implemented by 2045 at the latest. In its roadmap published in 2020, VDZ has shown how this can be achieved in concrete terms.[1] The study describes various levers for reducing CO_2 emissions and quantifies their contribution in a climate neutrality scenario. In this scenario, the cement industry already reduces its CO_2 emissions by around 27 per cent by 2030 compared to 2020. In addition to a further increase

Figure 2: housing loans and credit volume in Germany



Source: German Federal Bank

Figure 3: what hinders companies in Germany's construction industry?



Source: ifo Munich

in energy efficiency and alternative fuels usage (especially through the increased use of biomass and green hydrogen), the use of CEM II/C and CEM VI cements is an important building block on the way to a cement portfolio with lower clinker-cement factors.

In addition to partly new CO_2-efficient raw materials for clinker and cement production (eg, calcined clays and crushed concrete sand or recycling powder) and innovations in concrete production and construction, efforts towards complete decarbonisation of the sector will also be based on carbon capture and subsequent utilisation and storage (CCUS). The first pilot projects in Germany are already underway, such as catch4climate in Mergelstetten, LEILAC 2 in Hanover, the Carbon2Business in Lägerdorf, and GeZero in Geseke, among other initiatives.

A strategy for carbon management

VDZ expects that in 2045 the cement industry in Germany will need to capture more than 10Mt of CO_2 to reach the net zero target. Further amounts of greenhouse gases to be captured will come from thermal waste treatment plants and the lime industry, which in total amount to more than 40Mt. To use or store the CO_2 a respective transport infrastructure is required (see Figure 4). In the long-term, there will be no way around transporting CO_2 by pipeline. However, trains and, to some extent, ships also offer possibilities with little effort compared to pipelines. There are indications that significant rail capacities will be available in Germany as early as 2025. This seems ambitious in view of the infrastructure backlogs in the German railway sector, but the pure transport volumes, also in comparison to other bulk goods, appear manageable.

The challenges are undoubtedly at the transfer points: the filling or emptying of the wagons still takes too long, so new procedures are being worked on intensively in this regard. This is also true of uniform standards for couplings and connections through which wagons are loaded and unloaded. Using rail or ship, the CO_2 needs to be cooled and can be transported at a comparatively moderate pressure of 15bar. This operating point, at which the CO_2 as a gas and as a liquid are in equilibrium, is a compromise in terms of the transport volume and structure of the tanks. In comparison, in pipelines a much higher pressure (160bar) can be set and it is possible to work at ambient temperatures. Therefore, the CO_2 can be transported in significantly higher quantities.

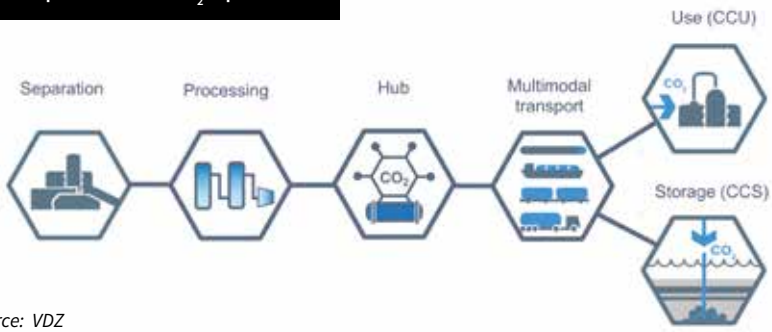
Besides the expected quantities of CO_2 captured in the coming years and the possible methods of transportation, it will be important to evaluate how these amounts will be distributed geographically. Questions include:

- What/where are the specific sources of CO_2?
- Where are the industries that will use it as a raw material (such as the chemical industry)?
- Where are the geological formations that are well suited to store CO_2?
- What could a CO_2 transportation grid look like (see Figure 5)? What are the challenges, what are the solutions?

VDZ is working intensively on these issues and will publish a CO_2 infrastructure study at the end of 2023 to provide some answers.

Part of this process is an intensive exchange with different project partners – from waste management, lime and the natural gas industry to the producers of tank wagons. Beyond this, VDZ is approaching the federal government to promote the necessary framework conditions for capturing, storing and/or using CO_2 from clinker production. Among other things, financial incentives for these cost-intensive technologies are required. An interesting example are the so-called carbon contracts for difference (CCfD). CO_2 avoidance costs for capture technologies are, at least today, higher than costs for emitting a tonne of CO_2. To stimulate

Figure 4: process chain CO_2 separation



Source: VDZ

investment, the state takes over the costs exceeding the CO_2 price. The German Federal Ministry of Economic Affairs and Climate Action has published a draft funding guideline, which unfortunately comes with several challenging preconditions, so that this instrument might not be used by the cement industry to such a degree as expected.

Another precondition for getting the carbon management value chain on track is the legal framework. The currently insufficient regulations for carbon capture, transport and transshipment, as well as for offshore CO_2 storage, need to be adapted and, among other things, supplemented by the aspect of CO_2 utilisation. Obstacles to national and CO_2 transport must be urgently removed (eg, by Germany ratifying Resolution LP.3(4) of the International Maritime Organisation amending Article 6 of the London Protocol). In addition, the existing legal framework (essentially the German Carbon Dioxide Storage Act) must be further developed.

All these aspects need to be combined in the carbon management strategy that is currently being developed in Germany in close cooperation with the cement industry and partners from NGOs and other industries. It will be very important that at the end of this process, there will be a toolbox of pragmatic instruments to promote and speed up the implementation of CCUS projects.

The cement industry in Germany has already started heading towards net zero CO_2 cement production and over the 2019-21 period has invested around EUR700m in its machinery alone, which corresponds to around eight per cent of the industry's turnover generated in this period. This also includes investments in air pollution control and resource efficiency.

Conclusion

The overall situation in Germany will still bring different challenges. However, irrespective of the recent market situation, the cement sector will be part of the solution needed to overcome bottlenecks in the construction value chain, and even more so in the decarbonisation of cement and concrete. ■

Figure 5: CO_2 transportation grid by OGE

Source: OGE

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[1] VDZ (2020) 'Executive summary – Decarbonising cement and concrete: a CO_2 roadmap for the German cement industry' *https://www.vdz-online.de/fileadmin/wissensportal/publikationen/zementindustrie/Executive_Summary_VDZ_Study_Decarbonising_Cement_and_Concrete_2020.pdf*

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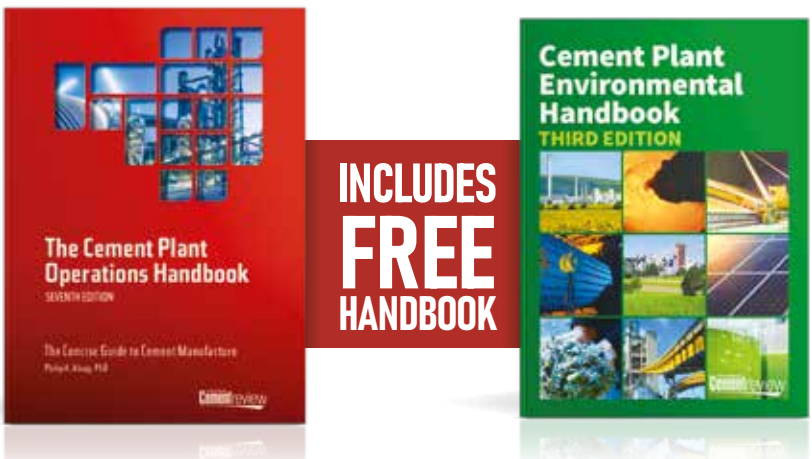

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