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BASF's Wintershall DEA Divestment: Valuation & Exit Analysis in a Geopolitically Challenging Environment

-A Portfolio Approach to Understanding Environmental Dynamics in the Oil and Gas Sector-

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Abstract

This paper investigates both the theoretical framework and real-world applications of valuing a private company, particularly in the context of divesting. The research examines Wintershall DEA, a privately owned oil and gas company. It gains relevance in light of BASF's intention to divest its stake in Wintershall DEA. For establishing a fair purchase price, the paper employs both intrinsic and relative valuation methods to establish a valuation range. Key findings are: (1) Industry-specific variations influence intrinsic valuation approaches, (2) Peer comparison in E&P is subject to increased complexity, (3) Macroeconomic and geopolitical instabilities increase corporate valuation volatility, (4) Strategic exit options are influenced by market conditions and timing.

Besides, companies achieving high environmental scores, like Wintershall DEA, are perceived as less risky and show better portfolio performance, potentially leading to higher valuations and investor appeal.

Keywords

Corporate Valuation, Intrinsic Valuation, Relative Valuation, Strategic Divestment Options, M&A, IPO, Oil & Gas Industry

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1. Introduction (Group Part)

1.1. Problem Definition and Objective

While day-to-day business operations affect shareholder value, certain financial transactions like mergers, acquisitions, IPOs, and share buybacks can also significantly impact shareholder returns. For a company, it is essential to accurately assess its value and understand the market implications of its valuation choices to ensure positive outcomes from these financial decisions. Inaccurate valuations and poorly timed transactions can significantly undermine the gains achieved through business operations (Rappaport and Mauboussin 2022).

BASF, a publicly listed chemical company, holds a significant 73% stake in Wintershall DEA, an internationally diversified oil and gas exploration and production firm. Wintershall DEA was an attractive investment for BASF at the time of the acquisition as it provided energy security and asset diversification (Wintershall DEA 2019). However, considering current geopolitical tensions, a resulting business loss in Russia, and the uncertain long-term prospects of the oil and gas market, BASF plans to divest from the energy sector (Handelsblatt 2023).

This paper aims to examine valuation methods to analyze available exit options for BASF. Valuation plays a critical role in the assessment of exit strategies like *Mergers and Acquisitions* (M&A) or *Initial Public Offering* (IPO) as it ensures that the departing party receives the fair value of their investment.

1.2. Structure and Methods

The papers' structure is organized as follows: In Section 2, three valuation methods are explored by referencing journal articles, research papers, and corporate finance textbooks. A differentiation is made between intrinsic valuation methods and relative valuation techniques. The section also examines how a company's valuation relates to exit options like M&A or IPOs. Moving on to Section 3, a case study on the company of interest, Wintershall DEA, operating in the E&P sector, is conducted. This section provides insights into the company's distribution

of ownership, business model, industry dynamics, macroeconomic factors, risks involved, and various options for the divestment of Wintershall DEA. It includes a description of the valuation methodologies used, along with a presentation and discussion of the analysis. Section 4 summarizes and discusses the key findings derived from the study, while Section 5 acknowledges the concluding remarks of the study. The research paper specifically highlights the factors involved in valuing oil and gas companies during times of geopolitical volatility.

2. Corporate Valuation

Within this section, the paper introduces the core concepts of corporate valuation based on kernel literature of corporate finance. Making use of corporate valuation is conceivably one of the most crucial aspects of corporate finance that enables optimal decision-making by providing a framework for measuring and managing the value of companies (Koller, Goedhart, and Wessels 2020). In terms of corporate valuation, when valuing a company, the definition of value varies depending on the applied valuation method. A distinction is made between book value, intrinsic value, and relative value (Kulwizira Lukanima 2023). This paper focuses on the valuation methods of intrinsic and relative valuations while neglecting the methods of measuring the book value of a company, as this approach is not commonly used as a standalone approach in modern corporate finance (Rosenbaum and Pearl 2020).

2.1. Intrinsic Valuation Methods

Intrinsic valuation methods find their origin far in the past. Prominent economists and writers, like John Maynard Keynes or Alfred Marshall, played a significant role in shaping the concept and application of discounted cash flow criteria (Parker 1968). Today, current academic literature has intensely reviewed and discussed intrinsic valuation approaches like the *Discounted Cash Flow* (DCF) method to determine a company's *Enterprise Value* (EV) (Reilly and Damodaran 1995; Janiszewski 2011; Koller, Goedhart, and Wessels 2020). Despite its not always ideal applicability in different industries and fields, the intrinsic valuation method is still

one of the most used methods today (Miciuła, Kadłubek, and Stępień 2020).

2.1.1. Discounted Cash Flow Analysis

When considering methods for determining a company's value, the DCF model is typically, although not exclusively, used. The analysis helps estimate an investment's worth based on its cash flows. To conduct this valuation, it is necessary to examine the three principal accounting statements: *Income Statement* (IS), *Balance Sheet* (BS), and *Cash Flow Statement* (CF). Additionally, company reports provide details that enhance and clarify the analysis (Hillier et al. 2021). As Tim Koller, Marc Goedhart, and David Wessels (2020) elaborate, it is crucial for the DCF analysis to transform these statements into a predictive format. Therefore, historical financial statements need to be scrutinized and adjusted to present a standardized view of the company's economic reality. This refinement process involves categorizing items into three sections: core operations, non-core operations, and financing activities in order to create forecasts of the company's performance. The significance of this approach lies in its ability to enhance the understanding of what drives a company's value. By reformulating the statements, analysts can calculate the *Free Cash Flows* (FCF), which are crucial for the DCF model. This allows to determine the *Present Value* (PV) of the free cash flows by assessing how much those cash flows are worth today. It achieves this by predicting the in- and outflows of investments and discounting them using a discount rate often referred to as the cost of capital. As a result, the DCF model provides a measure of intrinsic value for the investment (Haley 2018). Additionally, when valuing an asset using the DCF, it is essential to consider its risk. Riskier assets contain a higher discount rate, while less risky ones warrant a lower rate (Damodaran 2012). The DCF valuation model spans a risk continuum. On the one hand, a default-free zero-coupon bond promises a certain future cash flow, which is therefore valued by applying a riskless discount rate. As one navigates through increasing levels of risk, for example, in corporate bonds, the respective default risk must be represented in the discount rate accordingly.

When moving to even riskier assets like equities, the valuation becomes contingent upon expected cash flows and an adjusted discount rate that accurately represents the embedded risk and high level of uncertainty (Damodaran 2012).

2.1.2. Alternative Intrinsic Valuation Methods

Besides the DCF method, other options can be taken into consideration when valuing a firm. The dividend discount model, residual income model, or real options valuation are only some examples, among many others (Rosenbaum and Pearl 2020a). However, this paper focuses on the DCF method besides relative valuation methods, introduced in the upcoming chapter.

2.2. Relative Valuation Methods

Besides intrinsic valuation, relative valuation methods are widely used in corporate finance to determine the value of a company. These methods involve comparing the financial metrics and multiples of a company to those of similar companies in the same industry or market. By using this approach, analysts can assess the relative attractiveness and value of a company compared to its peers (Koller, Goedhart, and Wessels 2020).

One predominant approach for assessing a company's EV is the *Comparable Company Analysis* (CCA), which involves utilizing multiples (ratios) in which a measure of value, e.g., "price" is the numerator, and a relevant "performance measure generating cash flow" serves as the denominator. These ratios are observable for other companies that are considered similar or akin to (Larsen 2008).

Another commonly used approach is the *Comparable Transaction Analysis* (CTA). In this alternative relative valuation approach, past transactions of comparable companies are analyzed in order to determine the potential acquisition price (Rosenbaum and Pearl 2020a).

2.2.1. Comparable Company Analysis

CCA, also known as peer group analysis or multiples analysis, is a valuation method employed to ascertain a company's worth by comparing it with companies within the industry. The

underlying assumption is that comparable companies serve as benchmarks when determining the value of a target (Damodaran 2012). The analysis involves the calculation of ratios or multiples, like Price to Earnings (P/E) ratio, Price to Sales (P/S) ratio, or Enterprise Value to EBITDA (EV/EBITDA) ratio, for both the target company and similar companies in the industry (Koller, Goedhart, and Wessels 2020). When conducting this analysis, it is crucial to select companies with similar characteristics to the target asset. Factors such as industry, size, growth prospects, and financial performance should be taken into account when identifying these companies (Damodaran 2012). Additionally, a thorough examination of statements and market data is essential to ensure a good comparison (Pratt, Reilly, and Schweihs 2000). Moreover, when choosing peer companies for valuation purposes within industries like the oil and gas sector, one can customize multiples such as EV to EBITDAX (EV/EBITDAX), excluding exploration expenses. Alternatively, introducing entirely industry-specific metrics like Enterprise Value to Proven Reserves (EV/1P) can also be considered in this context (Bryan 2012).

2.2.2. Comparable Transaction Analysis

The CTA is another method in corporate valuation to determine and validate a valuation range for a target company. The approach involves examining past M&A-transactions of comparable companies to estimate a potential purchase price (Gaughan 2010). The CTA approach assumes that companies with comparable operating models, geographic coverage, and financial characteristics should have similar risk and return profiles, which are reflected in their transaction prices (Janiszewski 2011). Additionally, the size of the target company also influences the valuation process. Acquiring larger targets is associated with lower premiums. However, despite these lower premiums, acquiring larger targets tends to result in greater value destruction for acquirers in both the short and long term, while expected synergy gains are lower (Alexandridis et al. 2013).

2.3. Strategic Options

2.3.1. Mergers and Acquisitions (M&A)

Mergers and Acquisitions are strategic options for businesses aimed at creating value through integrating complementary operations (Rosenbaum and Pearl 2020a). The main concept behind M&A activities is to achieve synergies where the combined value and performance of two companies exceed their individual parts. Synergies can emerge from sources such as reducing costs, exploring revenue opportunities, or enhancing market positioning (Gaughan 2018).

