Business Adaptive Strategies in the German Chemical Industry: The Case of BASF & Evonik Facing the Energy Crisis

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Abstract

The energy crisis in Europe has immensely affected Europe, especially the German economy. Energy-intensive industries are under immense pressure. The chemical industry is Germany´s largest industrial energy consumer, depending heavily on natural gas and electricity supplies. Three aspects give companies in the industry cause for concern: skyrocketing prices for electricity and gas, the threat of insufficient commodity supply, and fading economic competitiveness compared to global markets.

The following thesis, presented as a pedagogical case study, focuses on the strategic measures of two companies to mitigate the severe consequences of the energy crisis: BASF and Evonik Industries AG. In a comparative analysis, their measures are being examined in the research note alongside three strategic management theoretical concepts: "Dynamic Capabilities"; "Resource-Based View"; and "Strategic Response to Crisis". The case study and the teaching notes are intended to be used as a pedagogical framework mainly suggested for management courses emphasizing business strategy, crisis management, and strategic renewal.

As a result, both companies were able to cope with the devastating consequences of the energy crisis through the following measures: Entering into strategic partnerships to diversify energy and resource supplies, investing and relocating production to sites with less dependence on Russian gas, substituting natural gas with other energy sources, and implementing cost-saving and restructuring measures.

Title:
Business Adaptive Strategies in the German Chemical Industry:
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Resumo

A crise energética na Europa afectou imensamente a Europa, especialmente a economia alemã. As indústrias de energia intensiva estão sob uma enorme pressão. A indústria química é o maior consumidor industrial de energia da Alemanha, dependendo fortemente do abastecimento de gás natural e eletricidade. Três aspectos preocupam as empresas do sector: a subida em flecha dos preços da eletricidade e do gás, a ameaça de um abastecimento insuficiente de produtos de base e o enfraquecimento da competitividade económica em relação aos mercados mundiais.

A tese que se segue, apresentada como um estudo de caso pedagógico, centra-se nas medidas estratégicas de duas empresas para atenuar as graves consequências da crise energética: BASF e Evonik Industries AG. Numa análise comparativa, as suas medidas estão a ser examinadas na nota de investigação juntamente com três conceitos teóricos de gestão estratégica: "Capacidades Dinâmicas"; "Visão Baseada em Recursos"; e "Resposta Estratégica à Crise". O estudo de caso e as notas de ensino destinam-se a ser utilizados como um quadro pedagógico sugerido principalmente para os cursos de gestão que dão ênfase à estratégia empresarial, à gestão de crises e à renovação estratégica.

Resumindo, as empresas foram capazes de lidar com as consequências devastadoras da crise energética através das seguintes medidas: Estabelecimento de parcerias estratégicas para diversificar o fornecimento de energia e de recursos, investimento e deslocalização da produção para locais menos dependentes do gás russo, substituição do gás natural por outras fontes de energia e implementação de medidas de redução de custos e de reestruturação.

Título:
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Autor: Luca Ehmer

Descritores: Indústria Química Alemã; BASF; Evonik; Crise Energética; Fontes de Energia; Estratégias Empresariais; Capacidades Dinâmicas; Visão Baseada em Recursos; Resposta Estratégica à Crise

List of Abbreviations

CAGR	Compounded Annual Growth Rate
EUR	Euro
FY	Financial Year
GW	Gigawatt
GWh	Gigawatt Hours
KW	Kilowatt
KWh	Kilowatt Hours
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MW	Megawatt
MWh	Megawatt Hours
OEM	Original Equipment Manufacturer
PPA	Power Purchase Agreement
R&D	Research and Development
TW	Terawatt
TWh	Terawatt Hours
USD	US Dollar
VCI	Verband der Chemischen Industrie (German Chemicals Association)

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1 Introduction

"The consequences of the energy price crisis will be felt more strongly by companies in 2023 than in 2022. We will see changes in our industrial structure in the medium term. It won't be clearcutting or deindustrialization, but energy-intensive industries in Europe will shrink rather than grow," says Martin Brudermüller, CEO of the world's largest chemical company BASF, about even more significant risks for the German economy due to the energy crisis in 2023 (ZEIT Online, 2023).

It was not yet foreseeable at the beginning of 2022, but the energy crisis resulting from the Russian attack on Ukraine has become a bitter reality. Energy-intensive industries are under immense pressure. The chemical industry is the largest industrial energy consumer in Germany. Dependence on natural gas and electricity is thus a crucial factor for companies in the industry as they are a fuel for power generation and a primary material in this sector. Ultimately, three aspects give companies cause for concern: Firstly, the skyrocketing prices for electricity and gas; secondly, the threat of insufficient commodity supply, with potentially precarious consequences for the production of the chemical industry in Germany; and thirdly, fading economic competitiveness compared to the US and Asian markets.

The effects of the energy crisis are highly topical and extremely relevant for large parts of the economy and industry. As production in the German chemical industry continues and companies have coped with the energy crisis so far, a closer examination of the measures companies have taken to overcome the crisis is particularly interesting and underlines the relevance of this academic dissertation.

After this introduction, the second chapter explains the methodological approach and why the selected companies are particularly suitable for this case study. The research note explains the theoretical concepts: "Resource-based View," "Dynamic Capabilities," and "Strategic Response to Crisis," which are relevant to the analysis of the case study. The fourth chapter presents the case study, which separately describes the German chemical industry, the risks arising from the energy crisis, and the two companies BASF and Evonik and their crisis management measures. The teaching note then explains the pedagogical application of the case study and synthesizes the theoretical concepts and the case study. The fifth chapter introduces limitations that must be considered when interpreting the results, and the sixth chapter provides a concluding summary.

2 Methodology & Case Selection

2.1 Methodology

Several primary and secondary sources are used to provide a well-rounded perspective on the topic for this case study. Information is examined from 8 academic papers, 17 corporate reports from BASF and Evonik Industries AG, 13 analyst reports, and more than 30 press articles and articles from specialized journals. The official documents of BASF and Evonik Industries AG provide information related to their energy management practices, energy efficiency programs, utilization of renewable energy, energy consumption, and crisis management measures. Analyst reports provide information on the context of the energy crisis and any circumstances impacting the chemical sector. Specialized articles on the chemical industry give background information to bolster the analysis.

A comparative analysis of BASF and Evonik Industries AG will discern commonalities and differences in these companies' strategies related to the energy crisis. This comparison provides a broader understanding of German chemical companies' challenges and helps draw differentiated conclusions for the industry.

2.2 Case Selection

BASF is an ideal company for this case study on the energy crisis and how German chemical companies deal with it. As the world's largest chemical company, BASF is at the center of the industry and plays a vital role in the German economy. The size and diversity of the company allow for a comprehensive analysis of the challenges, opportunities, and strategies related to the energy crisis. BASF is known for its innovation and global operations, making it a representative example of the complexity and global impact of the energy crisis challenge.

The choice of Evonik Industries AG as the second company broadens the perspective and enables a meaningful comparison with BASF. As a significant specialty chemicals company in Germany, Evonik plays an essential role in a specific chemical industry sector. Its focus on specialty products and innovative solutions for various industries gives Evonik a specific dynamic in dealing with the energy crisis. The comparison between BASF and Evonik makes examining similarities and differences in strategic approaches, reactions to the energy crisis, and their impact on the respective business models easier.

3 Research Note

The following three critical concepts provide frameworks to analyze companies' strategic decisions: "Resource-Based View", "Dynamic Capabilities", and "Strategic Response to Crisis". These frameworks offer diverse perspectives on how companies utilize resources for sustained advantages and strategic reactions and adaptations to navigate the challenges of the ongoing energy crisis.

3.1 Resource-Based View

The "Resource-Based View" (RBV) concept underlines that a firm's competitive advantage is rooted in its distinctive resources and capabilities. These could be defined as its (in-) tangible assets tied semi-permanently to the firm and contribute to its strengths or weaknesses. Resources include brand names, in-house knowledge, financial strength, skilled personnel, trade contacts, machinery, efficient procedures, capital, and the ability to deploy these resources effectively (Wernerfelt, 1984).

Under the assumption that resources and capabilities are heterogeneously distributed across firms, by bundling these, companies can obtain competitive advantages (Barreto, 2010). The **VRIO** framework Barney (1995) developed underscores that resources should be valuable, rare, inimitable, and organized to sustain competitive advantage:

Valuable: Resources provide value by enabling a firm to take advantage of opportunities and/or eliminate threats. Depending on the external environment, these resources can be valuable in different ways for their utilization (Barney, 1995).

Rare: Only a few other competitors should possess this resource. As many resources can be valuable while simultaneously being common, they are unlikely to give a competitive advantage to a firm (Barney, 1995).

Inimitable: Resources that are "inimitable" give firms a competitive advantage. Firms replicating these resources will face cost disadvantages (Barney, 1995). For example, cost disadvantages for the imitating company can arise from the long-term process of creating these resources. Moreover, they may have been obtained and developed by “reputation, trust, friendship, teamwork, and culture” (Barney, 1995), which takes time and effort to build.

Organized: To exploit its resources properly, a company has to be organized. By aligning and structuring its complementary resources, such as management control systems, reporting structures, and compensation policies, a firm can fully realize its competitive advantage through its resources and capabilities related to its business (Barney, 1995).

More recent RBV strategies emphasize the diversification of resources throughout businesses. Companies can benefit by shifting capabilities from one business to another. Through reduced unit costs over time, firms can obtain economies of scope when reallocating resources from low-margin/growth businesses to higher-margin/growth businesses and diversifying their business processes and areas (Barney, 2023).

Ultimately, approaches to the RBV are exploring companies' efforts to manage stakeholders and address environmental, social, and governance (ESG) challenges. Due to the rise of these aforementioned ESG challenges, businesses have recently needed to approach them more than in the past. It has become clear that if these issues are not tackled, they could jeopardize the fundamental sustainability of individual businesses and the economy as a whole (Barney, 2023).

3.2 Dynamic Capabilities

"Dynamic capabilities" is a fundamental concept in strategic management. The initial framework by Teece (1997) focused on changing environments as the relevant context. By suggesting a unique capability and stressing the essential role of strategic management in fostering it, the concept of RBV was extended by another dimension (Barreto, 2010).

Dynamic capabilities represent a firm's capacity to sense changes in its external environment, adapt rapidly, and rearrange its resources and processes. Critical aspects of the framework include adaptation, integration, reconfiguration, and learning of internal and external competencies (Teece, 1997). 'Dynamic' directs to restoring competencies aligning with the changing business surroundings. Therefore, specific innovative responses are needed; timing is crucial as rapid technological shifts and markets are challenging to determine. 'Capabilities' stresses the integral role of strategic management in appropriately adapting, integrating, and reconfiguring internal and external resources to match the evolving circumstances (Teece, 1997). This presupposes continuous oversight of markets and technologies and the willingness to take over best practices. Making timely and market-oriented decisions is crucial to reconfigure and transform ahead of competitors quickly (Teece, 1997). Dynamic capabilities can be split up into the capacity: (1) to perceive opportunities and threats, (2) to seize possibilities, and (3) to strengthen competitiveness through improving, safeguarding, and reconfiguring a firm's assets. This includes inimitable capabilities needed to adapt to evolving customer and technological demands. They also embrace the company's ability to solve problems systematically, shape its ecosystem, develop new products, and implement feasible business models (Teece, 2007).

The foremost goal of developing dynamic capabilities is to gain and uphold a competitive advantage. They are individual to each firm, shaped by their circumstances, resources, and strategic goals. Therefore, companies with solid dynamic capabilities are better positioned to thrive and prosper in challenging environments (Teece, 2007).

In conclusion, the primary goal of dynamic capabilities is not directly generating rents for companies. Instead, they are higher-order processes to enhance assets and routines that manage firms' primary businesses (Tallman, 2015).

3.3 Strategic Response to Crisis

The concept of "Strategic Response to Crisis" investigates how businesses manage unexpected and highly disruptive circumstances that profoundly impact their operations. Wenzel (2020) examines 13 Strategic Management Science Journal studies, providing empirical evidence on how firms respond to crises (Wenzel, 2020). Deriving from this, he identified four types of strategic responses to crises:

Retrenchment

This response refers to enforcing cost-cutting measures in assets, production, products, product lines, and overhead. On one side, retrenchment can help mitigate short-term revenue losses and is often required at the start of a crisis. The effects of retrenchment measures can include irreversible damage, such as the loss of synergies and constraining economies of scale and scope in the long run, given that allocating resources and costs across business units is no longer possible. Especially when a crisis lasts longer, continued retrenchment may lead to a decline in a firm's valuable resources and capabilities (Wenzel, 2020). On the other side, retrenchment can be considered an essential component of long-term firm recovery, as it stabilizes performance declines and enhances the focus on existing activities by reducing complexity, boosting transparency, and providing a substantial foundation for strategic renewal (Wenzel, 2020).

Persevering

This response relates to measures aiming at sustaining a company's business activities and the status quo to mitigate the adverse effects of crises – contrasting a narrowed scope of activities through retrenchment. While persevering can help firms manage the mid-term challenges of a crisis, it may become increasingly unsustainable over time as the internal and external resources required to uphold the status quo eventually exhaust. This approach depends on available resources, both internal and external, enabling managers to delay strategic renewal (Wenzel, 2020). However, persevering can be a very effective strategic response. Especially in uncertain situations where firms face changing circumstances daily, persevering firms may outperform competitors that aim for strategic renewal. Frequent directional changes jeopardize renewal intention and shift competitive advantages to organizations persevering in the status quo (Wenzel, 2020).

