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The situation and risks facing the chemical industry

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The chemical industry is at the core of the socio-ecological transformation: as the largest industrial consumer of mineral oils and natural gas in Germany and thus a significant source of emissions, it faces a particular challenge to undergo fundamental change. Without a profound transformation of this sector, national climate and environmental goals cannot be achieved. In addition to the pressure to transform due to environmental and climate-related regulations and fluctuating energy prices, the chemical industry faces further challenges, such as weak demand in national and global sales markets. Although production has been curtailed in recent years due to weak demand on national and international markets, the industry continues to make a substantial contribution to overall economic value added.

As part of an ad hoc task in the German Environment Agency's (Umweltbundesamt –UBA) project “Demand and employment effects of future environmental protection measures,” the situation of the German chemical industry and two cumulative scenarios were examined. The scenarios deal with two key factors influencing the future development of the chemical industry: higher energy costs and the use of new and more efficient technologies.

The scenario analyses are based on the QINFORGE model system, which is updated, evaluated, and used as part of the QuBe project (www.qube-projekt.de). For this work, the model status from wave 8 was used, taking into account structural data from official statistics up to 2023 and key parameters up to 2024. The model follows a bottom-up approach: calculations are made at the industry level, and variables such as gross domestic product are obtained by addition. Key exogenous parameters for the baseline scenario include population development from the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung - IAB) demographic model and information from the GINFORS world trade model for import prices and export demand for goods. The QuBe base projection (8th wave) serves as the baseline for the information on the projected development of the chemical industry in Germany and as a reference scenario against which the results of the scenarios calculated for the chemical industry are compared.

In addition to the quantitative analysis, a discussion was held with experts from companies, associations, and scientific institutions. The discussion was conducted as a structured, guideline-based exchange.

The qualitative evaluation served to validate the model findings, expand the analysis to include factors that cannot be represented in the model or can only be depicted indirectly (e.g., infrastructure bottlenecks, approval processes, transformation sequence, market pull mechanisms), and perform a sensitivity analysis in the sense of assessing which assumptions made in the model are rather conservative or rather optimistic.

This study shows that the German chemical industry is potentially facing three rising cost components simultaneously. These include rising labor costs, rising costs for intermediate inputs, and higher depreciation. Analysis of the baseline projection shows that wages are rising significantly, partly due to the shortage of skilled workers and in response to inflation. In addition, prices for many intermediate goods, including energy, are rising, driven by factors such as CO₂ prices and geopolitical uncertainties. Investments made in the course of the transformation to achieve climate neutrality or to avoid higher material costs lead to depreciation downstream. The socio-ecological transformation of the chemical industry can only be achieved if it is supported by policymakers.

The expert discussion confirms the diagnosis of a structural break in 2022/2023. The model-based identification of a “double cost challenge” arising from rising input costs (especially energy) and labor costs is reflected in reports from the field: production at a 30-year low, capacity utilization rates well below the break-even point, and a return on sales that has halved in a short period of time. Against this backdrop, the scenarios of rising energy prices (scenario 1) and additional investments in efficiency technologies (scenario 2) become

more plausible: from the companies' perspective, these are not abstract model variants, but real decision-making situations in which investments in decarbonization and efficiency improvements must be made under conditions of persistently thin margins. In addition, the expert discussion makes it clear that the abstraction deliberately chosen in the model for energy prices and investment paths only reflects a fraction of the actual transformation challenges.

The experts point to a number of physical and institutional prerequisites—hydrogen and CO₂ infrastructure, storage projects, grid expansion, approval procedures—which are only indirectly represented in the model via cost paths and investment assumptions. In addition, the expert discussion sharpens the view of the heterogeneity of the industry. The modeling and aggregated data necessarily work with the WZ 20 as the overall industry, following the classification of economic activities by the German Federal Statistical Office. The discussants warn against analytical and political trivialization: the creeping reduction in raw material capacities jeopardizes the basis of the entire chemical value chains in the medium term. The interaction between model calculations and expert discussion gives rise to several strategic implications for economic and environmental policy design that go beyond a purely compensatory logic of individual measures. The combination of model analyses and expert discussion also suggests several lines for further research and in-depth policy advice.

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