2.3.2. Initial Public Offering (IPO)

In addition to M&A, an IPO offers another strategic option and represents a significant milestone in a company's journey, marking the transition from being privately owned to becoming a publicly traded entity. The main goal of an IPO is to raise capital, allowing companies to access markets for funding, growth, repaying debts, or pursuing corporate objectives (Rosenbaum and Pearl 2020a). Furthermore, an IPO often boosts a company's visibility and credibility, potentially opening up market prospects (Ritter and Welch 2002).

2.3.3. Additional factors: Geopolitical uncertainties

When considering political environments characterized by levels of uncertainty and volatility, strategic decisions for M&A transactions, IPOs, or opting against selling or going public, are influenced by various factors. According to Martynova and Renneboog (2005), economic and political uncertainties have an impact on M&A activities. These uncertainties can impact the valuation of target companies, the availability of financing options, and the strategic rationale behind acquisitions. During uncertain times, companies may opt for M&A as a strategy aimed at consolidating markets or acquiring strategic assets that provide them with a competitive advantage. However, uncertainty can also lead to hesitation and restraint among the parties involved. Moreover, when faced with uncertainty, making decisions regarding IPOs becomes more intricate. As highlighted by Ritter and Welch (2002), the volatility of the market can have

an impact on the timing and success of an IPO. During times of uncertainty, companies may choose to delay or reconsider their IPO plans due to market instability. This cautious approach aims to avoid undervaluation or a lack of investor interest (Baker, Pan, and Wurgler 2012). In fact, in periods of uncertainty, it is not uncommon for companies to prefer maintaining the status quo and focusing on efficiencies and organic growth strategies rather than dealing with the complexities and risks associated with external growth or exposure in the public market (Rosenbaum and Pearl 2020a).

Considering political uncertainties, it is crucial to exercise caution when evaluating options. Both short-term challenges and long-term strategic objectives should be carefully considered. This understanding is essential for assessing M&A as well as IPO strategies discussed in subsequent chapters, particularly within uncertain market environments.

3. Case Study: BASF's Wintershall DEA Divestment

3.1. Wintershall DEA

"Our ultimate decision to fully exit Russia was difficult, but the only possible decision to take."
– Mario Mehren, CEO (Wintershall DEA 2022a)

The changing economic and environmental landscapes have significantly impacted the strategic outlook of energy companies worldwide, particularly those involved in *Exploration and Production* (E&P). Wintershall DEA, an oil and gas company primarily owned by chemical industry giant BASF, has also been greatly affected by these geopolitical shifts. As a result of the Russian war of aggression against Ukraine, the company was forced to completely abandon its activities in Russia and write them off. Wintershall DEA's decision to completely withdraw from its operations in Russia resulted in a financial loss of €4.8 billion in FY2022. This loss stems from the fact that two-thirds of the company's oil and gas reserves were obtained through investments in Russia but are no longer accessible as assets. In line with BASF's strategy to reduce reliance on fossil fuels, they have been planning to sell their 73% stake in Wintershall

DEA for some time now. However, the ongoing conflict in Ukraine has added complexity to assessing its value and has clouded investor sentiment. This situation has potentially shifted the focus from an IPO to considering a sale to a strategic buyer. The estimated worth of BASF's stake is measured between six to eight billion Euros, making this divestment a significant financial and strategic move for the company (Handelsblatt 2023).

3.1.1. Company Description

Wintershall DEA AG is a leading European oil and gas company that mainly engages in the exploration and production of natural gas and crude oil (Wintershall DEA 2022a). The production portfolio spans three regions and eleven countries and was formed through the merger of Wintershall Holding GmbH and DEA Deutsche Erdöl AG in 2019. The crude oil and natural gas production of Wintershall and DEA amounted to a combined 215 *million barrels of oil equivalent* (BOE) pro forma in 2018 (Wintershall DEA 2019).

As previously stated, the companies' Russian oil and gas business was fundamentally impacted in 2022. The reassessment of the involvement in and control over the Russian entities resulted in the recognition that the criteria for sufficient control and influence were no longer being met due to limitations imposed by Russian decrees (Wintershall DEA 2022a). The presidential decrees effectively expropriated approximately two billion euros of working interest cash within the *Joint Ventures* (JV). Due to price caps, upstream investments in Russia were devalued from €4.7 billion to €240 million, causing a €4.5 billion non-cash charge and a significant €4.8 billion net loss in 2022 (Wintershall DEA 2022c).

3.1.2. Business Model

The oil and gas industry can be broken down into three major parts of the value chain, moving from the raw material to a marketable product: Upstream, midstream, and downstream. **Upstream** is the exploration and production of oil and gas, which is a business linked to high uncertainty, capital intensity, and long project durations (Inkpen and Moffett 2011). In the E&P

business, oil is measured in barrels and natural gas in cubic feet, with gas converted to barrels of oil equivalent (BOE) for comparability, using a ratio of 6,000 cubic feet of gas per boe. The **midstream** sector involves transporting or storing these raw materials, while the **downstream** sector focuses on processing them into consumer products like fuel, heating oil, or asphalt (McClay 2022).

The segments Northern Europe, Latin America, and Middle East/North Africa comprise Wintershall DEA's E&P activities. These activities can be further specified as exploration, appraisal, field development, and production. The company's revenues are almost entirely based on oil and gas sales and trading activities, with the revenue amounting to €18.549 million in FY2022 (including the Russian business). The FY2022 revenue consists of 82% gas sales and trading, 17% oil sales and trading, and 1% other revenue sources, including the midstream business (see Figure 6). The record gas sales in FY2022 are attributable to the sharp rise in northern European gas prices because of the Ukraine war. The average realized gas price of the Northern Europe division increased by 218% from 7.92$/mscf in FY2021 to 17.32$/mscf in FY2022 (Wintershall DEA 2022a). In FY2022, the company reported 321 mboe/d production, of which 65% came from gas. Furthermore, the *Proven and Probable* (2P) oil and gas reserves stood at 1,400 Mmboe at the end of FY2022 (excluding Russian reserves). The Russian production in FY2022 accounted for 46% of the total production (Wintershall DEA 2022a). The business model's success relies on several general critical factors such as hydrocarbon prices, fluctuations in foreign exchange rates, regulatory/political developments and correct estimation of recoverable reserves (Wintershall DEA 2022a). Table 1 below shows how changes in oil and gas prices, compared to the basic scenario in Appendix C3, affect the expected revenue from oil and gas in FY2024.

		Gas Price						
		-15.0%	-10.0%	-5.0%	0.0%	5.0%	10.0%	15.0%
Oil Price	-20.0%	9,435.05	9,919.37	10,403.69	10,888.01	11,372.33	11,856.65	12,340.97
	-15.0%	9,539.75	10,024.07	10,508.39	10,992.71	11,477.03	11,961.35	12,445.67
	-10.0%	9,644.46	10,128.78	10,613.10	11,097.42	11,581.74	12,066.06	12,550.38
	-5.0%	9,749.16	10,233.48	10,717.80	11,202.12	11,686.44	12,170.76	12,655.08
	0.0%	9,853.86	10,338.18	10,822.50	11,306.82	11,791.14	12,275.46	12,759.78
	5.0%	9,958.57	10,442.89	10,927.21	11,411.52	11,895.84	12,380.16	12,864.48
	10.0%	10,063.27	10,547.59	11,031.91	11,516.23	12,000.55	12,484.87	12,969.19
	15.0%	10,167.97	10,652.29	11,136.61	11,620.93	12,105.25	12,589.57	13,073.89
	20.0%	10,272.67	10,756.99	11,241.31	11,725.63	12,209.95	12,694.27	13,178.59

Table 1: Oil and Gas Revenue 2024 Price Sensitivity Base Case (in €M)

E&P companies are special in that their main assets, oil and gas reserves, are diminished by production. Companies in this business must, therefore, constantly invest in the development of new reserves to secure their value in the long term. From an investor's point of view, the value of the E&P business lies in the reserves that are accessible. The value attached to these is, in turn, strongly dependent on future expectations regarding commodity prices (R. Kumar and Sukumaran 2017). In the oil and gas industry, 2P reserves are estimates of hydrocarbon quantities that can be economically extracted with current technology. 'Proved' reserves have a 90% or higher confidence level of meeting or exceeding estimates, while 'probable' reserves imply a 50% or higher confidence of surpassing both proved and probable estimates combined (Demirmen 2007). Table 9 shows the breakdown of reserves in the various areas where Wintershall DEA operates, their development status, and the change compared with 2021. The loss of the Russian business resulted in the severe loss of 2,116 Mmboe of oil and gas reserves. With the energy sector being in a historical transition, Wintershall DEA will need to adapt its business model towards less carbon intensity to sustain itself and comply with the regulatory environment (IEA 2020). The company aims to intensify efforts to decrease its Scope 1 and Scope 2 emissions, which are the CO2 emissions produced during gas and oil production (Wintershall DEA 2022a). The planned projects towards less carbon intensity are explained in Appendix C1.

3.1.3. Industry Analysis

The market turmoil in 2022 caused by the Russian invasion of Ukraine led to high and volatile energy prices, causing record profits for oil and gas producers. The upstream industries' *Capital Expenditures* (CapEx) reached $499 billion, the highest amount since 2014 (see Figure 1). The increase in CapEx compared to 2021 is due to higher costs and an increase in production activities. This is shown by the fact that *year-over-year* (YoY) cost inflation increased by 20%, while the number of drilling rigs also increased by 22% YoY (International Energy Forum 2023). In the period from 2015-2021, E&P companies faced challenges in investment due to limited capital, attributed largely to a low commodity price environment and other factors like weak cash flow and dependence on external capital. In contrast, the situation shifted significantly in 2022 and beyond, where companies now experience excess capital coming from record profits and a higher commodity price environment. The prevailing challenge, therefore, pivots from capital availability to decision-making regarding the optimal allocation of the available capital. E&P companies are at a point where they need to decide whether to reinvest their financial gains in upstream activities, either by improving existing developments or embarking on new projects. Alternatively, they could consider using these surplus funds for other purposes, such as returns to shareholders and stakeholders or investment in low/alternative carbon assets (International Energy Forum 2023).

3.1.4. Macroeconomic and Risk Analysis

The global oil and gas industry faces significant challenges in adapting to climate change and shifting investor sentiment. With the need to halve emissions by 2030 and mixed investor outlooks, companies are navigating risks like financial loss and societal rejection (IEA 2023). Different scenarios like overinvestment or underinvestment in oil, gas, or low-carbon alternatives, along with regional variations in demand, shape the industry's future. This is further outlined in Appendix C2.