Multinational enterprises are more likely to thrive over time if they are more internationally diversified. Although potentially exposed to more significant risks in the short run, international diversification is associated with a broader reaction base, a positive portfolio effect, and broader possibilities to evade crises by persevering (Wenzel, 2020).

Innovating

Besides the risks, crises can also open up a space for new strategies. In contrast to persevering or pursuing retrenchment measures, firms may engage in strategic renewal. In this situation, the usual restraints around decision-making are overridden, thus offering to enforce what used to be unimaginable or unfeasible. Therefore, firms widen their scope of activities to different sectors or acquire other companies. However, unless companies can create something from scratch or understand and exploit their resources, they most likely need excess capacities to realize strategic renewal (Wenzel, 2020). The transformative impact of a crisis on business environments underscores the necessity of innovation as a strategic crisis response by exploring new alternatives and expanding activities. Given the resource-based limits to persevering over time, innovating in specific business areas is valuable to sustain a firm's survival, if not unavoidable. Therefore, this response is essential for securing long-term competitiveness (Wenzel, 2020).

Exit

This response refers to firms leaving a particular business during a crisis, preempting a forced exit due to economic circumstances. An exit may be inevitable when firms conclude that discontinuing their business is the most suitable action as they do not consider any other option to enable their firm to survive the crisis (Wenzel, 2020). Exit rates depend on the vulnerability of companies' businesses, represented by the degree of immediate exposure to the crisis, inimitable resources that would be difficult to replace, and a firm's ability to deal with economic loss (Wenzel, 2020). An exit can be conducted at any point during a crisis and does not necessarily indicate the end of the road for the firm. It can flatten the way for strategic renewal by releasing resources for upcoming activities. In contrast to filing for bankruptcy, an exit can be an advantageous decision from the outset (Wenzel, 2020).

Effectively deploying these four responses to crises equips businesses with valuable strategies to withstand unforeseen and disruptive events, ensuring resilience, adaptability, and long-term sustainability in changing and demanding business landscapes.

4 Case Study: German Chemical Industry in the Energy Crisis

4.1 Industry Overview[1]

General Information

Germany's chemical industry, comprising more than 2000 companies, is dominated by major multinational players. Spread across 40 locations, German chemical parks facilitate collaboration among large corporations and SMEs, generating cost-reducing synergies. The industry offers secure and well-paid jobs as Germany's sixth-largest employer, with nearly 480,000 workers (VCI, 2023). Serving various sectors, including commodity, specialty, and agriculture, the industry's products, such as petrochemicals and organic base materials, contribute to diverse automotive, personal care, and polymer production applications. Inorganics, like industrial gases and fertilizers, cater to the metal, electrical, and agriculture industries (Statista, 2023). Fueled by increasing industrialization and GDP growth, the industry's demand extends to European countries (MarketLine, 2023).

Key Economic Figures

Germany is the largest chemical producer in Europe, constituting 22.5% of the region's market value. In 2021, the industry generated sales of 242 billion USD, representing 27% of the EU's chemical sector revenue. However, in 2022, the German market contracted to 171.1 billion USD (Zainzinger, 2023). Despite a compound annual growth rate of 1.8% from 2017 to 2022, Germany's chemical revenues fell, contrasting with the growth in the French and UK markets, which reached 101.6 billion USD and 47.8 billion USD in 2022. In 2022, the commodity chemicals segment dominated, with a market value of 103.5 billion USD, while specialty chemicals comprised revenues of 25.1 billion USD (MarketLine, 2023).

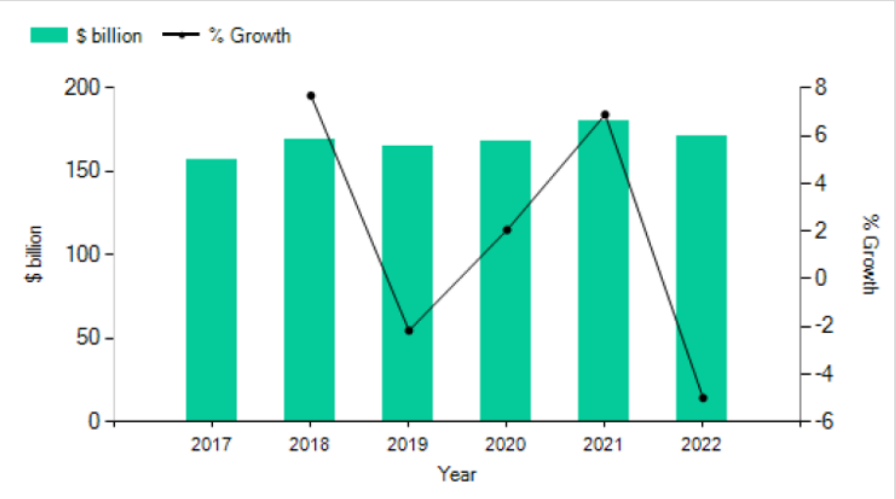

Figure 1: German chemical market value 2017-2022 (MarketLine, 2023)

[1] Extended information and graphics about the content of Chapter 4.1: "Industry Overview" are in the appendix.

Industry Competition

The chemical market is dominated by large multinational corporations, leading to intense competition marked by mergers and acquisitions. Key aspects include chemical product sales, production optimization, environmental impact reduction, and raw material exploration (MarketLine, 2023). Buyers encompass plastic product manufacturers, consumer chemical makers, and water utility companies. At the same time, suppliers, mainly oil, gas, and mining firms, exert significant power due to the industry's reliance on natural resources. High start-up costs and strict regulations deter new entrants, though low product differentiation attracts them. Chemicals have few substitutes, making technological advancements crucial for competitive advantage. However, high fixed and storage costs, driven by the hazardous nature of chemicals, pose challenges to market exit (MarketLine, 2023).

Recent Industry Developments

The German chemical market rebounded in 2021 after a negative shift in 2020 but faced challenges in 2022 due to the Russia-Ukraine war. Rising energy costs, increased raw material expenses, and reduced trade strained the industry. Reduced international trade, especially with China and the Eurozone, has led to a decline in Germany's chemical industry output, resulting in a smaller market and intensified competition for existing players (MarketLine, 2023). The chemical sector in Germany is navigating challenges such as raw material scarcity, climate change, and the need to address the energy transition and resource efficiency (CHEManager, 2022). Companies are exploring emerging technologies like nano- and biotechnology, the hydrogen economy, and digitalization to support sustainability goals and thrive in economically challenging circumstances (MarketLine, 2023).

Economic Impact & Forecast for the German Chemical Industry

The German chemical industry faces increasing challenges due to high energy and raw material costs. To stay competitive, companies should enhance supply chain resilience, secure energy access, and ensure raw material availability (McKinsey, 2023). The German chemical market is anticipated to grow significantly from 2022 to 2027. It will focus on sustainability, digitalization, and health and safety. The market is forecasted to reach 239.9 billion USD in 2027, with a 40.2% increase from 2022 and a projected CAGR of 7% over 2022–2027. German companies must diversify geographically, with China being a vital market despite geopolitical uncertainties. China represents 40% of primary chemical demand and 34% of special chemical capacity, and future growth, accounting for over 60% of global chemical growth, is expected in the Asian region (MarketLine, 2023).

4.2 Energy Consumption & Threats from the Energy Crisis[2]

German Chemicals Industry Energy Consumption

The chemical industry, highly dependent on energy, has historically benefited from inexpensive natural gas in Western countries. However, energy costs remain a significant manufacturing expense, particularly in Germany, which imported 55% of its natural gas from Russia in 2021, dropping to 35% by April 2022 (Spacek, 2022). The complex "Verbund" production system connects various processes in large chemical parks. It is integral to the German chemical industry's success. BASF's Ludwigshafen site, the world's largest integrated chemical complex, illustrates this model with 39,000 employees and 200 production plants covering 10 km2 (FAZ, 2023). Natural gas, crucial for processing heat, presents a challenge for substitution without significant investments in alternative technologies. Energetic efficiency gains from past optimizations approach thermodynamic limits, restricting further improvements (Spacek, 2022). In the short to medium term, the chemical sector's energy savings potential is only 4%, with natural gas accounting for 43.6% of energy consumption and electricity for 24.8% (CHEManager, 2022). The German government plans to diversify and reactivate coal-fired power plants to reduce reliance on Russian gas imports to 10% by 2024 (Urbano, 2023). Securing energy supply is crucial for the industry's growth and maintaining Germany's status for high-value industries (ifo Institute, 2023).

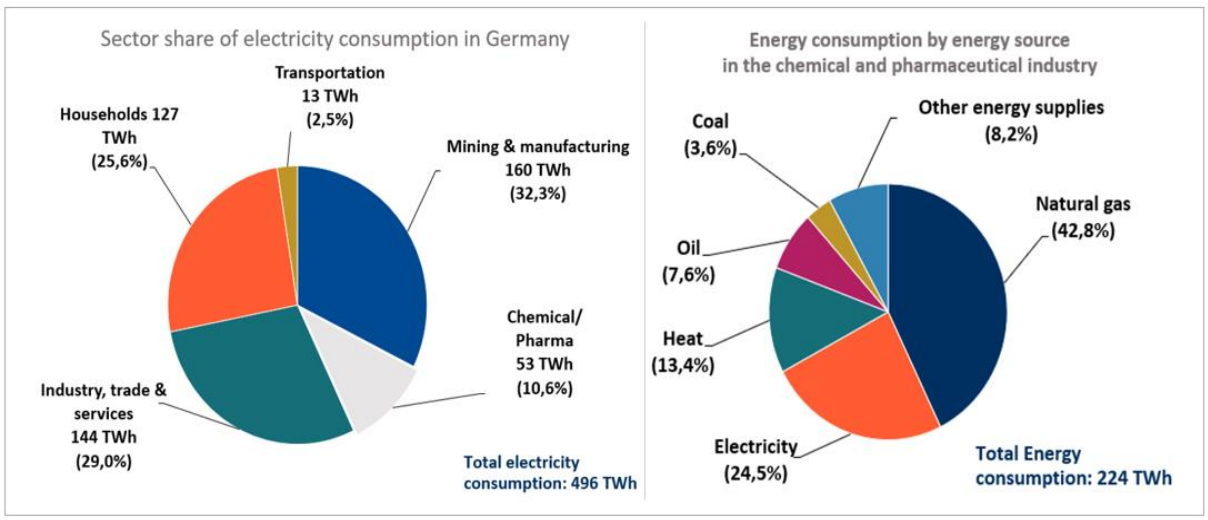

Figure 2: The chemical industries % in energy and electricity consumption in Germany in 2021 (VCI, 2022)

[2] Extended information and graphics about the content of Chapter 4.2: "Energy Consumption & Threats from the Energy Crisis" are in the appendix.

Insufficient Commodities Supply

The EU's natural gas supply from Russia is restrained due to the ongoing war, impacting energy-intensive industries in Germany. Dependency on Russian gas leaves Germany more vulnerable to the energy crisis than other European countries (Spacek, 2022). Besides insufficient gas supply, companies are grappling with shortages of crucial raw materials, leading to an 80% drop in profits for many firms (Zainzinger, 2023). While other European countries can turn to alternative gas sources, Germany faced challenges as it lacked LNG terminals at the start of the crisis, relying on the non-functioning Nord Stream 1 pipeline. Germany has since initiated two LNG terminals, with four more planned by the end of 2023, emphasizing the continued importance of natural gas in Germany's energy system (Urbano, 2023). Gas shortages are expected until 2025, with prices potentially remaining above pre-crisis levels despite an anticipated decrease, highlighting the need for Germany to shift from Russian gas to enhance energy autonomy, stability, and security (McKinsey, 2023).

Skyrocketing Commodity Prices

In 2021, Russia supplied the EU countries with more than 40% of their total gas imports. Some of which had a dependence of almost 80% on gas imports from Russia (Urbano, 2023). As a reaction to Russia’s invasion of Ukraine, the EU adopted several sanctions on economic interactions and the finance, energy, transport, and technology sectors. These sanctions directly affected the trading of natural gas between Russia and Europe. Therefore, the sanctions were likely to increase the consequences of the existing energy crisis. As a result of the war, gas prices have exploded. 2022, these were 100% higher than the previous year (VCI, 2023). Natural gas - an essential chemical raw material - rose by 420% between 2010 and 2020 compared to average prices in Europe. At the same time, the situation is also significantly impacting the EU electricity market. Electricity prices climbed by 500% between 2021-2022 (McKinsey, 2023).

Fading Economic Competitiveness

Skyrocketing gas prices also threaten the competitiveness of the European chemical industry, leading to increased costs and shrinking margins, particularly affecting companies with less diversification (McKinsey, 2023). In contrast, the US and Asian markets face lower gas price increases, with the US prices only a fifth of Europe's due to abundant energy supplies (CHEManager, 2023). Overall, the chemical industry's output dropped by almost 10%, with the petrochemical sector experiencing a significant 16% production decline (McKinsey, 2023). Capacity utilization in the sector stands at 81.4%, well below normal levels, and swift recovery is not foreseeable, in contrast to the US and Asia, which have lower prices (CHEManager, 2022).

4.3 BASF

4.3.1 Company Overview

General Information

BASF, headquartered in Ludwigshafen, Germany, is the largest chemical company in the world, producing and selling chemicals, performance products, functional materials, and agricultural products. The company also manufactures cement additives, flooring systems, sealants, polyurethanes, engineering and biodegradable plastics, polymer dispersions, resins, chelating agents, vitamins, acids, sterols, enzymes, carotenoids, and emulsifiers. BASF offers its products to miscellaneous industries. Among others, the chemical and plastics, automotive, coatings, oilfield, construction, furniture, packaging, textile, and pharmaceutical industries are BASF customers (AcquisData, 2023).

BASF benefits from operating in more than 90 countries worldwide and from its "Verbund" structure. "Verbund" is BASF's approach to vertical integration, which involves the production site to create efficient value-adding chains. BASF can use by-products of chemical reactions as raw materials for other processes that would otherwise have to be wasted. The company runs six "Verbund" sites and 243 other production sites worldwide. Geographically, the company categorizes its operations into five territories: Europe, North America, Asia Pacific, South America, Africa, and the Middle East (MarketLine, 2023).

Business Activities

BASF operates through Six business segments: Chemicals, Materials, Industrial Solutions, Surface Technologies, Nutrition & Care, and Agricultural Solutions:

The *Chemicals* segment is the cornerstone of BASF's "Verbund" production structure and provides the other segments with primary chemicals and intermediates. The segment accounted for 18.1% of the company's revenue in FY2021. The *Materials* segment offers advanced materials and their precursors for new applications and systems essential for plastics and plastics processing. FY2021, the Materials segment accounted for 20.3% of BASF's revenue. The *Industrial Solutions* segment comprises the Dispersions & Pigments and the Performance Chemicals divisions. The segment develops and markets ingredients and additives for industrial applications for critical industries such as automotive, plastics, and electronics, accounting for 11.8% of the firm's revenue in FY2021.

The *Surface Technologies* segment produces chemical solutions for surfaces with the Catalysts and Coatings divisions. The products are mainly used in the automotive and chemical industries, as well as surface treatments, colors, and coatings. In FY2021, the segment accounted for 30.2% of the BASF's revenue. The *Nutrition & Care* segment produces ingredients and solutions for consumer applications in nutrition, home, and personal care. Its customers include food and feed producers and the pharmaceutical, cosmetics, detergent, and cleaner industries, accounting for 8.6% of the company's revenue in FY2021. The *Agricultural Solutions* segment produces fungicides, herbicides, insecticides, biological crop protection products, and seeds and seed treatment products. Furthermore, Agricultural Solutions offers farmers innovative solutions. In FY2021, the segment accounted for 10.9% of the company's revenue (MarketLine, 2023).

Financial Performance

In FY2021, the individual regions contribute as follows to BASF's total revenues: Europe (40.2%), North America (27.9%); Asia Pacific (26.3%) and South America, Africa and the Middle East (5.6%) (MarketLine, 2023).

BASF reported revenues of 87.3 billion EUR for FY2022, an increase of 11.1% over FY2021. In FY2022, the company's operating margin was 0.3%, compared to an operating margin of 9.8% in FY2021. In FY2022, BASF's net loss was 627 million EUR, compared to a net profit of EUR 5.5 billion in FY2021. The company declared revenues of 19.9 billion EUR for Q1 of 2023, an increase of 3.5% over Q4 of 2022 (AcquisData, 2023). BASF's financial strategy aims to achieve profitability and sustainable growth. By 2025, BASF plans to generate around 22 billion EUR in sales from innovative products alone (MarketLine, 2023).

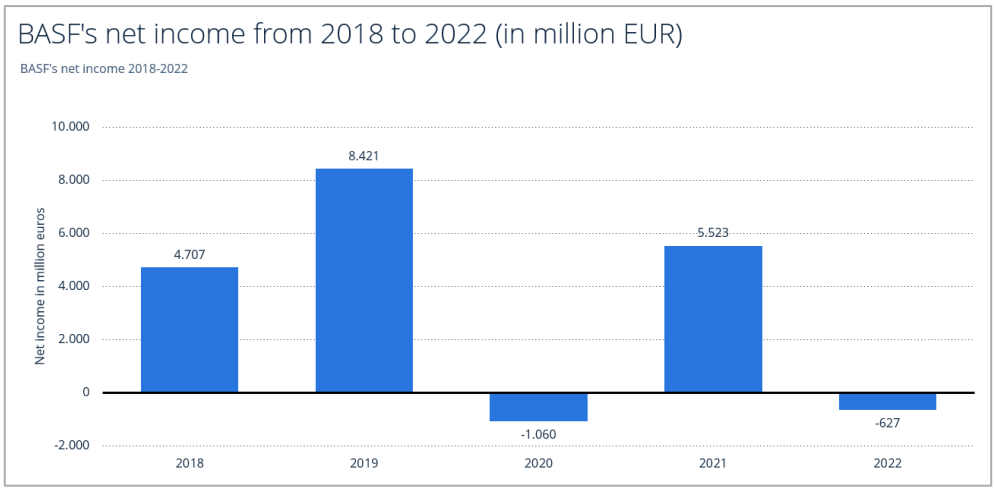

Figure 3: BASF´s net income 2018 – 2022 (Statista, 2022)

Economic Forecast for BASF

BASF's sales, which were still rising in the first half of 2022, are falling again. In addition, the economic slowdown in the EU region is leading to a decline in demand that will extend well into 2023. However, BASF is not only struggling with the weak global economic outlook; the competitiveness of its European plants has also been structurally disadvantaged by energy and CO2 policies. For the German chemical industry, particularly sector leader BASF, how cost structures settle in the medium term after the energy price shock will be crucial. In October 2022, the company spent 2.2 billion EUR more on gas at its European sites from January to September 2022 than in the same period last year (Financial Times, 2022). After all, the German benchmark index DAX gained around 8% in November 2023. BASF shares were among the three biggest gainers, with price increases of 1.5%. The prospect of a multi-billion-euro sale of BASF subsidiary Wintershall Dea to Harbour Energy for more than 10 billion EUR positively impacted analysts' assessments of BASF's future market positioning. Whether this upswing can be maintained remains to be seen (FAZ, 2023).

4.3.2 Crisis Management Measures

BASF Enters Strategic Partnerships

In May 2022, BASF entered a strategic partnership with BMW, in which BMW will use BASF's biobased corrosion-protection coatings. BMW is the first OEM to use BASF paints permitted according to the biomass balance approach to decrease fossil resources using more sustainable raw materials and minimize the carbon footprint (BASF, 2022). In June 2022, BASF announced the development of a new ammonia-producing facility at its production site in Texas. Therefore, BASF entered into a strategic partnership with Yara International, a global leader in fertilizer production. The new facility aims to increase both companies' ammonia production by 750,000 metric tons per year and strengthen the competitiveness of their customer value chain in the region (Offshore Energy, 2023). In November 2022, BASF and Moleaer announced a strategic partnership for the Mining Industry, integrating experience in chemical, mineral processing, gas transfer, and nanobubble technologies. To create cutting-edge mining techniques, this alliance will bring together experience in mineral processing, hydrometallurgy, gas transfer, and nanobubble technology (BASF, 2022).

500 Million EUR Cost-Cutting Plan

In October 2022, BASF announced that the company would drastically reduce the costs at its European sites. A savings program, implemented from 2023 to 2024, is expected to reduce annual non-production costs by 500 million EUR. The cost savings will primarily be implemented to adapt to deteriorating macroeconomic conditions (Manager Magazin, 2022). The program focuses particularly on German sites. More than half of the cost savings are to be realized at the site in Ludwigshafen. Therefore, corporate, service, and research areas must be streamlined (Morningstar, 2022). BASF responded to rising electricity and gas prices by cutting back on energy-intensive production, cutting thousands of jobs, and switching some of its power plants to oil. The company permanently closed two ammonia plants because they were no longer competitive. BASF is also shutting down other units there. Therefore, the Ludwigshafen production site could be operated if BASF received only around 30% of the natural gas volumes (Zainzinger, 2023).

BASF Enters PPAs for Clean Energy Supply in the US

BASF is dedicated to supplying its production sites across the US with renewable energy and has signed PPAs for wind and solar power totaling 250MW. More than 20 of BASF's manufacturing sites across the US are intended to be supplied with renewable energy instead of the carbon-intensive electricity used up until now. The agreements derive a total purchase of more than 660,000 MWh of electricity annually. The PPAs are estimated to offset more than 472,500 tons of CO2 emissions annually and increase BASF´s share of renewable energy in its North American electricity consumption to around 25%. BASF is collaborating with various partners to realize its ambitious emission goals. Therefore, BASF will buy 100 MW of power from Dawn Solar. Additionally, BASF will purchase 185 MW of renewable energy capacity from EDF Energy Services (MarketLine, 2023).

BASF Bundles Renewable Energy Activities in New Subsidiary

In January 2022, BASF bundled its activities in renewable energies in the wholly owned BASF Renewable Energy GmbH subsidiary. Its business activities will concentrate on providing BASF business operations in Europe with electricity from renewable energies, electricity trading in Europe, and global consulting for BASF and its Group enterprises in the field of renewable energies. Projects already initiated to generate electricity from renewable energy sources include participating in the Hollandse Kust Zuid wind farm with Vattenfall and a wind farm in the German North Sea cooperating with RWE. In addition, BASF signed the first long-term PPA for offshore wind energy in Europe with Ørsted, Denmark's largest energy supplier (MarketLine, 2023).

BASF signs long-term LNG deal with Cheniere

In August 2023, BASF signed a long-term contract to import LNG from the US with Cheniere Energy, the largest US producer of super-cooled fuel. The contract is the latest in a series signed by German companies after the country had to abandon Russian gas. BASF will purchase 800,000 tons of LNG annually from Cheniere Energy from 2026 to 2043. The deal comes after BASF closed several of its plants in 2023 due to high energy costs and committed to investing outside of Europe. LNG contracts in the US are more flexible than in other countries, allowing cargoes to be easily resold if the buyer does not need them (Financial Times, 2023).

BASF Divests in Wintershall Dea

BASF holds 72.7% of the oil and gas company Wintershall Dea, and the investment company LetterOne holds 27.3%. BASF had been planning to sell its subsidiary Wintershall Dea for some time after plans for an IPO fell through. The British oil company Harbour Energy is taking over the BASF subsidiary after an agreement on the sale was signed between BASF, LetterOne, and Harbour Energy. The transaction values Wintershall Dea at around 10.2 billion EUR. The sale foresees transferring the production and development business and exploration rights in Norway, Argentina, Germany, Mexico, Algeria, Libya, Egypt, and Denmark and licenses for capturing and storing CO2. The deal is expected to close in Q4 2024 - depending on antitrust and regulatory approvals (FAZ, 2023).

Restructuring the "Verbund" Production Network

Until now, BASF utilized the "Verbund" – a system that creates efficient value chains extending from basic chemicals to consumer products. Six "Verbund" sites worldwide produce over 50% of BASF's production volumes (MarketLine, 2023). In December 2023, BASF announced that the three business units, Battery Chemicals, Coatings, and Agricultural Solutions, will be spun off from the parent BASF SE and transferred to legally independent companies. The businesses that are not so profoundly integrated into the Group are to be given more space to meet the needs of their specific customer industries. At the same time, they will continue to benefit from the advantages of an integrated company. The divisions are geared towards a focused market and must, therefore, also be measured against direct competitors. For this reason, there will be separate control parameters and a separate SAP system for the divisions concerned. Therefore, BASF plans to shift them into legally independent units to make them more effective and profitable (FAZ, 2023).

4.4 Evonik Industries AG

4.4.1 Company Overview

General Information

Evonik Industries AG, a subsidiary of RAG-Stiftung, is headquartered in Essen, Germany. Evonik is one of the world's leading chemical companies that produces and distributes specialized chemical products. The firm provides special intermediates, polymer materials for rubber, plastics, and automotive industries, and chemicals for animal nutrition, consumer goods, and healthcare-related products. Additionally, Evonik produces high-performance materials for the adhesives, automotive, construction, and coatings industries and offers site management, engineering, process technology, logistics, waste management, and technical services (MarketLine, 2023).

The company operates worldwide in the Americas, Asia-Pacific, the Middle East, Africa, and Europe. It has production plants in 102 locations across 28 countries and has a presence in 100 countries across the globe. A diversified portfolio of products helps Evonik to achieve profitable growth. The company has, therefore, a strategic advantage and sets a solid baseline to expand in multiple high-growth specialty chemical sectors, including specialty additives, health and care, smart materials, and animal nutrition. Significant investments in these areas in recent years have underlined Evonik´s strategy to secure its leading position in specialty chemical production (MarketLine, 2023).

Business Activities

Evonik operates through Six business segments: Specialty Additives, Nutrition and Care, Smart Materials, Performance Materials, Technology and Infrastructure, and Others.

The *Specialty Additives* segment produces and sells ingredients, specialty additives, and system solutions for consumer goods and specialized industrial applications. In FY2021, it accounted for 24.8% of Evonik's revenue. The *Nutrition and Care* segment provides a range of chemicals for use in animal nutrition, consumer goods, and healthcare-related products, as well as additives, system solutions, and ingredients for specific industrial applications and consumer goods, accounting for 23.8% of the firm's revenue in FY2021. The *Smart Materials* segment provides high-performance materials for energy-efficient and environment-friendly systems for paints, coatings, automotive, adhesives, construction, and many other industries. In FY2021, it accounted for 26.2% of the Evonik's revenue. The *Performance Materials* segment manufactures and markets intermediate and polymer materials for rubber, plastics, and automotive industries, accounting for 19.5% of the company's revenue in FY2021.