3.1.5. BASF's Strategic Options (M&A vs. IPO vs. No-Sell)

Looking at the future of its 73% stake in Wintershall DEA, BASF has several strategic options. One possibility is pursuing an M&A approach, where BASF could sell its stake to another company. This strategy will be viable if a strategic buyer who is keen on expanding their presence in the oil and gas sector is found to capitalize on Wintershall DEA's existing production portfolio. Alternatively, BASF could opt for an IPO of Wintershall DEA. Yet, the effectiveness of this strategy might be hindered by market volatility and investor attitudes towards the energy sector, particularly due to the current energy shift and environmental issues. The third option for BASF is to maintain its stake in Wintershall DEA because of a belief in the potential future value of the company.

3.2. Applied methodology: Analysis & Valuation

When considering the options for BASF's divestment, the fair value of Wintershall DEA needs to be determined. This involves applying the in Chapter 2) introduced valuation methods DCF, CCA, and CTA while incorporating pertinent literature to guide the analysis (Damodaran 2012; Gaughan 2018; Koller, Goedhart, and Wessels 2020; Rosenbaum and Pearl 2020; Hillier et al. 2021). The underlying data was collected and analyzed from the annual reports of Wintershall Holding GmbH, Deutsche Erdöl AG, the merged entity Wintershall DEA, and other sector-related companies, as well as Refinitiv and Fitch Ratings. The date of valuation is set to the 1st of July 2023.

The **DCF valuation** utilizes published data from Wintershall DEA as well as the pre-merger companies Wintershall Holding GmbH and Deutsche Erdöl AG. The revenues of the two companies prior to the merger were consolidated, allowing for more significant insights into the company's economic development since 2016 (see Table 6). Based on Rosenbaum and Pearl (2020), this paper follows five discounted cash flow analysis steps to derive the company's fair value (see Table 3). **Step (I)** involves **studying the target** and determining **key performance**

drivers. This can be further separated into two parts, of which the **target's study** is examined within Chapter 3.1 of this paper and involves markets and industry analysis, macroeconomic factors, and a risk assessment. The results of this analysis can be consulted in the corresponding chapter but will also be found in financial indicators used in the valuation. Determining the **key performance drivers** for Wintershall DEA hinges on the recognition that in the E&P business, reserves constitute significant assets and a fundamental metric of a company's valuation (Odo et al. 2016). Therefore, they can be recognized as the essential key performance driver in the analysis of Wintershall DEA, besides related drivers such as current and future oil and gas prices as well as CapEx and impairments on these reserves due to price fluctuations. **Step (II)** proceeds with the **projection of the Free Cash Flow (FCF)**. The FCF is the amount a company can pay out to all its investors after investing in business growth (Hillier et al. 2021). The FCF differs from the net income as it's the cash available to all investors and, therefore, must be calculated before interest payments.

$$FCF = EBIT * (1 - T) + D\&A - CapEx - \Delta NWC$$

Equation 1: Free Cash Flow

When projecting the FCF, an estimation of the future is made (Brealey, Myers, and Allen 2019). To make this estimation of Wintershall DEA's future reasonable, a reformulation with forecast assumptions of the underlying balance sheet and income statement is carried out first. This helps to create a viable scenario for future projections covering FY2023e to FY2033e (Koller, Goedhart, and Wessels 2020). The forecasted reformulated financials can be found in Table 6 and Table 7. Assumptions and details on the forecasted financials and the financial reorganization are provided in Appendices C3 and C4. Cash flows not influenced by the capital structure are determined using the EBIT framework. These cash flows are accessible to both shareholders and creditors, as well as other non-equity stakeholders (Rosenbaum and Pearl 2020). To arrive at the Unlevered Net Income, estimated corporate taxes are subtracted from

EBIT, as explained by Rosenbaum and Pearl (2020). Effective corporate tax rates (44%) are presumed to forecast FY2023e and forward. These relatively high tax rates are due to special E&P industry-related effects and deferred tax accounting, further detailed in Appendix C3. Following this, Unlevered Net Income values are subject to adjustments to derive the FCF based on the forecasted accounting data. These adjustments entail the reinstatement of non-cash items like depreciation, amortization, and impairments, which were previously subtracted from EBITDA to calculate EBIT (Hillier et al. 2021). The non-cash expenses may reduce reported earnings, but they do not impact FCF, necessitating their addition back to the Unlevered Net Income value. Additionally, YoY increases in *Net Working Capital* (NWC) are subtracted (Hillier et al. 2021). Furthermore, Unlevered Net Income values are adjusted by deducting annual CapEx, ultimately deriving the proposed future FCF.

Within **Step (III),** the *Weighted Average Cost of Capital* **(WACC)** is calculated before the companies PV of future free cash flows can be derived (Rosenbaum and Pearl 2020):

$$WACC = r_E \frac{E}{D+E} + r_D(1-T_c)\frac{D}{D+E}$$

Equation 2: WACC

The WACC calculation is illustrated in Table 15. E and D represent the market values of a firm's equity and debt, r_E the cost of equity and r_D the cost of debt with T_c as the marginal corporate tax rate (Brealey, Myers, and Allen 2019).

$$r_E = r_f + \beta_L(r_M - r_f) + CRP_i$$

Equation 3: Capital Asset Pricing Model

The cost of equity r_E represents the compensation the market demands in exchange for owning the asset and bearing the risk. It's calculated by using the *Capital Asset Pricing Model* (CAPM) (Hillier et al. 2021), which includes the risk-free rate r_f, a levered company beta β_L and the market risk premium r_M (MRP) and – in the special case of Wintershall DEA – a company risk

premium CRP_i as illustrated in equation (3).The applied risk-free rate r_f of 4.78% was based on the yield curve rate of a 10-year U.S.-government bond, which is commonly used as a standard proxy for the risk-free rate (Rosenbaum and Pearl 2020). With Wintershall DEA being headquartered in Kassel, the MRP r_M of 5% for Germany, was retrieved based on Damodaran (2012) on NYU Stern data for country risk premiums. For Wintershall DEA, a company specific risk premium CRP_i of 5% has been added, necessary for a more realistic and accurate valuation in light of its unique circumstances (Altman 1968; Pettit 1972). A more detailed description of this rationality can be found in Appendix C5.

Beyond that, in the case of Wintershall DEA as a private company, determining the cost of equity r_E, target capital structure, and beta β_L involves referencing a set of industry peers listed on the stock exchange with market capitalization. Based on Damodaran (2012), firstly, the target capital structure can be established by calculating the mean debt and equity ratio among these industry peers. Next, the industry beta β_{iL} needs to be calculated. To eliminate the distorting effect of different debt-to-equity ratios of comparable firms on beta β_L, it is necessary to compute the de-levered beta β_U for each firm (see Table 15).

$$\beta_U = \frac{\beta_L}{\left(1 + (1 - T_c) * \frac{D}{E}\right)}$$

Equation 4: De-levered Beta

The obtained industry average de-levered beta β_{iU} can be used to derive the re-levered beta β_L for Wintershall DEA of 1.65 using the assumption that the Wintershall target net debt equity ratio is the industries average. Beyond, the method of enterprise value weighted average has been used, yielding marginal differences (Rosenbaum and Pearl 2020). The procedure is further outlined in Appendix C6. For the derivation of the cost of debt r_D in line with R. Kumar (2016), r_D is the *Yield to Maturity* (YTM) of a Wintershall DEA long-term bond, which matures in 2031. The YTM of 4.88% is retrieved with Refinitiv (Refinitiv Eikon 2023)

For the final WACC calculation, all derived values need to be plugged into the equation (2). The weights for r_E and r_D are based on the mean of the peer's capital structure (see Table 15). According to Rosenbaum and Pearl (2020) moving on to **step (IV),** the *Terminal Value* (**TV**) is determined. Based on the defined time horizon until FY2033e, the FCF of the last year of projection is used. The growth rate g represents the expected rate at which the company's cash flows will grow in the future. Considering that oil and gas reserves are finite and depleting, but presumably not until FY2033e, a growth rate of 1% has been assumed for the base scenario (Table 16). The pre-defined time-adjusted discount rate $WACC$ minus g is used to discount the future cash flows to their PV.

$$TV = \frac{(FCF_n * (1 + g))}{(WACC - g)}$$

Equation 5: Terminal Value

Within **step (V),** the previous steps are combined, calculating the **PV** and **determining the valuation**, ultimately deriving the PV of future cash flows (Rosenbaum and Pearl 2020).

$$EV = \sum_{i=1}^{n} \frac{FCF_i}{(1 + WACC)^i} + \frac{TV}{(1 + WACC)^n}$$

Equation 6: Enterprise Value

The model employs the Gordon Growth Model to compute the PV of the TV using the perpetual growth approach, as illustrated in the second part of equation 6 (Gaughan 2018). The implied EV of Wintershall DEA is represented by the summation of PV calculations for FCFs and the TV. A sensitivity analysis is conducted to assess the impact of adjustments in the WACC and alterations in terminal growth rates on the implied EV. Ultimately, the implied equity value of Wintershall DEA is applied by subtracting the total interest-bearing debt (see Table 16).