The *Technology and Infrastructure* segment provides utilities, site management, technical, process technology, waste management, logistics, and engineering services for the chemical segments and external customers. In FY2021, it accounted for 5.3% of the company's revenue. The *Other* segment includes management of the Evonik Group by the corporate center, strategic research, and intersegment consolidation effects accounting for 0.4% of the company's revenue in FY2021 (MarketLine, 2023).

Financial Performance

In FY2021, the individual regions contribute as follows to Evonik´s total revenues: Europe, Middle East and Africa (49.2%), North America (23.4%), Asia-Pacific (22.8%), Central and South America (4.6%) (MarketLine, 2023).

Evonik reported revenues of 18.5 billion EUR for FY2022, an increase of 23.6% over FY2021. In FY2022, the company's operating margin was 5.1%. The company reported 4 billion EUR of revenues for Q1 2023, a decrease of 7.7% over Q4 2022 (MarketLine 2023). In comparison, the operating margin of FY2021 was 7.8%. In FY2022, the company recorded a net margin of 2.9%, compared to a net margin of 5% in FY2021.

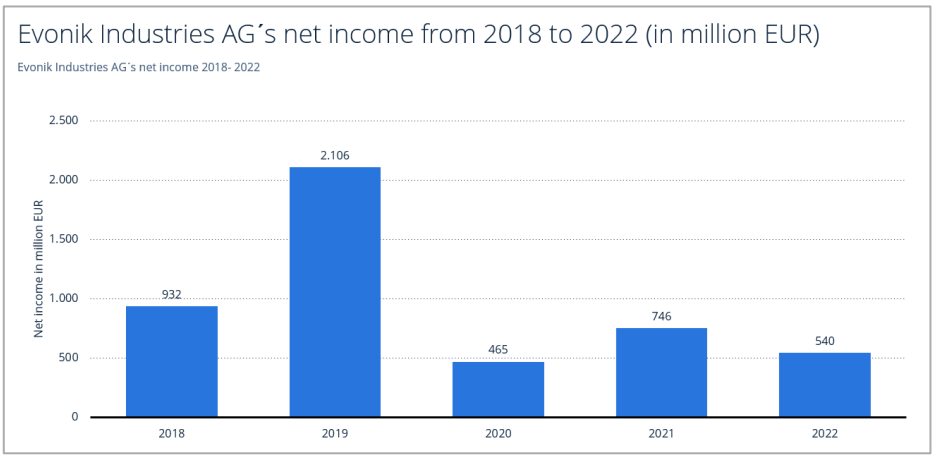

Figure 4:Evonik's net income 2018 – 2022 (Statista, 2022)

Economic Forecast for Evonik

Evonik said a comeback in 2023 would depend on energy prices, inflation, and the development of the global economy. Given high energy prices and the uncertainties surrounding the development of the global economy, the company anticipates a decline in profits in 2023. With 17 to 19 billion EUR sales, operating income is expected to be 2.1 to 2.4 billion EUR. In Q1 2023, in particular, the negative development of Q3 and Q4 2022 has continued. After that, the Group was optimistic that the economic situation would improve (Financial Times, 2023).

In November 2023, Evonik was a sought-after chemical stock in the German M-Dax. The share was upgraded from "hold" to "buy". Analysts say confidence in profit recovery for specialty chemicals companies is increasing. Market expectations are realistic, which is good news in a challenging environment. Whether the positive expectations can be fulfilled remains to be seen (FAZ, 2023).

4.4.2 Crisis Management Measures

Evonik Enters Strategic Partnerships

In July 2022, Evonik entered into a strategic partnership with Interoceanic to supply the firm with liquid ammonium sulfate solution from its site in Alabama, US. Interoceanic distributes fertilizers and industrial chemicals. Its terminal network and transportation fleet link producers and end users in North America. This partnership enhances Evonik's business strategy, focusing on its core business in Animal Nutrition by using Interoceanic's marketing network to sell its high-value products (Evonik, 2022). In September 2022, Evonik partnered with Shell to de-fossilize heavy-duty road transport with Bio-LNG. Shell supplies Evonik with Bio-LNG produced from agricultural waste. With this initiative, both companies want to promote the use of biomethane in heavy-duty transport. Bio-LNG can reduce CO2 emissions by approximately 86% compared to diesel (Evonik, 2022). In May 2023, Evonik agreed with specialty chemicals distributor Safic-Alcan to provide nutraceuticals to a broader customer base. The partnership promotes distributing a full range of Evonik nutraceuticals to customers in Europe, Turkey, and Egypt. Evonik reaches more customers by benefitting from Safic-Alcan´s network of local sales offices, enhancing its portfolio to target consumer needs (Evonik, 2023).

Evonik Substitutes Significant Share of Natural Gas at German Sites

The company makes energy supply at its German sites significantly less dependent on natural gas. Hence, the risk of shutting down production in case of a Russian gas stop is now significantly reduced. The most crucial measure is being implemented at Evonik's largest German site in Marl using its production network's side product liquefied petroleum gas (LPG). Instead of natural gas, LPG will generate power at the production plant's new gas-fired power plant. The flexibility of using LPG and natural gas in the new gas-fired power plant is an immense advantage for a diversified energy supply at Evonik's German sites. Another coal-fired power plant in Marl also contributes to securing energy supply. Evonik had initially planned to shut down this power plant in 2022. Evonik procures around 15 TWh of natural gas annually worldwide, most used for power and steam generation, and has also identified measures for substituting natural gas at its other

German sites. Fuel oil will partially replace natural gas to diversify the energy supply further. Corresponding investments have already been initiated. In addition to securing its production, Evonik contributes to preserving natural gas in Germany: The substituted gas volume equals the annual consumption of more than 100,000 households (Evonik, 2022).

Evonik & EnBW Sign Long-term Contracts for Offshore Wind Energy

In November 2022, Evonik and EnBW signed a long-term PPA for electricity from offshore wind farms. In addition to diversifying the energy supply, Evonik depends less on fossil fuels and their price fluctuations. From 2026 on, for the term of 15 years, the PPA covers 25% of Evonik's electricity needs in Europe, and EnBW supplies Evonik with 100 MW of electricity annually from a wind farm in the German North Sea (Evonik, 2022). Evonik produces products for the offshore wind turbines of EnBW's wind park. Silica and silanes strengthen the bonding of glass fibers and resin. Structural foam will increase the efficiency of future rotor blades used in the turbines. Cost-effective synthetic base oils ensure the lubrication of the turbines' gearboxes and protection from wear and corrosion (Evonik, 2022). In February 2023, Evonik extended its cooperation with EnBW and signed a second PPA, adding a further 50 MW. Thus, Evonik can cover 30-35% of its energy supply in Europe from 2026 onwards (Evonik, 2023).

Evonik Stockpiles Coal to Keep Production Running

Evonik started contingency planning in March 2022 after Russia invaded Ukraine. The company screened all its production sites to determine how to replace natural gas as a primary energy source. Evonik started using oil instead of gas at some of its smaller sites, but one of the most significant shifts has been keeping its power plant in Marl fired by coal running until 2024. The coal-fired power plant should have been closed by the end of 2022. Instead, it was kept running through the winter and beyond, providing energy and helping to maintain more than 10,000 jobs in the production park in Marl. One challenge has been ensuring sufficient coal supplies to operate the plant. Evonik stockpiled enough coal to keep the power plant running over the winter months of 2022-23. The extended lifespan shows the risk of power shortages in the country because gas imports from Russia have been cut. These measures resulted in reducing Evonik´s natural gas needs by 40%. Costs, however, have inevitably risen - the company’s energy expenses have jumped roughly 500 million EUR (Financial Times, 2022).

Evonik Sells Production Site to Focus on High-margin Specialty Chemicals

In April 2023, Evonik sold its German site and the associated business to the International Chemical Investors Group, an experienced chemical investor based in Luxembourg. Evonik wants to focus on high-margin specialty chemicals. To this end, the company invests in growth businesses and intends to divest areas no longer fit into its portfolio. The sale of the Lülsdorf production site, a vital component of the Functional Solutions Business Line of the Performance Materials Segment, represents the next step in this strategy (Evonik, 2023).

Evonik Invests in New Production Complexes

Evonik has invested around 400 million EUR in the new polyamide production complex at its most significant site in Marl, Germany. The facility primarily produces special raw materials for the 3D printing market. It is part of Evonik´s strategic growth of the Smart Materials segment that involves optimizing the performance and efficiency of products. The polyamide powder plant in Marl supports the development of future-oriented technologies and increases Evonik´s annual capacity for polyamide powders by 50% (Evonik, 2022). In 2023, Evonik finished the construction of a second plant to produce amino acids in Singapore, with investment costs of more than 500 million EUR. The new site increases Evonik's annual amino acid production capacity to 730.000 tons worldwide (Evonik, 2023).

Agile Transformation Plan

Evonik wants to become leaner, faster, and more international. For this transformation project, around three sites in Europe will be converted by the end of 2025, and service companies will take over their business in the future. Evonik wants to establish three independent operating companies for logistics, energy generation, technical services, workshops, and plant security and relocate 4,000 employees. The firm is also working on a new management model, which should be completed by spring 2024. All restructuring plans will be implemented within three years, and the management levels, in particular, will be streamlined (Finance Magazine, 2023).

Positive Effect of Cost-Cutting Measures

Evonik ranks second behind BASF in the German chemical industry, with sales of 18.5 billion EUR in FY2022. Despite strict cost-cutting measures, the Group, like many of its competitors, had to cope with a decline in profits in Q2 2023: Adjusted earnings before interest, taxes, depreciation, and amortization (EBITDA) fell by 38% year-on-year to 450 million EUR. Nevertheless, this result improved compared to Q1 2023 (409 million EUR), showing a positive effect of cost-cutting measures (FAZ, 2023)

5 Teaching Note

The following will assist in teaching the case study. It recommends assignment questions and gives guidance and examples for analyzing and discussing the case study.

5.1 Synopsis

The energy crisis resulting from the Russian attack on Ukraine, a critical juncture in a formerly regional conflict increasingly developing into a global challenge with many stakeholders involved has taken on unprecedented proportions. It has far-reaching global consequences, particularly for the European industrial sector. Energy-intensive industries are under tremendous pressure. In Germany, the chemical industry is the largest industrial energy consumer. Dependency on natural gas - particularly Russian gas supplies - and electricity is thus a critical aspect for companies in the industry as they are a source for power generation and a raw material in this sector. Highly increased prices for electricity and gas, insufficient commodity supply, and fading economic competitiveness compared to global markets are the three aspects that cause companies - this case study takes a closer look at BASF and Evonik - significant problems in their core business areas. This section aims to apply theoretical concepts to the impacts on the German chemical industry and analyze the companies' crisis management measures. Students will understand what mechanisms are crucial for crisis management, their impacts on companies, and the opportunities that emerge from these circumstances.

5.2 Teaching Objective

General Information

Students are challenged to identify, analyze, and evaluate business adaptive strategies that depend on a company's internal resources and capabilities and external environmental factors. In this case study, the German chemical industry is an example to engage students with highly topical and relevant problems affecting a firm's business model. Challenging circumstances and locational disadvantages mixed with an economic crisis should make students mindful of the urgency of strategic decision-making and crisis management measures. They will learn how to apply theoretical management frameworks to strategic and operational adjustments and how these decisions may impact a company's production processes, the sourcing of supplies, and core business areas. The case will enhance a discussion of how industrial production can be maintained in Europe if location factors and cost structures jeopardize global competitiveness. Consequently, it will enhance the students' strategic thinking.

Target Audience

This case study is ideal for undergraduate and graduate business management students. It is relevant for those pursuing studies in strategic management, business strategy, and crisis management - especially students interested in the chemical and energy sectors.

Teaching Approach

The case study is structured to adapt to various teaching methods. It can be approached as a collaborative in-class discussion, small group work, or individual exploration, making it adaptable as a take-home assignment. Regardless of the approach chosen, presenting the outcomes to the class fosters a comprehensive discussion of varied solutions following the analysis of the case questions. Giving students one to two weeks to work on the case is suggested. The relevant theoretical concepts must be taught in class before accessing the case. Additionally, the case's design ensures flexibility for various teaching strategies, allowing additional research and the application of supplementary knowledge for students and lecturers.

5.3 Assignment Questions

The following questions are recommended for analyzing the case study to achieve the greatest possible learning success and understanding of the overall topic:

Question 1: *Which external threats are BASF and Evonik exposed to? Which resources do the companies have, and to what extent did the external threats affect both companies' resources especially considering their strategic measures? Consider the* ***VRIO*** *framework in your answer.*

Question 2: *Which measures are BASF and Evonik taking to face the imposed threats from the energy crisis? Compare them using Wenzel's "Strategic Response to Crisis" concept.*

Question 3: *Assign BASF and Evonik's crisis management measures to the emerging threats and evaluate them. Do you think they are reasonable? Consider recent developments of the "Resource-Based View" concept in your answer.*

Question 4*: Identify a future threat from rising threats of the energy crisis for the German chemical industry. Do you think BASF and Evonik are well prepared for this threat according to the "Dynamic Capabilities" concept?*

5.4 Analysis & Discussion

The analysis provides possible solutions and answers for the proposed assignment questions. Some questions allow for different approaches and reasoning beyond the suggested answers.