Next, in line with Rosenbaum and Pearl (2020), the **Comparable Company Analysis (CCA)** is conducted using five steps (see Table 4). **Step (I)** comprises to select a universe of **comparable companies** for Wintershall DEA. To conduct a comparable company analysis in

the E&P sector and derive an EV for Wintershall DEA, some special features must be considered. According to Howard and Harp (2009), to find appropriate comparable upstream companies, it is important to look at different characteristics: the company's size (market cap or reserves), gas and oil mix (reserves or production), reserve life (proved reserves divided by last year's production volume), and lastly areas of operations (e.g., onshore vs. offshore). Wintershall DEA's production is globally spread out with a strong emphasis on Northern Europe. The daily offshore and onshore production in FY2022 of 321 mboe consists of 65% Northern European production, 15% Middle East/North African production, and about 20% Latin American production. The company is focused on natural gas, with the overall daily production commodity mix being 65% gas. The total 2P reserves stood at 1,400 mmboe, of which 1,000 mmboe are proven reserves. Since it is a major challenge to find publicly listed E&P companies with identical global production profiles, oil and gas mix, offshore, onshore mix, and reserves, the comparable company universe must be approximated with slightly different exploration and production company profiles. The set of comparable firms consists of globally diversified, American and Northern European E&P companies (see Table 19). The 1P reserves and daily production volumes of the comparable companies are obtained by a closer examination of the respective annual and 10-k reports. To further conduct the CCA in **Step (II),** the necessary **financial information** of the comparable companies is obtained using the financial information tool Refinitiv (Refinitiv Eikon 2023). This includes stock price, market capitalization, and net debt to ultimately compute the EV, EBIT, EBITDA, EBITDAX, and Earnings. In **Step (III),** the relevant **trading multiples** are derived. Important ratios among others in the oil and gas sector are EV-to-proven reserves, EV/daily production and EV/EBITDAX. EBITDAX is an important metric when analyzing upstream firms as exploration costs are inherent risks of the upstream business. By excluding exploration costs, EBITDAX offers a view of the company's operational efficiency in producing oil and gas,

irrespective of its exploration success or failure (Howard and Harp 2009). The trading multiples are displayed in Table 20 where the 75th percentile, average, median, and 25th percentile implied multiples are computed. Next, during **step (IV)**, the comparable companies are benchmarked against Wintershall DEA concerning their reserves, daily production levels, and reserve life. Looking at the high northern Europe production exposure of Wintershall DEA and the lack of comparable companies with similar reserves and simultaneously a comparable global portfolio, the closest peers for the final relative valuation are Aker BP, Var Energi, and Ithaca (n=3). Lastly, in **Step (V)**, the 25th percentile and 75th percentile multiples of the identified closest peer group within the E&P sector are used to derive a valuation range for Wintershall DEA's EV, equity value, and, ultimately, BASF's share value.

Thirds, following the procedure outlined by Rosenbaum and Pearl (2020b), the **Comparable Transaction Analysis** (CCA) is conducted using five steps (see Table 5). In **step (I)**, the universe of comparable acquisitions in the oil and gas E&P sector is determined. The screening for comparable past transactions is conducted with the financial information tool Refinitiv (Refinitiv Eikon 2023), using the following steps and screening criteria. The search parameters are adjusted for M&A, focusing specifically on transactions that have been finalized. For the M&A category, the emphasis is on transactions where the financial details have been publicly revealed. To identify deals similar to those in the industry where Wintershall DEA is active, the criteria for the business activities of the companies being acquired are specified to encompass activities related to the exploration and production of oil and gas. For a better understanding of historic deals and changes over time, the date is set to a larger timeline from FY2014 until today. The screening results in 338 completed exploration and production M&A transactions. Within **step (II)**, the relevant deal-delated and financial information is gathered. The target name and country, acquirer name and country, date of the announcement, EBIT *last twelve months* (LTM), EBITDA LTM, deal value, and EV are obtained. The dataset is cleaned,

excluding “n/a” values as well as outlier values. Furthermore, only deals with an EV higher than 500 $M are used due to more consistent and reliable data. The resulting final dataset contains 33 transactions. Having the relevant data assembled, **step (III)** involves spreading key statistics, ratios, and transaction multiples for each comparable deal. This step is fundamental in generating a standardized data set that facilitates direct comparisons. By analyzing valuation ratios like EV-to-EBITDA or EV-to-EBIT, a deeper understanding of the valuation landscape and how different transactions are priced can be obtained. The historical transactions and their key statistics are displayed in Table 23. **Step (IV)**: To ensure comparability in terms of the current valuation sentiment in E&P-related M&A transactions, only the transactions from 2022 onwards are considered as a benchmark. Lastly, in **Step (V),** an implied valuation range can be computed for Wintershall using the 25^{th} and 75^{th} percentile of the comparable transactions EV/EBITDA, EV/Sales, and EV/EBIT multiples (Rosenbaum and Pearl 2020).

3.3. Results & Discussion

In the subsequent sections, the outcomes of using DCF, CCA, and CTA in evaluating Wintershall DEA’s EV will be explored and discussed.

3.3.1. Discounted Cash Flow Analysis

The results of DCF analysis are based on five influential factors: 1) revenue volatility driven by fluctuating prices and uncertain quantities, 2) substantial EBITDA margins, 3) significant obligations through depreciation, amortization, and depletion as well as taxes, 4) volatile but overall stable *Unlevered Free Cash Flow* (UFCFs) and 5) customized considerations for the WACC rate. Due to the special nature of the various influencing factors, especially revenues, various scenarios have been created, described in Tables 16, 17, and 18.

Regarding future revenues, underlying assumptions are anchored in the constancy management of resources. A steady output from existing reserves is expected, maintaining production volumes until these reserves are exhausted. Complementarily, Wintershall DEA plans to

commission new oil and gas fields, effectively balancing the output from declining older fields, leading to overall production volumes of around 110 to 130 million boe per year. On the pricing front, stable oil and gas prices are projected in the short term, up to FY2025e, providing a prosperous revenue stream in the near future. However, from FY2026e onwards, a gradual decline in prices is anticipated, reflecting the sector's volatility and the range of expert market analyses considered (IEA 2022; Fitch Ratings 2023; Refinitiv Eikon 2023). This results in sustained revenue levels, exceeding €11 billion annually until FY2025e, following a record year in FY2022 when the company achieved an all-time high revenue exceeding €18 billion. Yet, post FY2025e, a gradual decrease in revenues is anticipated, with projections indicating a decline to approximately €6 billion by FY2033e (see Table 7).

Next, the DCF valuation considers substantial high EBITDA margins, historically being significantly above 40% (see Table 7). This can be identified as industry-specific in comparison to peer companies but clearly above many other industries. Companies operating in the E&P business typically incur high upfront capital expenditures for exploration and production, but once operational, the incremental costs for extracting oil and gas are relatively low (Wright and Gallun 2008). Since EBITDA excludes non-cash expenses like D&A as well as depletion, which are significant in this industry, it tends to show high EBITDA margins, reflecting efficient operational earnings before these costs. Based on the forecasted revenues and costs for exploration and production, the high EBITDA margin is not expected to be subject to change, constantly adjusting to a level of 44%.

However, the mentioned costs not included in the EBITDA, play a critical role as the third key factor in the DCF analysis. Their significant impact on unlevered net income effectively offsets the positive contribution of the EBITDA margin. Being a direct consequence of the industry’s capital-intensive nature, as previously highlighted, these costs are capitalized and then systematically expensed over time through D&A. Additionally, depletion being unique to

resource extraction industries like E&P, results in large associated charges, given the significant investment in assets like oil wells and natural gas reserves, which have a finite productive life (Wright and Gallun 2008). These expenses, having subtracted, results in large deductions for Wintershall DEA at a constant level until FY2033e. Further detailed in Appendix C4, taxes – especially deferred tax liabilities – play another distinctive role, resulting in a slightly higher rate of around 44%, decreasing the Unlevered Net Income. Between FY2023e and FY2033e, Wintershall DEA's Unlevered Net Income is projected to keep an overall high-level short term, rising to €1.98bn in FY2025e while experiencing a decline until FY2033e to €0.79bn. This forecast is grounded in the expected dynamics of the E&P sector, including short-term above-average projections of crude oil and natural gas prices, which normalize and fall below the average level.

Based on Rosenbaum and Pearl (2020), to derive at UFCF, the costs for D&A and depletion, and increases in NCW are added back while CapEx are subtracted, leading to short-term volatile but overall stable values of UFCF until FY2033e, yielding to €1.64bn in the terminal year.

The fifth pivotal component in the DCF valuation is the estimated customized WACC. For Wintershall DEA's WACC of 15.67% has been applied as a discount factor to derive the PV of UFCF and TV (see Table 15). The values for the WACC are determined after an analysis of the cost of capital, which depends on three factors: the levered beta ß$_L$, a company-specific risk premium CRP_i and the cost of debt r_D. The levered beta ß$_L$ is a key element in evaluating systematic risk and is calculated based on industry peer analysis (see Table 15). Levered equity beta coefficients are derived from comparable firms with Wintershall DEA's ß$_L$ calculated at 1.65. This high beta value (above 1) indicates a level of heightened market risk (Hillier et al. 2021), reflecting the volatile nature of the energy sector and Wintershall DEA's geopolitical market position. To further justify the ß$_L$ calculated using CCA peers, a calculation based on a global set comprising 161 E&P companies is also conducted. When using this set for

Wintershall DEA's levered equity beta calculation, ß$_L$ remains high at 1.93, which is even 9% higher. The broader market sentiment captured by this set may reflect uncertainties affecting the sector. Additionally, a company risk premium CRP_i, detailly described in Appendix C5, is incorporated to further adjust the WACC. For Wintershall DEA, a premium of 5% is set to account for the challenges they face, such as the separation of their business and the uncertainties in the global energy market. This adjustment, although different from traditional CAPM models, is necessary to reflect Wintershall DEA's risk profile, especially considering recent losses in reserves. The cost of debt r_D are determined by looking at the yield to maturity (YTM) of Wintershall DEA's long-term bonds, which is calculated at 4.88%. This yield takes into account the credit risk and current market conditions affecting the company. Estimating Wintershall DEA's synthetic rating results in a notably high pre-tax cost of debt that significantly contributes to the overall WACC.

Considering all these factors and beyond, it is projected that the present PV of UFCFs for Wintershall DEA is projected within the range of €9.162 billion to €10.939 billion. In terms of valuation, evaluating Wintershall DEA's TV presents a PV ranging between €2.012 billion and €2.906 billion, assuming a perpetual growth model. The terminal growth rate varies across scenarios. It is set at 0% in a scenario where there are no prospects for industry growth but goes up to 2% in an upside scenario. After analyzing the combined value of UFCFs and PV of TV, the estimated Equity Value for Wintershall DEA falls within the range of €8.636 bn to €11.307 bn. This valuation considers the company's potential within the energy sector landscape and its strategic initiatives. It is important to note that since BASF divested its stake in Wintershall DEA, one needs to consider BASF's 73% share, resulting in a valuation range of €6.304 bn to €8.254 bn (see Table 16). The forecast period demonstrates a volatile but still, overall stable amount of FCFs, considering Wintershall DEA's proven reserves, current and future projects, and strategy towards more sustainability. It also thoroughly analyzes how variations in WACC

and terminal growth rates impact Wintershall DEA's Equity Value. An increase in WACC leads to a decrease in EV resulting in an EV decline of approximately €0.35bn. Conversely, raising the growth rate positively, increases EV, highlighting the significance of long-term growth expectations on the company's valuation (see heatmap in Table 16).