Question 1: *Which external threats are BASF and Evonik exposed to? Which resources do the companies have, and to what extent did the external threats affect both companies' resources especially considering their strategic measures? Consider the* ***VRIO*** *framework in your answer.*

This question examines whether the students have read the case study carefully and can grasp information relevant to the questions. The external threats refer, on the one hand, to factors that characterize the German chemical industry in general and, on the other hand, to external threats, both specifically addressed in the case: Fierce competition for raw materials, insufficient commodity supply, skyrocketing commodity prices, and fading economic competitiveness. In addition, the question requests the students' understanding of the **VRIO** framework, identifying key resources, and linking the external threats with the resources from the theoretical concept as well as with the companies´ strategic measures.

External Threats

Fierce Competition for Raw Materials

In a highly competitive market dominated by multinational corporations, core dynamics shape the landscape, including sales, optimized production, and raw material exploration. The industry faces high entry barriers and limited product differentiation, attracting new entrants if they can pass the entry barriers. While technological advancements provide a competitive edge, intricate manufacturing processes involve high fixed costs, contributing to intense industry competition. The industry, which is highly dependent on affordable Russian natural gas, is facing a major challenge as rising energy costs significantly impact production costs. Shifting from natural gas demands substantial investments in alternative technologies. Technological constraints limit further efficiency gains, while natural gas and electricity still have a crucial role. Companies in the industry face fierce competition to access critical raw materials.

Insufficient Commodities Supply

The ongoing war significantly strained the EU's natural gas supply from Russia, impacting energy-intensive industries. By April 2022, Germany witnessed a decrease in imports from 55% to 35%. Alongside gas shortages, challenges in sourcing critical base materials led to an 80% profit drop for many companies. Despite efforts to source LNG from other countries, natural gas remains crucial for Germany's chemical industry. Gas shortages are anticipated until 2025, emphasizing the high dependence on Russian gas and insufficient commodity supply.

Skyrocketing Commodity Prices

In response to Russia's invasion of Ukraine, the EU imposed sanctions on various sectors, including finance, energy, transport, and technology. These sanctions directly impacted natural gas trading between Russia and Europe, worsening the energy crisis. Consequently, gas prices surged by 100% in 2022 compared to the previous year, while the EU electricity market saw a significant 500% price increase between 2021 and 2022.

Fading Economic Competitiveness

Rising gas prices threaten the European chemical industry's competitiveness, increasing costs and declining margins. In contrast, the US and Asian markets experience lower gas price increases - around 105% and up to 50%, respectively - maintaining prices significantly below those in Germany. The 2022 surge in gas prices adversely affects chemical production, leading to a nearly 10% reduction in European production capacity. With capacity utilization at 81.4%, a swift recovery is not imminent.

VRIO Framework from the Resource-based View Concept

Valuable resources enable firms to exploit opportunities and/or eliminate threats.

Rare resources are only possessed by a few other competitors.

Inimitable resources give firms a competitive advantage because they are difficult to replicate.

Organizing its processes helps a company to exploit its resources properly.

Note:
*When using the VRIO framework to address this question, it should be noted that the framework is adapted to provide a clear introduction to the examination of the resources that BASF and Evonik possess and use for the strategic response to the external risks of the energy crisis. The focus is, therefore, less on gaining a competitive advantage over competitors and more on the strategic utilization of resources. The assessment of the VRIO criteria is therefore done independently instead of following a logical sequence from **V** to **O**. The resources listed can be extracted from the case study and represent a suggestion for answering the question. However, they should not be considered exhaustive, and students are welcome to develop further possible resources independently.*

Effect on BASF´s Resources

Resources	Type	BASF				Relevance for Strategic Measures				
		V	R	I	O	Strategic Partnerships	Cost-Cutting Measures	Clean Energy Supply	Divest in Wintershall Dea	Restructuring Production Network
Research and Development	-	✔	✔	✔	✔	✔	-	✔	-	✔
Global Presence	-	✔	✔	✔	✔	✔	-	-	✔	✔
Financial Strength	-	✔	✔	✔	✔	✔	✔	✔	✔	✔
Supply Chain Management	-	✔	✔	✔	✔	✔	✔	✔	-	✔
Talent and Human Capital	-	✔	✔	✔	✔	✔	-	-	✔	✔
Sustainable Practices	-	✔	x	-	✔	-	-	✔	-	
Technological Expertise	*Broad*	✔	✔	✔	✔	✔	✔	✔	-	✔
	Specialized	x	-	-	-	-	-	-	-	-
Product Portfolio	*Broad*	✔	✔	✔	✔	✔	-	-	-	-
	Specialized	x	-	-	-	-	-	-	-	-
Brand Reputation	-	✔	✔	✔	✔	✔	-	-	✔	-
Customer Relationships	-	✔	✔	x	✔	✔	-	-	✔	-

✔	x	✔	-
Fullfilled	Not Fullfilled	Relevant	Irrelevant

The energy crisis poses multifaceted challenges for BASF across its operations. Regarding *Research and Development*, the increased energy costs hamper innovation efforts, diverting financial resources that could otherwise be allocated to developing more energy-efficient technologies. This financial strain on R&D activities limits BASF's capacity for technological advancements. Compared to the US and Asia, the crisis's disruption to the European natural gas supply adversely affects BASF's European operations. Increased energy costs in Europe create a competitive disadvantage for BASF globally, impacting its market share and overall *Global Presence*.

The strain on BASF's *Financial Strength* directly impacts its ability to invest in growth initiatives, sustainable practices, and long-term strategic investments. The *Supply Chain Management* also faces challenges due to disruptions in the supply and pricing of natural gas, leading to increased costs and logistical challenges that affect the timely and cost-effective delivery of products. The energy crisis further impacts talent retention and recruitment, as increased economic challenges create uncertainties for employees, influencing the overall *Talent and Human Capital* resources.

Sustainable Practices, a core commitment for BASF, face difficulties due to higher energy costs, impacting the company's standing among environmentally conscious consumers and stakeholders. Technologically, the rising energy costs impede the implementation of advanced technologies. The cost-intensive nature of developing and deploying cutting-edge solutions constrains BASF's ability to maintain *Technological Expertise* in the industry. Additionally, the increased energy costs compromise BASF's *Broad Product Portfolio*, influencing the production costs of various chemicals and challenging competitiveness across product lines.

Furthermore, sustainability is a crucial aspect of BASF's *Brand Reputation*, the energy crisis poses a risk to its corporate image. If the company resorts to more expensive or less environmentally friendly energy sources, it could negatively impact its reputation as a sustainable and responsible industry player. In this challenging scenario, it is especially difficult for BASF as there is fierce competition for access to raw materials, adding another layer of complexity to its resource management.

Effect on Evonik´s Resources

Resources	Type	Evonik				Relevance for Strategic Measures					
		V	R	I	O	Strategic Partnerships	Clean Energy Supply	Stockpiling Coal	Selling & Investing Production Sites	Agile Transformation	Cost-Cutting Measures
Research and Development	-	✔	✔	✔	✔	✔	✔	-	-	-	-
Global Presence	-	✔	✔	✔	✔	✔	-	-	✔	-	-
Financial Strength	-	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Supply Chain Management	-	✔	✔	✔	✔	✔	✔	✔	✔	-	✔
Talent and Human Capital	-	✔	✔	✔	✔	✔	-	-	✔	✔	-
Sustainable Practices	-	✔	x	-	✔	-	✔	-	-	-	-
Technological Expertise	*Broad*	x	-	-	-	-	-	-	-	-	-
	Specialized	✔	✔	✔	✔	✔	-	✔	✔	-	✔
Product Portfolio	*Broad*	x	-	-	-	-	-	-	-	-	-
	Specialized	✔	✔	✔	✔	✔	-	-	✔	-	-
Brand Reputation	-	✔	x	-	✔	✔	-	-	✔	-	-
Customer Relationships	-	✔	✔	x	✔	✔	-	-	✔	-	-

✔	x	✔	-
Fullfilled	Not Fullfilled	Relevant	Irrelevant

The energy crisis poses many challenges for Evonik across its operations. The financial strain induced by higher energy costs significantly limits the company's investment in *Research and Development*, hindering its capacity to develop new specialty chemical solutions and stay technologically competitive. This financial constraint also extends to Evonik's *Global Presence*, where increased energy costs in Germany compromise its competitiveness compared to the US and Asia. Higher production costs make it challenging to compete globally, impacting the company's market share in various regions.

Furthermore, the strain on Evonik's *Financial Strength* limits its ability to invest in growth initiatives, research and development, and strategic acquisitions, potentially affecting its long-term financial sustainability. The disruptions in energy supply further impact Evonik's S*upply Chain Management*, posing challenges in sourcing raw materials, managing logistics, and ensuring timely delivery, impacting the efficiency and profitability of operations.

The commitment to sustainability faces challenges as the energy crisis leads to increased reliance on less environmentally friendly energy sources, impacting Evonik's image and *Sustainable Practices* as a provider of eco-friendly solutions. The financial strain also affects *Talent and Human Capi*tal, challenging the company's ability to retain and recruit skilled talent and impacting its overall capacity for innovation and adaptation. The energy crisis has a cascading effect on Evonik's *Specialized Product Portfolio*, escalating specialty chemicals' production costs and

affecting its ability to offer competitive product prices, diminishing its market share. *Technical Expertise* is also impacted, particularly in developing and manufacturing complex chemical products, potentially affecting the quality and efficiency of specialty chemicals.

Customer Relationships are strained as rising costs associated with the energy crisis may force Evonik to adjust prices, impacting its ability to maintain collaborative and long-term client relationships and customer loyalty. Lastly, the reliability associated with Evonik's *Brand Reputation* is at risk if the energy crisis leads to compromises and disruptions in product supply due to increased costs. Moreover, it is particularly challenging for Evonik as there is fierce competition for access to raw materials, adding challenges to its resource management and exacerbating the difficulties posed by the energy crisis.

Question 2: *Which measures are BASF and Evonik taking to face the imposed threats from the energy crisis? Compare them using Wenzel´s "Strategic Response to Crisis" concept.*

This question aims to ensure that the students comprehensively record and structure the measures taken by BASF and Evonik against the risks of the energy crisis. Identifying similarities and differences in the companies' strategies is crucial through a comparative approach to the "Strategic Response to Crisis" concept.

BASF´s Measures to Face the Threats from the Energy Crisis

Retrenchment

500 Million EUR Cost-Cutting Plan

In October 2022, BASF initiated a 500 million EUR cost reduction plan for its European sites in 2023-2024, focusing on Ludwigshafen, Germany. This involves streamlining operations, job cuts, transitioning some power plants to oil, closing two ammonia plants permanently, and further unit closures to operate with about 30% of original natural gas volumes.

Persevering

BASF signs a long-term LNG deal with Cheniere

In August 2023, BASF secured a long-term LNG contract with Cheniere Energy for 800,000 tons annually from 2026 to 2043, part of its shift from Russian gas due to high energy costs. This move includes increased investments outside Europe, and the flexibility of US LNG contracts allows for easy resale if not needed.

Innovating

BASF Enters Strategic Partnerships

In May 2022, BMW became the first OEM to use BASF's biobased corrosion-protection coatings under the biomass balance approach. In June 2022, BASF and Yara International partnered to increase ammonia production in Texas. In November 2022, BASF and Moleaer formed a strategic partnership for advanced mining techniques.

BASF Enters PPAs for Clean Energy Supply in the US

BASF strengthens its US renewable energy commitment, signing PPAs for 250MW of wind and solar power across sites, offsetting 472,500t of CO2 yearly. This aids in achieving 25% renewable energy in North American electricity consumption, aligning with ambitious emission reduction goals and collaborations with Dawn Solar and EDF Energy Services.

BASF Bundles Renewable Energy Activities in New Subsidiary

In January 2022, BASF created BASF Renewable Energy GmbH, streamlining renewable initiatives with projects like the Hollandse Kust Zuid wind farm and an offshore wind Power Purchase Agreement with Ørsted for Europe.

Exit

BASF Divests its stake in Wintershall Dea

BASF is selling its subsidiary Wintershall Dea to Harbour Energy for approximately 10.2 billion EUR. The deal, which includes transferring production and development businesses and exploration rights in various countries, is expected to close in Q4 2024, pending antitrust and regulatory approvals.

Restructuring the "Verbund" Production Network

BASF is restructuring its "Verbund" production network by spinning off three business units - Battery Chemicals, Coatings, and Agricultural Solutions - from BASF SE, allowing them more autonomy while retaining integration benefits. This move aims to enhance effectiveness and profitability by aligning the divisions closely with their specific markets and direct competitors.

Evonik´s Measures to Face the Threats from the Energy Crisis

Retrenchment

Positive Effect of Cost-Cutting Measures

Evonik, the second-largest German chemical firm with FY2022 sales of 18.5 billion EUR, experienced a Q2 2023 profit decline, reporting a 38% year-on-year drop in adjusted EBITDA to 450 million EUR. Despite this, the figure improved compared to Q1 2023 (409 million EUR), indicating a positive impact from implemented cost-cutting measures.

Persevering

Evonik Stockpiles Coal to Keep Production Running

Evonik initiated contingency plans in March 2022, assessing production sites to replace natural gas after the Russia-Ukraine conflict. Notably, the company extended the operation of its coal-fired power plant in Marl until 2024. Challenges included securing adequate coal supplies, prompting Evonik to stockpile enough coal for the winter months of 2022-23.

Evonik Substitutes Significant Share of Natural Gas at German Sites

Evonik is reducing reliance on natural gas at German sites, enhancing energy resilience. The Marl site now uses liquefied petroleum gas (LPG) in a new gas-fired power plant, adding flexibility to the energy mix. A coal-fired plant in Marl, initially set for closure in 2022, further secures energy supply.

Innovating

Evonik & EnBW Sign Long-term Contracts for Offshore Wind Energy

In November 2022, Evonik and EnBW inked a 15-year PPA for 25% of Evonik's European electricity needs from a German North Sea wind farm. The collaboration extends to providing materials for EnBW's wind turbines. In February 2023, a second 15-year PPA was signed, adding 50 MW and bringing Evonik's coverage to nearly 30-35% of its European energy requirements from 2026 onward.

Evonik Invests in New Production Complexes

Evonik invested 400 million EUR in a new production complex in Marl, Germany, targeting the booming 3-D printing market. This strategic move enhances annual polyamide powder capacity by 50%. Additionally, over 500 million EUR were invested to complete a second amino acid plant in Singapore, increasing global capacity to 730.000t.

Evonik Enters Strategic Partnerships

In July 2022, Evonik joined Interoceanic to supply liquid ammonium sulfate solutions, utilizing Interoceanic's network for high-value product sales. In September 2022, a collaboration with Shell aimed at reducing CO2 emissions by de-fossilizing heavy-duty transport using Bio-LNG from agricultural waste. In May 2023, Evonik expanded nutraceutical distribution by partnering with Safic-Alcan, targeting customers in Europe, Turkey, and Egypt through local sales offices.

Agile Transformation Plan

Evonik is transforming and converting three European sites by 2025, establishing independent logistics, energy, and services companies, and relocating 4,000 employees. The firm aims for a streamlined management model, completing restructuring within three years by spring 2024.

Exit

Evonik Sells Production Site to Focus on High-margin Specialty Chemicals

In April 2023, Evonik divested a German site and associated business to the International Chemical Investors Group, aligning with its strategy to focus on high-margin specialty chemicals and divest non-core areas. The sale of the production site is crucial in this approach.

Similarities & Differences

BASF and Evonik, leading players in the German chemical industry, share commonalities in their strategic responses to external crises. Both implemented retrenchment strategies, cutting costs and streamlining operations, demonstrating resilience by seeking alternative energy sources to cope with rising costs. They also prioritized innovation, forming strategic partnerships, and exploring new technologies. Additionally, both considered exits or divestitures aligning with broader organizational goals.

While BASF and Evonik showed similarities, their strategic responses differed in critical aspects. In retrenchment, BASF executed a focused 500 million EUR cost-cutting plan, mainly at German sites, while Evonik's measures led to improved financial figures. Their perseverance strategies varied, with BASF securing long-term LNG contracts and Evonik adapting its energy mix, extending a coal-fired plant's operation, and reducing reliance on natural gas. In innovation, BASF entered diverse sectors, while Evonik focused on partnerships in wind energy, 3-D printing, and specialty chemicals. Evonik outlined an explicit agile transformation plan, contrasting with BASF's aim to restructure its production network. Exit strategies also differed, with BASF divesting due to financial losses, while Evonik's sale was part of a strategy to focus on high-margin specialty chemicals.

Question 3: *Assign BASF and Evonik's crisis management measures to the emerging threats and evaluate them. Do you think they are reasonable? Consider recent developments of the "Resource-Based View" concept in your answer.*

This question focuses on the student's judgment. The aim is to evaluate the measures in terms of their effectiveness in tackling the risks resulting from the energy crisis. It is also crucial that new developments in the "Resource-Based View" concept from the teaching note are recognized and incorporated into evaluating the measures from the case study.

Recent Developments in the "Resource-Based View" Concept

Diversification

Recent RBV strategies prioritize resource diversification across businesses, enabling firms to benefit from shifting capabilities and achieving economies of scope. This strategic approach involves reallocating resources, reducing costs, and promoting diversification in business processes and areas.

ESG Challenges

RBV approaches focus on how companies manage stakeholders and address ESG challenges. The increasing need for proactive approaches to these challenges is evident, as neglecting them could jeopardize the sustainability of businesses and the overall economy.

BASF and Evonik Facing Threats from the Energy Crisis

Insufficient Commodity Supply

Facing the pressing threat of insufficient commodity supply, BASF has proactively implemented a comprehensive retrenchment and cost-reduction plan. This strategic initiative involves streamlining various operational areas, cutting jobs, and transitioning certain power plants to oil, aiming to mitigate potential disruptions in commodity supply chains. By further diversifying its energy supply sources with various measures, the company has positioned itself against the insufficient supply of commodities.

On the other hand, Evonik has strategically adapted its energy mix to navigate potential challenges from insufficient commodity supply. This measure includes the proactive measure of stockpiling coal to ensure the continuous operation of its production processes and a deliberate reduction in reliance on natural gas.

Skyrocketing Gas & Electricity Prices

Addressing the significant challenge of skyrocketing gas and electricity prices, BASF has exhibited a multifaceted response. The company has diversified its energy sources by signing a long-term LNG import contract with Cheniere Energy. This move signifies a strategic shift away from reliance on Russian gas and positions BASF to cope effectively with the impact of high energy costs. Simultaneously, the company has intensified its commitment to renewable energy by signing power purchase agreements for wind and solar power. These agreements contribute to reducing carbon emissions and serve as a strategic response to rising gas and electricity prices.

In a parallel approach, Evonik has tactically adapted its energy mix to address the challenges of soaring gas prices. This measure involves reducing reliance on natural gas at German sites and implementing a new gas-fired power plant using LPG. By embracing this diversified energy strategy, Evonik positions itself to navigate the uncertainties created by escalating gas prices while ensuring a stable and resilient energy supply.

Fading Competitiveness

BASF, in a strategic move, has entered into innovative partnerships and collaborations to advance its capabilities. These include partnerships with BMW, Yara International, and Moleaer, focusing on biobased coatings, increased ammonia production, and advanced mining techniques. Additionally, BASF is divesting its stake in Wintershall Dea, reflecting a strategic decision to exit the oil and gas exploration sector and potentially reallocate resources to more competitive areas.

Similarly, Evonik has strategically responded to market challenges by investing in new production complexes, specifically targeting the burgeoning 3-D printing market. These strategic moves enhance Evonik's foothold in innovative sectors, allowing it to stay competitive in the ever-evolving landscape. Furthermore, the company has expanded its presence in wind energy, specialty chemicals, and nutraceutical distribution through strategic partnerships, reinforcing its commitment to staying agile in a dynamic market environment.

Evaluation of the Measures

BASF's measures align reasonably well with the RBV framework principles, particularly regarding business diversification. The company's strategic partnerships and innovations, including biobased coatings, ammonia production, and advanced mining techniques, demonstrate an effort to broaden its resource base. By investing in renewable energy and signing long-term contracts for clean energy, BASF diversifies its energy sources, aligning with the RBV's emphasis on leveraging various resources for sustainable competitive advantage. Additionally, the exit strategy from Wintershall Dea reflects a commitment to reallocating resources from challenging sectors to more competitive areas.

Evonik's measures align with the RBV framework, especially considering diversification across businesses, proactive management of stakeholders, and ESG challenges. The company's investments in new production complexes for 3D printing and expansion in wind energy, specialty chemicals, and nutraceutical distribution through strategic partnerships demonstrate a commitment to diversifying capabilities. Moreover, the agile transformation plan reflects a proactive approach to addressing challenges. The sale of a production site to focus on high-margin specialty chemicals aligns with RBV's emphasis on optimizing the business portfolio. However, it is to be noted that Evonik's steps to continue operating some power plants with coal or converting to other fossil fuels are not in line with the new ESG criteria. Overall, Evonik's measures are strategic and well-aligned.

Question 4: *Identify a future threat from rising threats of the energy crisis for the German chemical industry. Do you think BASF and Evonik are well prepared for this threat according to the "Dynamic Capabilities" concept?*

The last question requires the most work on the part of the student and expects them to develop their thoughts on the information presented. A potential future risk of the energy crisis is to be identified. To make matters more complex, this risk and the measures taken by BASF and Evonik are to be linked to the concept of "dynamic capabilities" to finally assess whether or not the two companies have positioned themselves sensibly against this risk.

Future Threat: Crumbling Production Process

The networked production system, cultivated over many years, is a pivotal determinant of success for the German chemical industry. If companies were to move away, then the fixed costs incurred in the industrial park would have to be passed on to fewer companies in the future. This would make things more expensive for them, which could lead to a vicious circle. The challenge lies in the integrated nature of chemical parks, where companies produce essential materials utilized by others, fostering cost-effectiveness compared to importing. If individual building blocks are torn out of this cycle, far more companies will be affected than the particularly energy-intensive ones. Some companies whose production is very energy-intensive have already cut back production. These companies monitor how energy costs develop in Germany and Europe. It is particularly critical when companies already manufacture a product in other countries. Production can then be relocated quickly, as there is no need to build an entirely new plant. This does not affect the entire spectrum of companies in the industrial park, but it does affect some of them.

Dynamic Capabilities

"Dynamic Capabilities" are a firm's capacity to adapt, renew, and reconfigure its resources and competencies to address changing environments and exploit new opportunities. It involves sensing shifts in the business landscape, seizing emerging possibilities, and effectively managing internal processes for ongoing innovation and competitiveness.

BASF´s and Evonik´s Preparation

Both BASF and Evonik have demonstrated dynamic capabilities by implementing measures to address the potential threat of companies within the German chemical industry considering relocating their production. BASF's initiatives, such as signing long-term LNG contracts and intensifying commitments to renewable energy, showcase adaptability to changing energy dynamics. Through its efforts to diversify its energy mix, extend the operation of a coal-fired plant, and invest in renewable energy partnerships, Evonik exhibits dynamic capabilities. These measures suggest a proactive response to potential challenges, aligning with the principles of the Dynamic Capabilities framework. The companies are enhancing their flexibility and resilience in the face of evolving industry conditions.

6 Limitations

Timeframe

The case study mainly covered the period between the end of 2021 and the end of 2023, so it was impossible to comprehensively cover past developments or long-term future impacts beyond this timeframe.

Other External Factors

External factors such as geopolitical events or global economic fluctuations could not be fully captured due to the limited scope of the case study, but they also correlate with the results. These external influences are difficult to predict and could affect the validity of the conclusions. For example, the main trigger for the energy crisis was Russia's invasion of Ukraine and the resulting restrictions on gas supplies. At the same time, the coronavirus pandemic was left out as a contributor to the energy crisis.

Limitation to Two Companies

Due to the focus on the two companies BASF and Evonik, capturing all measures to counter the energy crisis may not have been possible. The diversity of the German chemical industry and the differences in corporate strategies could lead to limited representativeness. The case study is limited to two companies in a highly complex global industry. Other companies within the German chemical industry may have different approaches to the energy crisis that could not be assessed in this study.

Limited Access to Internal Information

Access to internal information of BASF and Evonik is restricted to publicly available documents. The limited availability of such sensitive data may have affected the depth of the analysis and led to specific information gaps.

Considering these limitations, the case study offers valuable insights into the challenges and strategies of the German chemical industry in dealing with the energy crisis. Therefore, critically reviewing these limitations promotes a realistic interpretation of the results.

7 Conclusion

The impact of the energy crisis in Europe has been profound, particularly on the German economy. Industries with high energy consumption face significant pressures. As the largest industrial energy consumer, Germany's chemical industry relies extensively on natural gas and electricity. Companies in this sector are dealing with three primary concerns: the rise in prices of electricity and gas, the imminent threat of insufficient commodity supply, and the derogatory economic competitiveness on the global stage.

The case study "Business Adaptive Strategies in the German Chemical Industry: The Case of BASF & Evonik Facing the Energy Crisis" delves into the strategic initiatives undertaken by two companies, BASF and Evonik Industries AG, to counteract the profound implications of the energy crisis. A comparative analysis scrutinizes their measures in conjunction with three strategic management theoretical concepts: "Dynamic Capabilities", "Resource-Based View", and "Strategic Response to Crisis", detailed in the research note. The case study and accompanying teaching notes are composed as a pedagogical framework primarily recommended for management courses that underscore business strategy, crisis management, and strategic renewal.

Consequently, both companies effectively steered the severe repercussions of the energy crisis by employing diverse aspects of the outlined strategic management literature. They achieved this through strategic initiatives such as engaging in partnerships to broaden their energy and resource sources, investing in and relocating production to locations with reduced reliance on Russian gas, substituting natural gas with alternative energy sources, and enacting cost-saving and restructuring measures.

The presented case study addresses the highly topical global issue of energy supply in industrial sectors and how this can be ensured. However, as this is only a snapshot that can capture the measures taken by the companies and their impact to a limited extent, it is suggested that this field of investigation be expanded in the future due to its highly relevant nature. It remains to be seen how developments will mature and whether the measures will have a lasting positive impact.

Appendix

Extended Information on Chapter 4.1 - Industry Overview

General Information

There are over 2000 chemical and pharmaceutical companies in the German chemical industry. The most significant market shares are dominated by a handful of large multinational companies. In the production process, German chemical parks are not only aimed at the commercial activities of large corporations but are also open to establishing small and medium-sized companies. At 40 locations with excellent infrastructure, there are numerous opportunities to join forces and the collaboration results in cost-reducing synergies for all companies. The German chemical industry is the sixth largest employer in Germany, offering secure and well-paid jobs and employing almost 480.000 people (VCI, 2023).