3.3.2. Comparable Company Analysis

The identified comparable firms (n=14) have an average market cap of $31.096bn, and average proved reserves of 2,087.8 mmboe, average reserve life of 10 years, and an average daily production of 0.583 mmboe (see Table 19). For the final comparable company valuation, three close peers to Wintershall DEA are identified. Given Wintershall DEA's focus on Norway and its plans for expansion in the country, it is reasonable to use E&P companies operating in Northern Europe as a benchmark. This assumption is reinforced by the variations in valuation multiples when comparing geographically diversified E&P companies with counterparts in Northern Europe (see Table 20). The higher EV/EBIT ratios compared to EV/EBITDA and EV/EBITDAX for both groups highlight a focus on operational income. This could imply that the market values efficient and current operations more than future earnings or exploration prospects. By prioritizing EBIT over EBITDAX, the market may signal a preference for firms with lower exploration risks and stable cash flow from existing operations.

Looking at EV/EBITDA, EV/EBITDAX, and EV/EBIT multiples, it can be observed that the market places much higher valuations on American and geographically diversified E&P companies. This could partially be explained by **(1)** the valuation gap between US and European oil and gas companies due to ESG concerns and strategy shifts. After initially shifting towards net zero targets, European oil and gas companies are now pivoting back to fossil fuels, which is partially due to geopolitical events like Russia's invasion of Ukraine. This shift includes major deals focusing on fossil fuel supply, particularly LNG from Qatar (IEA 2022). Despite this, European companies like Shell, TotalEnergies, and Eni are still valued lower than their U.S.

counterparts like Exxon and Chevron, who have made significant acquisitions in the oil and gas sector. This suggests that investor confidence in European firms may be lower due to their fluctuating strategies and an 'ESG discount', whereas U.S. companies are seen as more stable investments due to their consistent focus on traditional oil and gas production. This difference in strategy and investor perception contributes to the valuation gap between European and U.S. oil majors (Bloomberg 2023). **(2)** American and diversified E&P companies might have better operational efficiencies and economies of scale, driving higher profitability and, consequently, higher EV/EBIT, EV/EBITDA, and EV/EBITDAX multiples. To further analyze the finding concerning region-based valuation differences on a larger scale, a set of E&P companies with headquarters in Asia Pacific (n=40), Europe (n=19), and North America (n=33) is analyzed. Interestingly, the previous finding also holds true for the larger set of E&P companies, with median EV/EBITDA, EV/EBIT, and EV/Sales ratios being higher for Asian Pacific and Northern American companies compared to European companies. Also, the discussed market emphasis on operational income can be observed using the larger set (see Table 22). Looking at EV/1P and EV/BOE/D multiples, higher valuations on American and geographically diversified E&P companies compared to Northern European companies can be observed. The valuation differences could be attributed to the quality and size of the reserves. Companies with larger or more lucrative oil and gas reserves (reflected in EV/1P) might command higher premiums. The quality of reserves in regions outside Northern Europe might be higher, leading to more efficient production and lower extraction costs (reflected in EV/BOE/D).

To derive a valuation for Wintershall DEA, the 75^{th} and 25^{th} percentile multiples of the Northern European peers are applied to the companies' financials. The resulting implied Enterprise Values, Equity Values, and BASF Share Values are displayed in Table 21. Looking at the different applied multiples, the comparable company analysis values the BASF stake on average between €5.921bn and €7.314bn. However, when considering the conducted analysis

on regional and multiple specific valuation differences for valuing Wintershall DEA, a blend of EV/EBIT, with consideration to EV/1P and EV/BOE/D for insights into reserve quality and production efficiency, seems appropriate. This approach takes into account both the market's preference for current operational profitability and the specific characteristics of Wintershall DEA's reserves and production capabilities in the Northern European context. This values the BASF stake between €6.499bn and €7.880bn.

3.3.3. Comparable Transaction Analysis

The identified comparable transactions (n=33) from FY2014 until FY2023, involving the acquisitions of E&P companies, are displayed in Table 23. The observed transactions have an average EV of €6.812bn. The mean (median) EV/Sales ratio is 4.23 (3.23), the EV/EBITDA ratio is 7.78 (6.15), and the EV/EBIT ratio is 19.24 (15.55). For the final valuation of BASFs stake in Wintershall DEA, only the transactions from 2022 onwards (n=6) are considered as the recent geopolitical events fundamentally impacted the oil and gas sector and potentially how acquirers view its business viability. For the implied Enterprise Value, Equity Value, and ultimately, BASF's share value, the 25th percentile and 75th percentile of the valuation ratios are used. The implied values are also displayed in Table 23. Looking at the different transaction multiples, a higher valuation and wider gap for BASF's share can be observed compared to the previous CCA. The three ratios of the comparable transaction analysis value the BASF share on average between €11.052bn and €18,186bn. This observed discrepancy compared to the CCA typically arises due to two factors. Firstly, precedent transactions often include a control premium, reflecting the additional value buyers are willing to pay to gain control of a company. This premium is absent in a CCA, which assesses companies as stand-alone entities without control changes. Secondly, CTA valuations might capture specific synergies anticipated by the acquirer, which are unique to the transaction and not reflected in the market valuations used in CCA. These synergies can significantly increase the value of a company (Cornell 2013).

3.3.4. Review of Divestment Options

Based on the conducted valuations, BASF's divestment options are further examined. The subsequent chart illustrates the low and high values derived from the applied valuation methods.

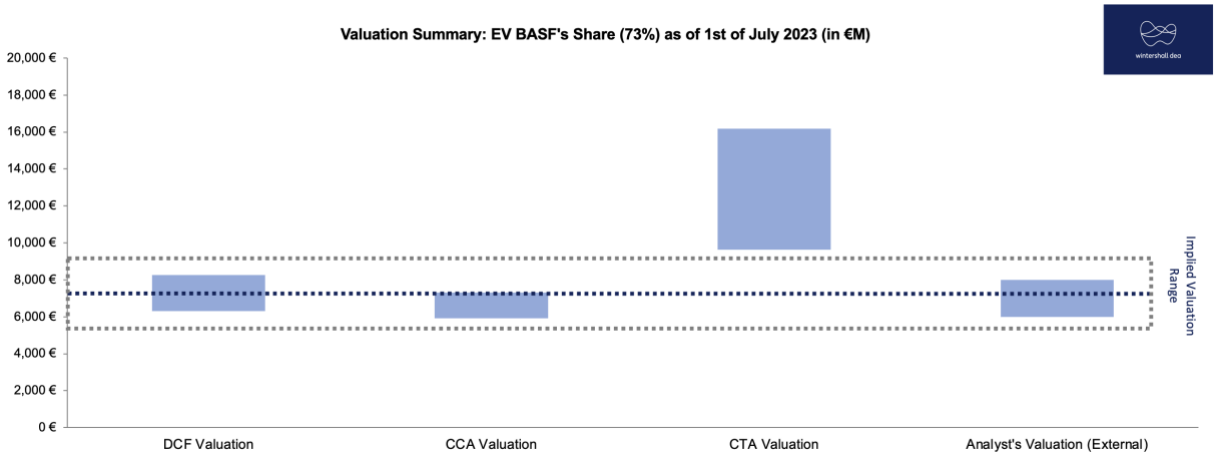


Table 2: Wintershall DEA - Football Field Chart

Both the CCA and DCF analyses yield valuation ranges that align closely with external analysts' opinions which suggests a consistent market perspective on Wintershall DEA's worth. However, the CTA, which examines recent transactions involving E&P companies, suggests a significantly higher valuation range. This disparity implies that strategic buyers, who may be seeking synergies, market expansion, or specific strategic assets, are potentially willing to pay a premium over the market valuation.

Based on this, the strategic direction of BASF must be considered. BASF is increasingly steering away from fossil fuels with a plan to invest up to €4 billion by 2030 in renewable energy sources, including wind parks and new technologies for CO2-free hydrogen production (BASF 2021). Based on these findings it would be more advisable for BASF to consider selling its stake, in Wintershall DEA to a strategic buyer than going forward with an IPO or keeping the stake. There are two main reasons for this suggestion: Firstly, the valuations obtained from DCF and CCA indicate that an IPO might not fully capture the value that a strategic buyer, drawn by synergies and a strategic fit could bring. Secondly, BASF's shift towards renewable

energies makes holding a stake in Wintershall DEA increasingly inconsistent, with its evolving business model and long-term strategic goals.