The chemical industry in Germany serves as a supplier for many sectors of the economy. It is classified into commodity, specialty, and agriculture. Several industries, including the automobile and personal care products sectors, use commodity chemicals. Segments of the chemical industry include, for example, organic base materials - such as petrochemicals - used to produce polymers. Inorganics, such as industrial gases or fertilizers, are mainly used in the metal and electrical industries and agriculture (Statista, 2023).

The demand for the chemical industry is driven by increasing industrialization and an expanding GDP. Other European countries also drive demand in this area, as the German chemical industry is an important trading partner for many countries. Germany is the center of many European supply chains, particularly with central and eastern Europe (MarketLine, 2023).

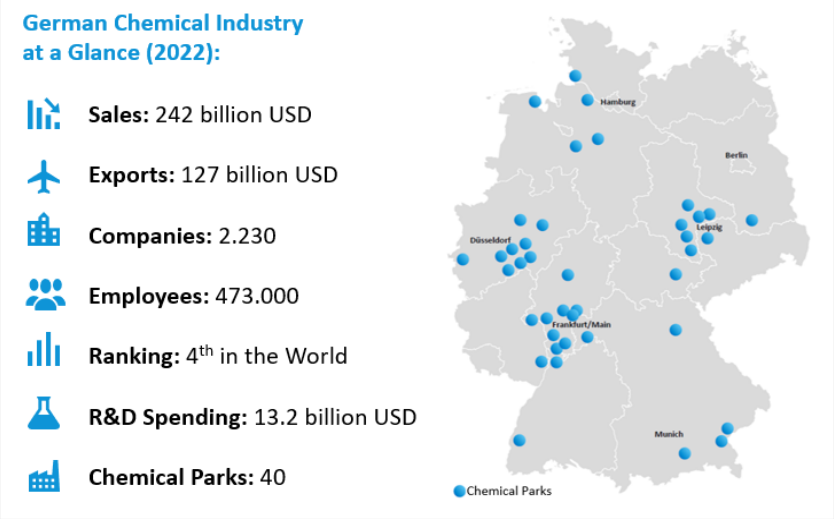

Figure 5: Overview of the German chemical industry (VCI, 2022)

Key Economic Figures

Germany is by far the biggest chemical producer in Europe. The country's industry accounts for 22.5% of the European chemicals market value. In 2021, the country's chemical industry yielded sales of 242 billion USD, or 27% of the sector's total revenue in the European Union. However, in 2022, the German chemicals market value shrank to 171.1 billion USD in revenues (Zainzinger, 2023).

The German chemicals market's total revenues present a compound annual growth rate of 1.8% between 2017 and 2022. In comparison, the French and UK markets grew with growth rates of 5.6% and 6.4%, respectively, over the same period to reach respective values of 101.6 billion USD and 47.8 billion USD in 2022 (MarketLine, 2023).

The commodity chemicals segment accounted for the market's most significant portion in 2022, with total revenues of 103.5 billion USD, equivalent to 60.5% of the market's overall value. The specialty chemicals segment contributed revenues of 25.1 billion USD in 2022, equating to 14.7% of the market's aggregate value (MarketLine, 2023).

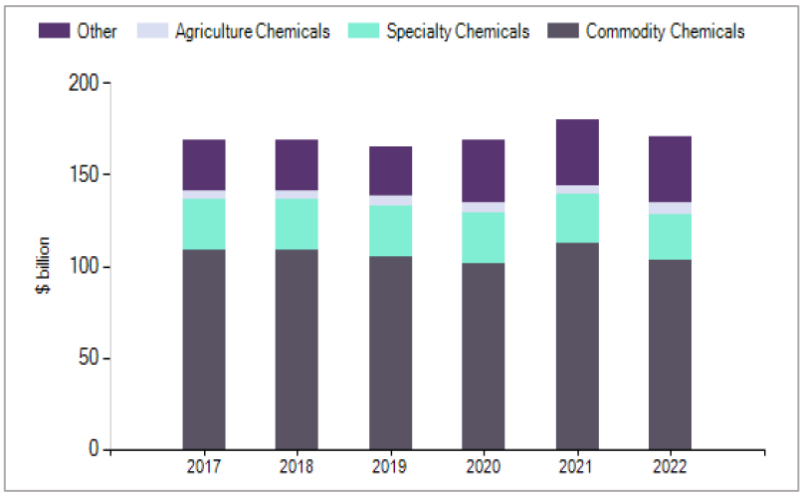

Figure 6: Germany chemicals market segmentation (MarketLine, 2023)

Recent Industry Developments

After registering a negative shift in 2020, the market growth accelerated in 2021. Due to the Russia-Ukraine war, the industry suffered a strong negative impact in 2022, which has depressed prices across the global chemicals market. Therefore, the chemical market in Germany is facing significant challenges due to rising energy prices, increases in the cost of raw materials and inputs, and reduced trade activities (MarketLine, 2023).

Due to reduced international trade with China and across the Eurozone, the industry output in Germany has dropped. Weak industry growth and manufacturing output have affected the demand for chemical products, resulting in a smaller market and intensified competition for market incumbents (MarketLine, 2023).

The scarcity of raw materials, climate change, population growth, urbanization, industrialization, and a shortage of skilled workers create different conditions for companies in the chemical industry than in the past. In Germany, there is also the need to encounter the challenges of the energy transition and resource efficiency. German chemical companies must adapt to these conditions (CHEManager, 2022).

Emerging technologies like nanotechnology, biotechnology, the hydrogen economy, and digitalization are being explored to support sustainability goals and to position well against future threats from economically challenging circumstances. Market players that successfully adjust to these trends are predicted to benefit from increasing demand and drive growth in the chemical market (MarketLine, 2023).

Economic Impact & Forecast for the German Chemical Industry

In the medium term, it will undoubtedly become more difficult for the German chemical industry and other energy-intensive sectors to remain competitive. Energy and raw material costs are still very high and are decisive factors (CHEManager, 2023). Companies can remain competitive by boosting resilience in the physical supply chains, securing access to energy, and gaining access to raw materials (McKinsey, 2023).

From 2022 to 2027, the chemical market in Germany is anticipated to grow at a considerable rate. Some key trends expected to impact the market in the coming years are sustainability, digitalization, and a focus on health and safety. The German chemical industry is developing new processes and products to achieve greenhouse gas neutrality by 2050. In 2027, the German chemicals market is forecast to have a value of 239.9 billion USD, an increase of 40.2% since 2022. The market's growth is forecasted to accelerate, with an anticipated CAGR of 7% for the five years over 2022 – 2027. Comparatively, the French and UK markets will grow with CAGRs of 5.5% and 4.6% over the same period, respectively, to reach respective values of 132.9 billion USD and 59.8 billion USD in 2027 (MarketLine, 2023).

To meet these growth forecasts, German companies will also have to diversify geographically, and business with China in particular - in addition to the USA - will remain important. Even if there is a great deal of geopolitical uncertainty, China will remain one of the largest markets for the chemical industry. China accounts for 40% of the demand for primary chemicals and 34% of the capacity for special chemicals. The rest of Asia accounts for a further 21% of demand and supply. Future growth, which BASF estimates will account for more than 60% of total global chemical growth this decade, will be dominated by this region (CHEManager, 2023).

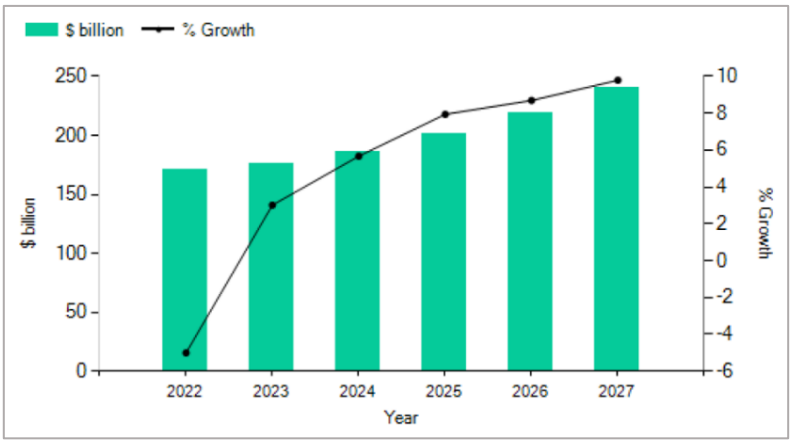

Figure 7: German chemical market value forecast 2022-2027 (MarketLine, 2023)

Industry Competition

Large multinational corporations dominate this market, and many mergers and acquisitions indicate high competition. Chemical product sales and marketing, optimizing the production and performance of chemicals, reducing environmental impacts, and exploring and producing raw materials characterize the industry´s competitive landscape (MarketLine, 2023).

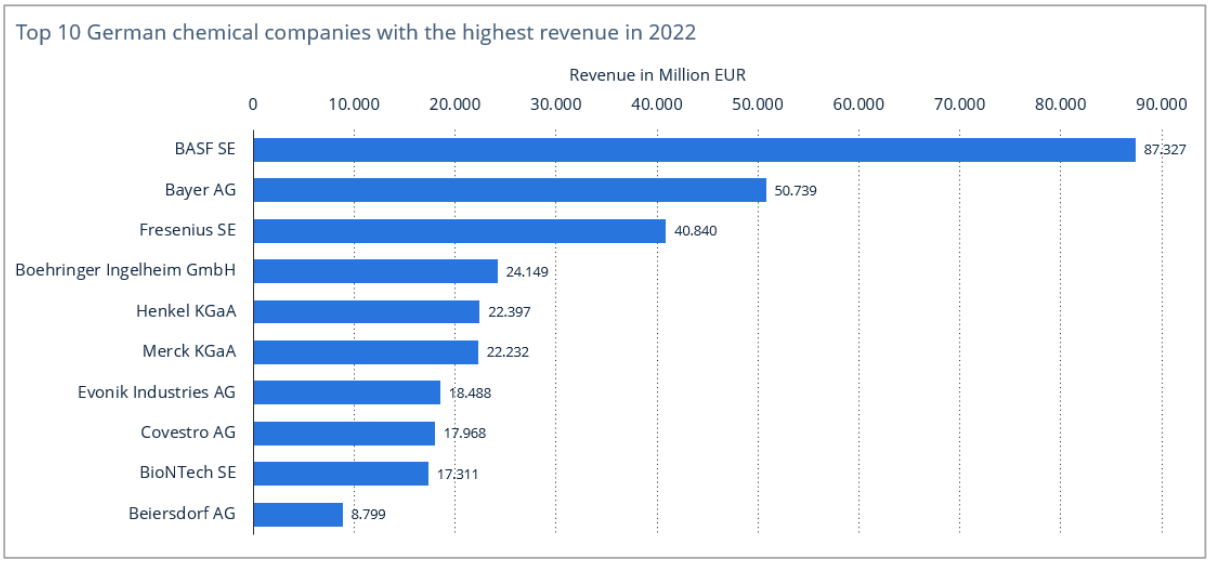

Figure 8: Top 10 German chemical companies with the highest revenue in 2022 (Statista, 2022)

Buyers in this market include manufacturers of plastic products, consumer chemical manufacturers, and water utility companies, among many others. Suppliers to this market include oil, gas, and mining firms. Given the size of these companies and the price fluctuations associated with natural resources, this gives suppliers great power. New chemical market entrants may be deterred by exceptionally high start-up costs and strict government regulations. However, low product differentiation helps attract new entrants to this market. There are very few substitutes for chemicals, as they are a fundamental raw material for various downstream industries. By advancing technologically and improving efficiency, companies can obtain a competitive advantage. However, the technicalities of the chemical manufacturing process imply high fixed costs. Storage costs are also high due to the hazardous nature of chemicals. This makes it challenging to exit the market. (MarketLine, 2023).

Extended Information on Chapter 4.2 - Energy Consumption & Energy Crisis Threats

The chemical industry has a significantly high energy demand, and the increasing profitability of companies in Western countries was driven by cheap natural gas as the primary energy source. Nevertheless, expenses for energy consumption are still a substantial part of manufacturing costs, making it a core topic for the chemical industry (Spacek, 2022). Until now, Germany has covered a significant portion of its natural gas requirements through imports from Russia. In 2021, the share of gas supplies from Russia amounted to 55%; at the end of April 2022, it was 35% (Weber, 2022).