4. Key findings

The results of this paper provide a detailed valuation and exit analysis for the German Oil & Gas company Wintershall DEA. The work provides valuable insight for analysts, researchers, and professionals working in an oil- and gas-related field. Throughout the work, four key findings were obtained: **(1) Intrinsic valuation approaches (i.e., DCF) differentiate significantly throughout various industries**. This finding leads to the need to adapt intrinsic valuation methods. The sources and drivers influencing revenue play a key role, but also – similarly important – legally prescribed cost factors such as depreciation and taxes. In the case of Wintershall DEA, dependent on market prices for oil & gas, the price-quantity equation cannot be determined by the company itself, which makes revenue planning more complex. Likewise, cost planning can hardly be carried out efficiently without leading to strong fluctuations in the operating result. Industry-specific D&A, depletion, and tax liabilities additionally contribute to volatile returns. Hence, forecasts based on these historical statements are exceedingly difficult to carry out, only possible by developing various scenarios. **(2) The search for E&P-operating peer companies for relative valuation methods is subject to increased obstacles.** E&P companies are often highly geographically diversified and differentiated, with varying degrees of exposure to different regions, reserves, and production mixes. This diversity makes it challenging to find peers that closely resemble the specific geographic diversification and reserve profiles of a company like Wintershall DEA, which has a significant presence in Northern Europe. One solution to enhance the comparable analysis would be to replicate Wintershall DEA's geographic exposure. The portfolio replication process, in theory, involves creating a synthetic portfolio of companies that mirrors the operational and geographical exposure of the target company. However, in practice, this process

faces significant challenges. The availability of suitable peers in regions like Argentina and Egypt is nonexistent, as there are no suitable publicly listed E&P companies operating exclusively in these areas. Consequently, using peer companies in the region with most of the exposure delivers the most accurate results. **(3) In times of macroeconomic uncertainties and geopolitical tensions, underlying assumptions are subject to high uncertainty, increasing the sensitivity to input variables in corporate valuations.** This critical finding is further underlined through the study of Wintershall DEA. The sensitivity analysis of Wintershall DEA (see Table 16, 17, 18) shows significant differences in valuation for different scenarios on the one hand but even more distinct through varying assumptions on the cost of capital and growth. The change of only 50 bps for both cost of capital and growth can change the company's equity value from €9.91bn to €9.62bn. Considering, e.g., future political sustainability regulations, as just one of many potential influencing factors, the company's equity value can fluctuate significantly. As input factors are hardly ever definite or unbiased, the parameters have a high impact on the valuation. In addition, the reference values for key inputs stated in the CCA and CTA may also obtain obstacles, for example, by a biased sample selection. Even if comparable financial data is a key factor for an appropriate valuation, certain key figures are always subject to assumptions and are, therefore, inherently uncertain. **(4) Strategic exit options (M&A, IPO, or neither) depend not just on the strategic importance but particularly on the timing of the transaction.** For Wintershall DEA, targeting an IPO was the preferred option for a long time. Its strong market position within Europe, driven by successful projects and a robust future strategy, made the company an attractive potential investment on the stock market through an IPO. Nevertheless, as market conditions changed, an M&A deal seemed to become the more attractive option. Yet, rising interest rates and economic stagnation did not offer good conditions either. Wintershall DEA's holding company BASF must now face the question of whether both exit options are desirable or whether the oil and gas company should be kept in

the portfolio even if this does not fit the company's strategic objectives.

5. Conclusion

This paper provides an in-depth analysis of Wintershall DEA, especially focusing on the firms' Enterprise Value and the future strategic exit options for its holding BASF. Regarding the firm's valuation, the methods of DCF, CCA, and CTA have led to overall significant results with a moderate outlier due to the CTA analysis. As presented in Table 2 below, the results lead to a valuation range for BASF's share (73%) on Wintershall DEA of €5.75bn to €9.10bn. The valuation range encompasses a large range, which, however, reaches such a significant size due to the various scenarios that the company has to face in the future.

In general, the paper finds that while an IPOs was the favorable option for BASF's exit its share on Wintershall DEA, an M&A-deal became the more attractive option. However, even this option is also characterized by substantial uncertainty. The near future does not promise any easing of circumstances, which does not make a decision for BASF any easier. The decision for a future option can be monitored with great curiosity and used as a reference for future strategic corporate decisions.

Overall, the paper resulted in four key findings: First, intrinsic valuation approaches (i.e., DCF) differentiate significantly throughout various industries and need to be adapted accordingly. Second, the search for E&P-operating peer companies for relative valuation methods (i.e., CCA and CTA) is subject to a detailed analysis of the respective operating areas. Third, underlying assumptions are subject to high uncertainty, especially in times of macroeconomic uncertainties and geopolitical tensions. Finally, strategic exit options (M&A, IPO, or neither) depend not just on the strategic importance but particularly on the timing of the transaction.

6. A Portfolio Approach to Understanding Environmental Dynamics in the Oil and Gas Sector (written by Justus Schroeder-Wildberg)

Introduction

In the year 2022, the US oil and gas sector experienced a significant upswing and was the best performing sector concerning stock performance compared to other industries. This observation was largely explainable by increased profits due to volatile commodity markets following Russia's invasion of Ukraine. As a result, investors have been attracted back to fossil fuel stocks, with US oil and gas producer Occidental Petroleum leading the S&P 500 realizing a remarkable 120% rise in share price. This rebound is compared to the overall declining S&P 500 and the shifting investor sentiment away from fossil fuel producers in the recent past (Financial Times 2022). A survey by Wong et al. (2022) conducted in August and September 2021 analyses how professional investors think about the future of oil and gas. These interviewed professional investors are mainly concerned about how oil and gas companies can adapt and report within the evolving context of ESG related industry issues, particularly in relation to climate change and transition to net zero. They see the strong necessity for oil and gas companies to reduce direct emissions (Scope 1 and 2), and there is a noticeable push for transparent reporting of these achieved reductions. However, there is much less consensus on whether companies should report Scope 3 emissions (emissions related to product combustion) and whether these emissions are their responsibility. Regardless, there's a call for more verifiable reporting and interim targets tied to executive compensation to ensure genuine progress. Investors find frameworks like TCFD (Task Force on Climate-related Financial Disclosures) and SASB (Sustainability Accounting Standards Board) useful in assessing climate-related risks and ESG performance, although many still rely on qualitative assessments due to the lack of precise metrics. Furthermore, active engagement with companies is preferred over a divestment of the stake. As Wintershall DEA is increasingly involved in ESG-related activities (blue hydrogen

and carbon capture), it is crucial to investigate how the market views and prices the risks and returns of ESG-engaged firms in the oil and gas sector. This is directly relevant and adds on the previous valuation results, as a higher perceived risk could lead to a higher cost of capital and a lower valuation. Giese et al. (2019) observed that, on average, companies in the top quintile regarding their ESG (Environmental, Social, and Governance) scores demonstrate a lower beta, indicating a reduced systematic risk. This implies that such companies are less vulnerable to market-wide shocks and, according to the Capital Asset Pricing Model (CAPM), would be subject to lower capital costs. Consequently, in a Discounted Cash Flow Model (DCFM), these companies would be valued more favorably due to the expectation of lower required returns by investors associated with their lower market risk sensitivity. Wintershall DEAs leading position in transitioning the industry is also showcased by the ESG Risk Ratings by Sustainalytics where the company is ranked in the 4th percentile within the Oil & Gas Producers industry group and in the 5th percentile within the subindustry category of Oil and Gas Exploration & Production (Wintershall DEA 2021).

This part aims to contribute to the valuation of Wintershall DEA by highlighting the potential market perception of environmental sustainability as a factor in financial performance and risk assessment. In line with S. Kumar and Stearns (2023) who examine the relationship of ESG ratings and stock return in “sinful industries” using among others a portfolio approach, the analysis in this part is conducted by creating portfolios based on high and low Environmental ratings and using CAPM and Fama-French time series regressions to analyze how Environmental factors in the oil and gas industry contribute to the systematic risk and expected return of such constructed portfolios.

Literature Review

The relationship between ESG (Environmental, Social, and Governance) ratings and corporate performance has been a subject of extensive research. Friede, Busch, and Bassen (2015)

examined aggregated evidence from over 2000 empirical studies and found a positive relationship between ESG criteria and corporate financial performance. This is further supported by Li et al. (2022) who found evidence of the positive impact of ESG performance on stock prices during the COVID-19 outbreak in China. However, there are mixed findings concerning risk adjusted performance and abnormal returns of high and low rated portfolios concerning ESG ratings. Auer (2016), Alessandrini and Jondeau (2020) and Kempf and Osthoff (2007) find a positive impact of ESG based portfolio construction on risk return characteristics. On the other hand Bannier, Bofinger, and Rock (2019) Bruno, Esakia, and Goltz (2022) and Zehir and Aybars (2020) find worse or no significant abnormal returns linked to ESG based investing.

Between those who perceive a positive link between ESG criteria and stock market performance and those who perceive a negative link, there are some who discern no correlation at all, or only observe a correlation under specific circumstances. In a study by Hamilton, Jo, and Statman in (1993), it was discovered that sustainable funds didn't show a statistically significant outperformance compared to conventional funds. Nonetheless, investors focused on social responsibility and sustainability also don’t have to anticipate lower returns either. (Hamilton, Jo, and Statman 1993) Additionally, an event study, which analyzed the immediate impact on returns following announcements of positive or negative ESG issues, found no distinctly significant effects. (Cheung 2011) Brammer and Millington (2008) present a slightly different perspective. They argue that only extreme ESG ratings influence returns. Interestingly, the direction of these ratings appears to be irrelevant. Companies with either exceptionally high or exceptionally low ESG ratings tend to yield higher returns. Based on the reviewed literature the following Hypotheses are developed:

Hypotheses 1: In line with Auer (2016), Alessandrini and Jondeau (2020) and Kempf and Osthoff (2007) it is hypothesized that by constructing portfolios based on high environmental

ratings in the oil and gas sector investors improve their risk adjusted return.

Hypotheses 2: In line with Giese et al. (2019) it is hypothesized that portfolios with high environmental ratings in the oil and gas sector demonstrate lower sensitivity to market risk compared to portfolios with low environmental ratings

Asset pricing models

Capital asset pricing models aim to determine the required rate of return of an asset to compensate for its risk. These pricing models are based on the principle of no arbitrage which means that assets with similar risk should have similar expected returns. The capital asset pricing model (CAPM) developed by Sharpe (1964) states that the expected return of an asset is determined by its beta which is a measure of an asset's non-diversifiable risk relative to the market. According to the CAPM, the expected return of an asset is equal to the risk-free rate plus a risk premium that is proportional to the asset's beta. The CAPM therefore provides a framework for determining the required rate of return for an asset based on its systematic risk**.**

Equation 3.1: CAPM

$$\boldsymbol{E\ (R_i) = R_f + \left[E(R_M) - R_f\right] * \beta_{i,M}}$$

The expected return of an asset i, expressed as $\boldsymbol{E\ (R_i)}$ is equal to the risk-free rate $\boldsymbol{R_f}$ plus the premium $\boldsymbol{\left[E(R_M) - R_f\right]}$ for taking on one unit of market beta $\boldsymbol{\beta_{i,M}}$. The market beta can be considered as the sensitivity of asset i to the overall market risk. (Fama and French 2004) Jensen (1967) expanded the CAPM to include Alpha. Therefore, Alpha represents the portion of the return that cannot be explained by the assumption of systematic risk. The regression equation is therefore:

Equation 3.2: CAPM Regression

$$\boldsymbol{R_{i,t} - R_{f,t} = \alpha_i + \left(R_{M,t} - R_{f,t}\right) * \beta_{i,M} + \varepsilon_{i,t}}$$

The Fama-French Five-Factor model is an extension of the Capital Asset Pricing Model (CAPM) that aims to explain stock returns through five distinct factors. These factors include market risk (like the CAPM), but also size (small vs. large caps), value (high book-to-market vs. low book-to-market ratios), profitability (high vs. low operating profitability), and investment (conservative vs. aggressive investment strategies). This model states that securities with higher exposure to these factors will, on average, have higher expected returns (Fama and French 2014).

Equation 3.2: Fama French 5 Factor Regression

$$R_{i,t} - R_{f,t} = \alpha_i + M_t * \beta_{i,M} + SMB_t * \beta_{i,SMB} + HML_t * \beta_{i,HML} + RMW_t * \beta_{i,RMW} + CMA_t * \beta_{i,CMA} + \varepsilon_{i,t}$$

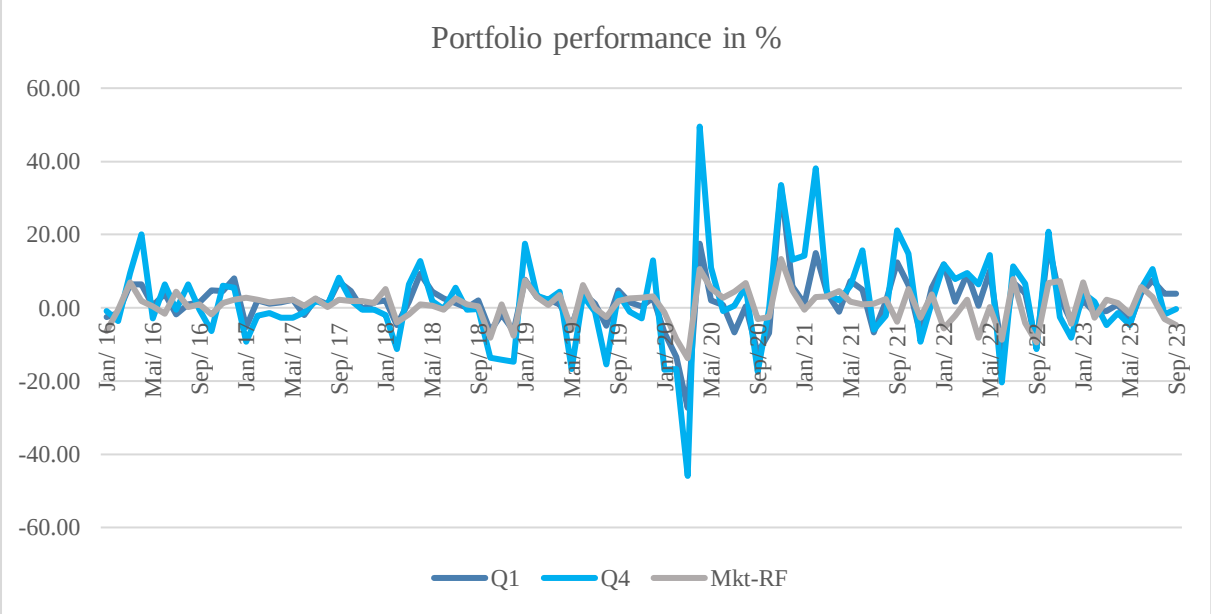
Data and Methodology

The portfolio construction in this analysis is based on the ESG ratings from Refinitivs ESG database. The respective data is sourced via an Excel plug-in. The relevant investment universe for the analysis is a selection of oil and gas companies from Europe and North America. To identify relevant companies for the analysis the Refinitiv industry screening for oil and gas is utilized to identify all the public companies within the sector that have an ESG rating. The environmental ratings for the oil and gas sector companies are retrieved for the period from December 31, 2015, to December 31, 2022, using the respective stock ISIN code. The portfolios are rebalanced annually on December 31st using the updated ratings from the previous year (ratings from year t-1 are applied to year t). Consequently, monthly returns from 2016 to 2023 for these companies are gathered via the Refinitiv Excel plug-in. The companies are sorted according to their respective ratings and are then divided into quintiles on a monthly basis. This approach to portfolio construction follows the methodology outlined by Bannier et al. (2019) , Giese et al. (2019) and S. Kumar and Stearns (2023) among others. Portfolio Q1 contains the securities with the highest ratings, while portfolio Q5 includes those with the lowest ratings.

This method of portfolio construction is chosen to create five equally sized portfolios in terms of the number of included stocks. The risk-free rate and risk factors $\boldsymbol{R_{f,t}}/\boldsymbol{SMB_t}/\boldsymbol{HML_t}/\boldsymbol{RMW_t}$ / $\boldsymbol{CMA_t}$ / $\boldsymbol{M_t}$ for the time period under consideration are retrieved from The Fama/French Data Library. (Fama and French 2023)

The dataset therefore comprises 180 publicly listed oil and gas companies from North America and Europe. The performance of the constructed high and low ratings portfolios against the market is displayed in Figure 3.1 below. Interestingly it can be observed that the lower rated portfolio is subject to an increased volatility for the observed period from 2016 to 2023. Due to heavy monthly return outliers regarding the lowest rated portfolio the Q4 portfolio is being analyzed instead.

Figure 3.1: Q1 and Q4 Portfolio Performance vs. Market Performance



Results and Discussion

The Results and Discussion section of this study aims to investigate whether companies in the oil and gas industry with high environmental ratings exhibit distinct risk-return characteristics compared to those with lower scores. The statistical tests carried out to ensure the reliability, validity, and adequacy of the model in capturing the relationship between the variables under

study are displayed in Appendix D.

Looking at Table 3.1 the CAPM regression **(3)** reveals a coefficient of 1.03 for MktRF indicating a beta slightly above 1. This suggests that the Q1 portfolio tends to perform better than the overall market during upward trends and slightly worse during downward trends. With a t statistic of 7.99 one can strongly reject the hypothesis stating that the coefficient is equal to zero (no effect). Such a high t statistic implies that MktRF significantly deviates from zero making it a significant predictor of portfolio returns. The intercept or alpha value is 0.81. However, its t statistic stands at 1.37 with a P value of 0.174 which is above the threshold of 10%, for significance. Consequently, it can be concluded that alpha does not significantly differ from zero indicating that the portfolio lacks, according to the CAPM, abnormal returns independent of market performance.

Table 3.1: Regressions coefficients Fama French 5 Factor (1)(2) and CAPM (3)(4)

	(1)	(2)	(3)	(4)
Variables	Q1_excess	Q4_excess	Q1_excess	Q4_excess
MktRF	1.149***	1.673***	1.032***	1.701***
	(10.10)	(7.66)	(7.99)	(7.57)
SMB	0.0427	1.293*		
	(0.12)	(1.97)		
HML	0.767**	1.438**		
	(2.51)	(2.45)		
RMW	-0.490	-0.406		
	(-1.16)	(-0.50)		
CMA	0.485	-0.151		
	(1.11)	(-0.18)		
Constant	0.921*	1.175	0.810	0.622
	(1.97)	(1.31)	(1.37)	(0.60)
N	93	93	93	93

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

For the Q4 Portfolio CAPM regression **(4)** in Table 3.1 the coefficient (beta) for MktRF is 1.7, which is higher than that of Q1. This suggests that Q4 is more responsive to market changes

compared to Q1. However, the intercept value is 0.62 and its p value is 0.55 indicating that it lacks significance. This implies that there are no abnormal returns for the Q4 portfolio.

In contrast to Q4, the Q1 portfolio shows according to the CAPM less sensitivity to market movements as evidenced by a lower beta coefficient. This could indicate that investors perceive companies with high environmental scores as less risky. While both the Q1 and Q4 portfolios display significant sensitivity for the MktRF factor it's important to note that neither portfolio exhibits statistically significant alpha. This suggests that both portfolios are not achieving different returns, from what would be expected based on their systematic risk level.

Looking at the Q4 Fama French 5 factor regression **(2)**, the model explains 58.74% of the portfolio's variability, with an adjusted R-squared of 0.56, suggesting a decent fit of the model and a higher explanatory power compared to the CAPM. The model's F-statistic is significant (Prob > F = 0.0) which indicates that the set of factors together significantly explain the returns of the Q4 portfolio. Specifically, the market risk factor (MktRF) and the High Minus Low book-to-market factor (HML) are statistically significant with coefficients of 1.7 and 1.4, respectively, and p-values of 0.00 and 0.016. This implies that the Q4 portfolio is positively and significantly exposed to market risk and to value stocks. The Size factor (SMB) has a coefficient of 1.3 and a p-value of 0.052, which is marginally significant at the 10% level which implies a small-cap tilt in the Q4 portfolio. The other two factors used in the regression, RMW and CMA, are not statistically significant.

When looking at the Q1 Fama French 5 factor regression **(1)**, the R-squared is even higher at 0.68, with an adjusted R-squared of 0.66. This finding indicates that the model explains a greater proportion of the portfolio’s variability compared to the Q4 portfolio. The F-statistic is again significant (Prob > F = 0.0). The MktRF factor tilt is highly significant with a coefficient of 1.15 and a p-value of 0.00. This implies that this portfolio's performance is closely tied to the market's performance. HML is also significant (p-value = 0.014) with a coefficient of 0.77. The

HML factor sensitivity is lower than for Q4 which suggests a less pronounced value stock orientation than in the Q4 portfolio. The RMW and CMA factors are not significant, which is similar to the findings concerning the Q4 portfolio.

When contrasting the two conducted Fama French 5 factor regressions for the returns of the high and low rated portfolios a significant relationship with the market risk factor can be observed. However, the observed sensitivity in terms of market risk is much lower for the high rated portfolio (Q1) compared to the lower rated portfolio (Q4). Furthermore, the constructed Q1 portfolio shows a lower but significant relationship with the value factor (HML) compared to the Q4 portfolio. This could imply that the high rated oil and gas companies are not as deeply embedded in the value risk factor space as their lower-rated counterparts.