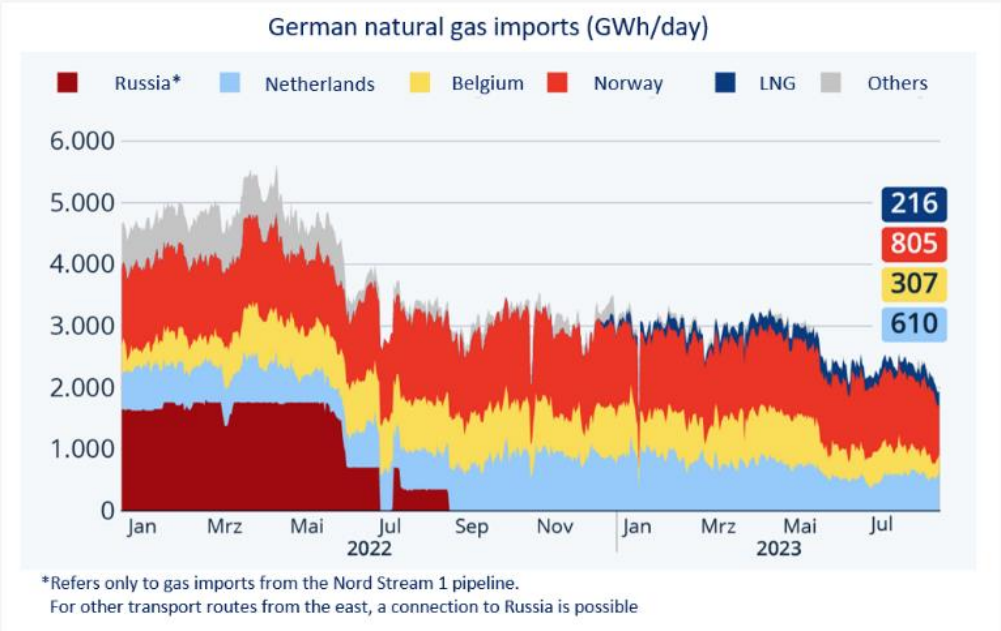

Figure 9: German gas imports categorized by country from 2022 to 2023 (MarketLine, 2023)

The “Verbund”, i.e., the convoluted production system that has grown over decades, has long been a significant success factor in the German chemical industry. In large chemical parks, everything is connected: Basic chemicals essential for manufacturing many other products are processed in large chemical plants. The end product of one plant becomes the primary raw material for the following chemical product in the production network (FAZ, 2023). BASF’s enormous site in Ludwigshafen symbolizes the industry’s reputation. The site is the world’s largest integrated chemical complex. It spreads across 10 km^2, has 39,000 employees, and accommodates 200 production plants. It consumes as much natural gas as the country of Switzerland (Zainzinger, 2023).

Natural gas is mainly used to generate process heat in the chemical industry. Substituting this fossil fuel is only possible through new investments in alternative process technologies (FAZ, 2023). Past optimization measures resulted in substantial energetic efficiency gains that determine the potential for further energy savings. Some processes even approach the thermodynamic minimum energy required, leaving virtually no significant improvement possible (Spacek, 2022). The chemical sector's short- to medium-term savings potential is only 4%. Alongside natural gas (43.6% of the sector's energy consumption), electricity (24.8%) is the chemical industry's second most essential energy source. This industry accounts for around 10.5% of German electricity consumption (CHEManager, 2022).

To reduce Germany´s natural gas imports from Russia to a maximum of 10% by 2024, the government has recently approved measures to reduce gas usage. This package includes the diversification of the gas supply and the reactivation of coal-fired power plants (Urbano, 2023). It is crucial for the German chemical industry's development that the energy supply is secured and that Germany is maintained as a location for industries with high-value creation and well-paid jobs (ifo Institute, 2023).

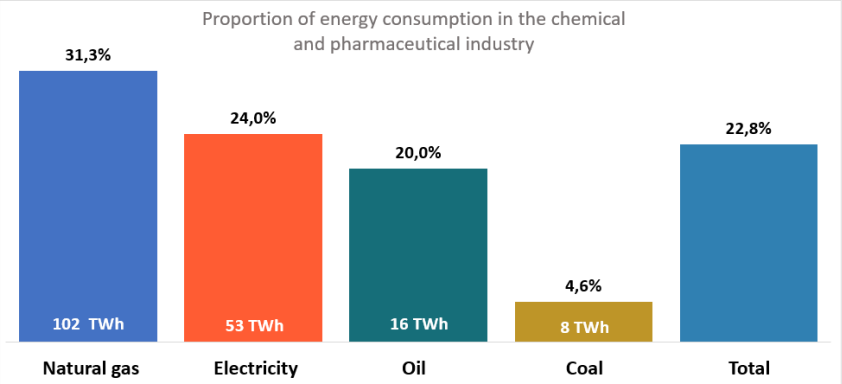

Figure 10: Shares of the chemical and pharmaceutical industries in the energy consumption of the manufacturing sector 2021 (VCI, 2022)

Insufficient Commodities Supply

The ongoing war has significantly strained the EU´s natural gas supply from Russia, and energy-intensive industries depend on this energy source (Spacek 2022). Before the conflict, most of the total natural gas imports derived from Russia, a share that had risen as EU countries shifted from coal to natural gas for decarbonization (Urbano 2023). Russia cut supplies after the EU imposed economic sanctions due to its invasion of Ukraine. Because of its dependency on Russian gas, Germany felt the consequence of the energy crisis more than other European countries (Zainzinger, 2023).

In addition to the insufficient gas supply, many companies have reported supply issues with other raw materials. Crucial base materials such as pigments, carbon and glass fibers, hydrochloric acid, caustic soda, technical carbon dioxide, silicones, and iron chloride are challenging to source, and profits are falling at 80% of the companies (Zainzinger, 2023).

Many European countries could source natural gas from Norway and Algeria or fall back on imported liquefied natural gas (LNG) shipped into their ports. Germany, however, had no LNG terminals at the beginning of the crisis. Until then, it obtained much of its natural gas supplies via the Nord Stream 1 pipeline, which runs from Russia to Germany. The pipeline was bombed in September and left non-functioning (Zainzinger, 2023). In late 2022, Germany started the operations of two new LNG terminals to import natural gas. Four more are planned to be completed by the end of 2023. Despite these measures, natural gas will remain a crucial commodity for Germany´s energy system (Urbano, 2023).

Further, gas shortages are likely to endure until 2025. While gas prices are anticipated to fall from current levels, they could stay above pre-crisis levels with persisting high volatility (McKinsey, 2023). However, the recent situation requires a shift from Russian gas, ensuring energy autonomy and boosting stability and security in energy markets (Urbano, 2023).

Skyrocketing Commodity Prices

In 2021, Russia supplied the EU countries with more than 40% of their total gas imports. Some of which had a dependence of almost 80% on gas imports from Russia (Urbano, 2023). As a reaction to Russia's invasion of Ukraine, the EU adopted several sanctions on economic interactions and the finance, energy, transport, and technology sectors. These sanctions directly affected the trading of natural gas between Russia and Europe. Therefore, the sanctions were likely to increase the consequences of the existing energy crisis (Urbano, 2023).

As a result of the war, gas prices have exploded. 2022, these were 100% higher than the previous year (VCI, 2023). Natural gas - an essential chemical raw material - rose by 420% between 2010 and 2020 compared to average prices in Europe (McKinsey, 2023). At the same time, the situation is also significantly impacting the EU electricity market. Electricity prices climbed by 500% between 2021-2022 (Urbano, 2023).

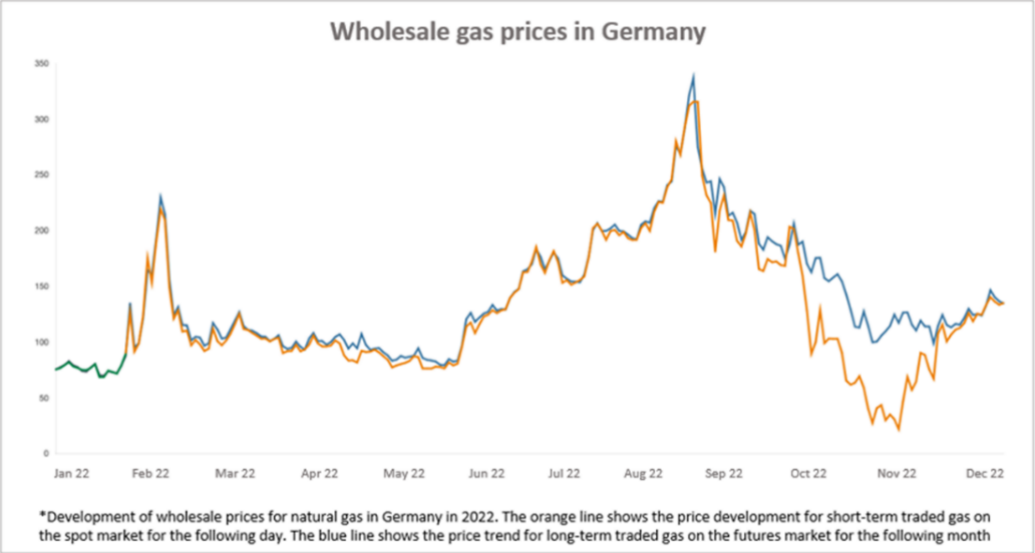

Figure 12: Wholesale gas prices in Germany 2022 (Bundesnetzagentur, 2023)

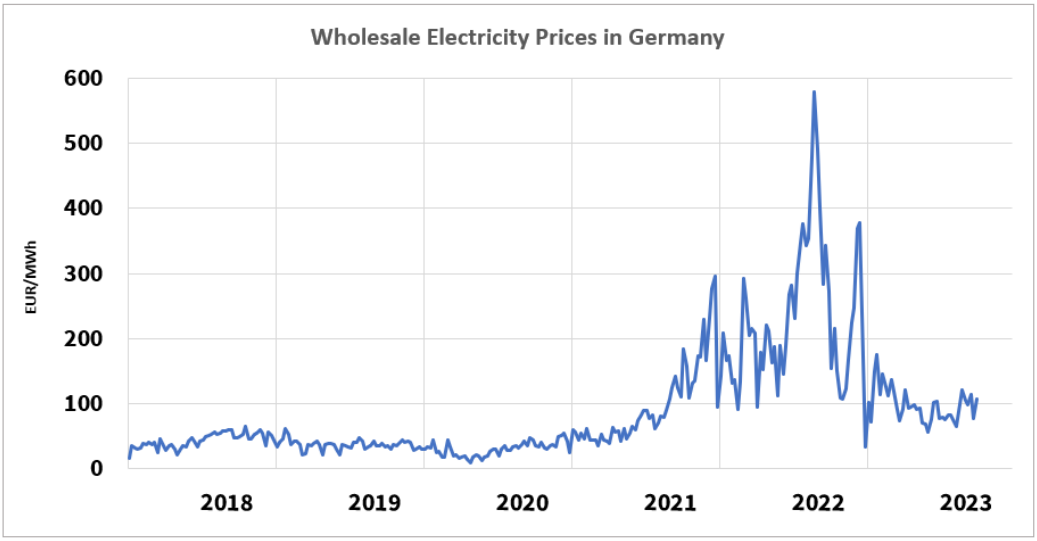

Figure 11: Wholesale market electricity prices 2018-2023 (VCI, 2023)

Fading Economic Competitiveness

The level of gas prices is threatening the European chemical industry's competitiveness. The cost of commodities and labor is rising throughout the industry, and margins are dropping, though diversified companies are exposed less to this effect (McKinsey, 2023).

Meanwhile, the US and Asian markets have faced significantly lower gas price increases of about 105% and up to 50%, respectively (McKinsey, 2023). They are expected to remain significantly lower than in Germany. Gas prices in the US are only a fifth as high as in Europe due to sufficient energy supplies. Energy prices in Asia are also likely to remain below the European level (CHEManager, 2023).

The 2022 skyrocketing gas prices affected chemical production negatively and are compounded by a lack of orders. Several commodity chemicals companies have already initiated reducing or shutting European production capacity (McKinsey, 2023). The production dropped by 6.0% in 2022 from 2021 and 0.9% in the first quarter of 2023 from the last quarter. In Q1 of 2023, demand from industrial customers shrunk sales by 6.7% compared to Q4 of 2022 (Zainzinger, 2023). The petrochemical sector was affected particularly, recording a 16% drop in production.

On average, the chemical industry's output fell by almost 10%. At 81.4%, capacity utilization in the sector was recently already below normal levels. An end to the rapid downturn is not in sight, in contrast to the lower prices in the US and Asia (CHEManager, 2022).

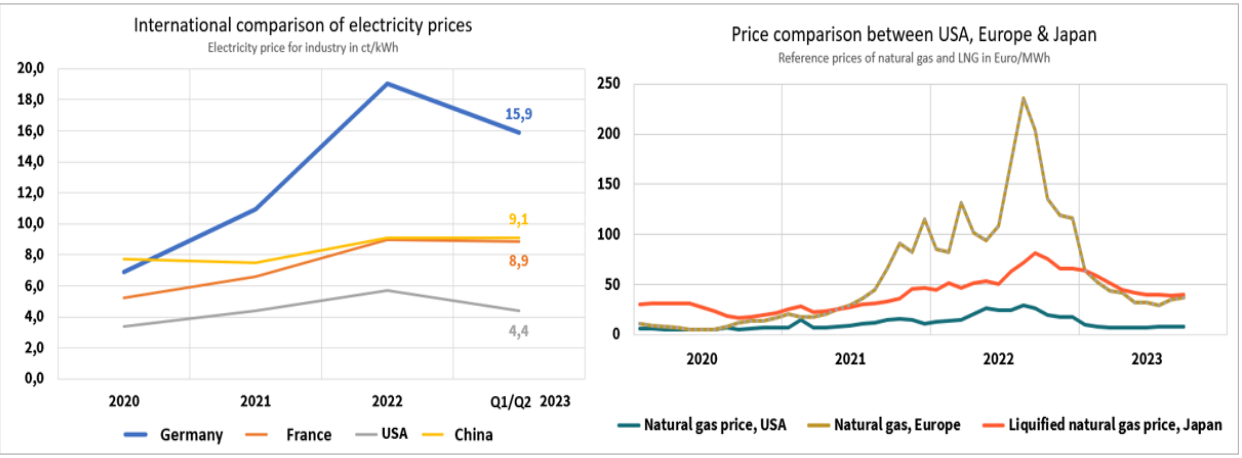

Figure 13: International price comparison of gas and electricity (VCI, 2023)

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