To summarize the Fama French 5 factor regression analysis, it can be observed that the high environmental rating portfolio (Q1) has a more stable and less pronounced exposure to size and value factors compared to the second lower rated portfolio (Q4). This could be interpreted as high rated firms being larger and also more growth-oriented than those in the Q4 portfolio. Growth-oriented firms typically prioritize reinvesting their earnings for expansion and innovation rather than paying out dividends or focusing on value-based strategies. This aligns with the idea that they are investing in environmentally friendly practices as part of their growth strategy. High Minus Low (HML) is a value premium representing a spread in returns between companies with a high book-to-market value ratio and companies with a low book-to-market value ratio. (Fama and French 2014) Consequently, this finding of less value factor exposure could also reflect a premium that investors put on high rated firms which is typically associated with lower book-to-market ratios. The observed insignificant results for RMW and CMA factor sensitivity for both portfolios suggest that these specific factors do not distinguish between the returns of high and low rated firms.

Conclusion

The quantitative analysis conducted in this part of the thesis using factor regressions on portfolios with different environmental scores provides insightful data. The findings valuable in several aspects of the valuation of BASF's share in Wintershall DEA, especially considering Wintershall DEA's involvement in blue hydrogen and carbon capture. The previous findings form the different regression analysis supports *Hypotheses 2* and suggest in line with Giese et al. (2019) that a higher environmental score leads to an investor's perception of lower risk and therefore lower cost of capital, which consequently increases a company's valuation through a lower discount rate on future cash flows. Furthermore, the observed higher R-squared for portfolio Q1 in the Fama-French regression shows that companies with higher environmental scores have returns that are better explained by the five risk factors which indicates a more predictable performance. This finding could be fundamental in improving investor sentiment towards Wintershall DEA if its business practices towards reducing CO2 emissions are seen as contributing positively to the predictability of portfolio performance. *Hypotheses 1* is supported when looking at the regression alpha, meaning the observed significant abnormal return, in the Q1 portfolio under the Fama-French model assumption. It can be concluded that oil and gas firms with strong environmental characteristics and future business viability may achieve returns that outperform those predicted by traditional risk factors. This poses an incentive to continue its engagement in sustainable practices, as it could lead to better valuation and investor appeal. These findings bring several implications for BASF's strategic alternatives. If investor sentiment is leaning towards environmental sustainability as an indicator of a firm's long-term potential and resilience, this could strengthen the case for holding onto the shares or possibly achieving a higher price in an IPO due to the expected premium on environmentally responsible companies. Furthermore, the outperformance characteristics as seen in the Q1 portfolio's positive alpha under the 5-factor regression, could be used as a major selling point in an IPO.

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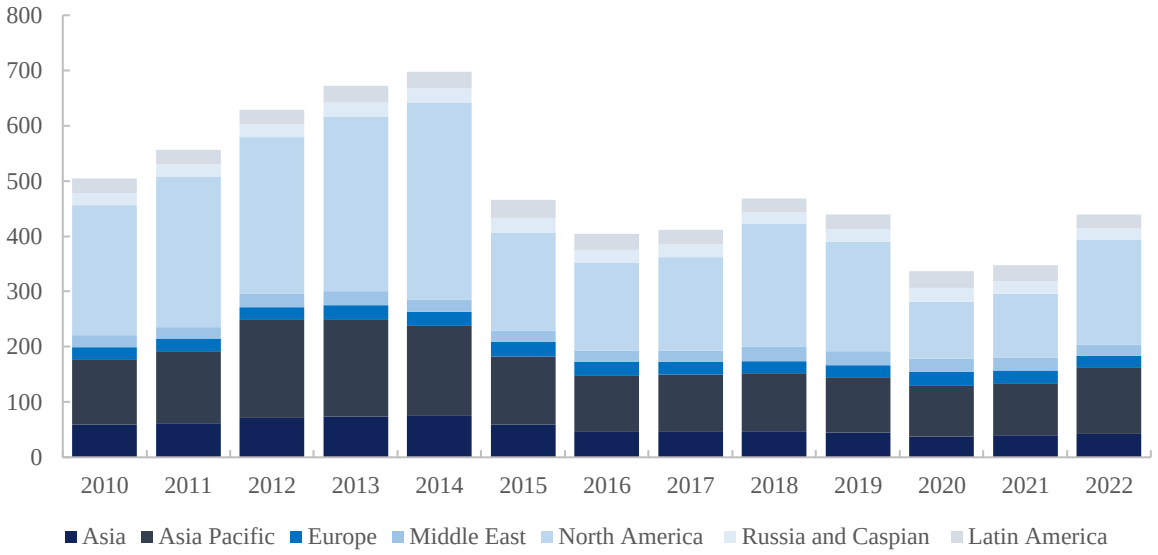
Appendices

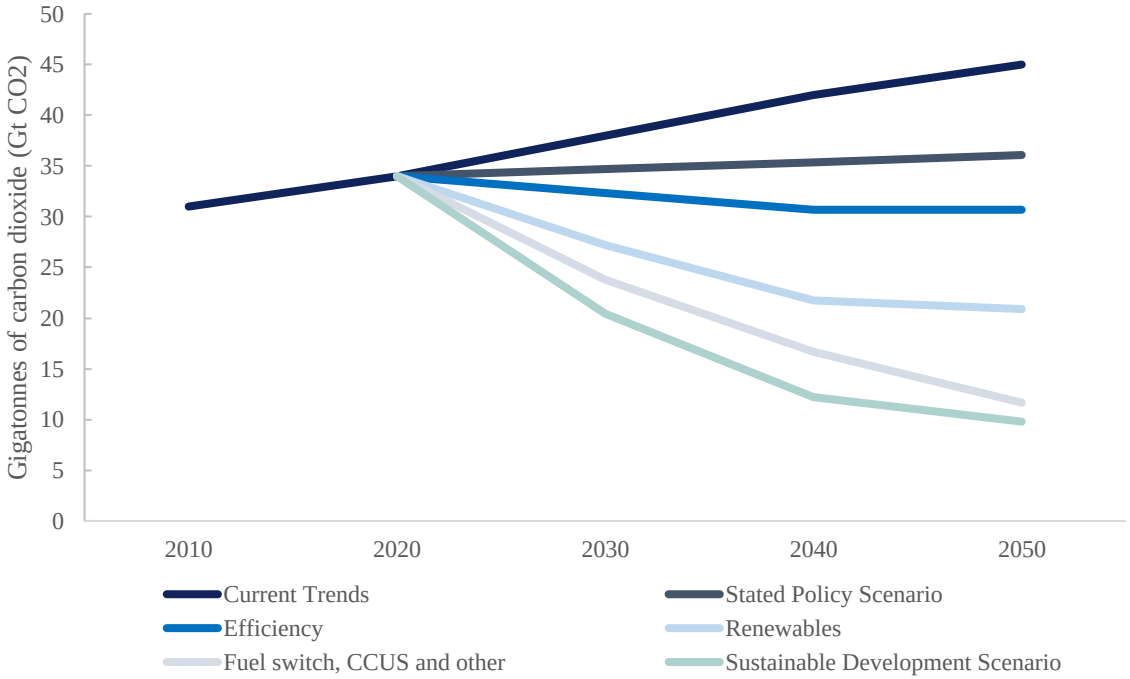
Appendix A: Figures

Figure 1: Global Oil & Gas Upstream Capital Expenditures



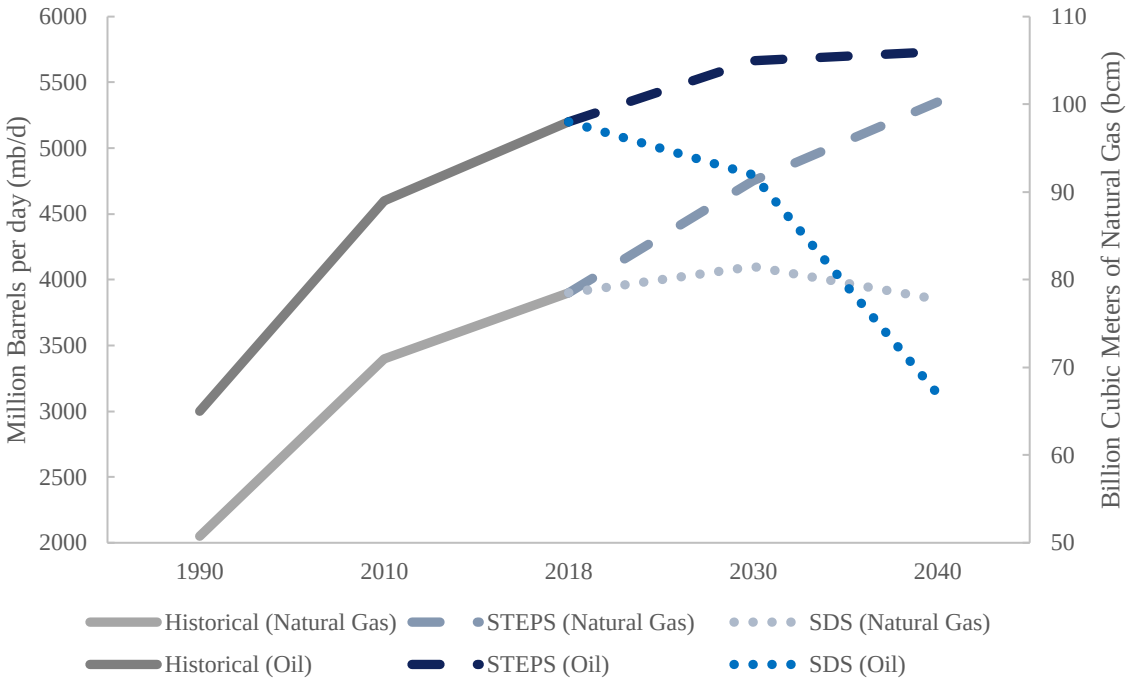
Source: International Energy Forum. 2023. 'Upstream Oil and Gas Investment Outlook'.

Figure 2: Range of Energy Transition Technologies



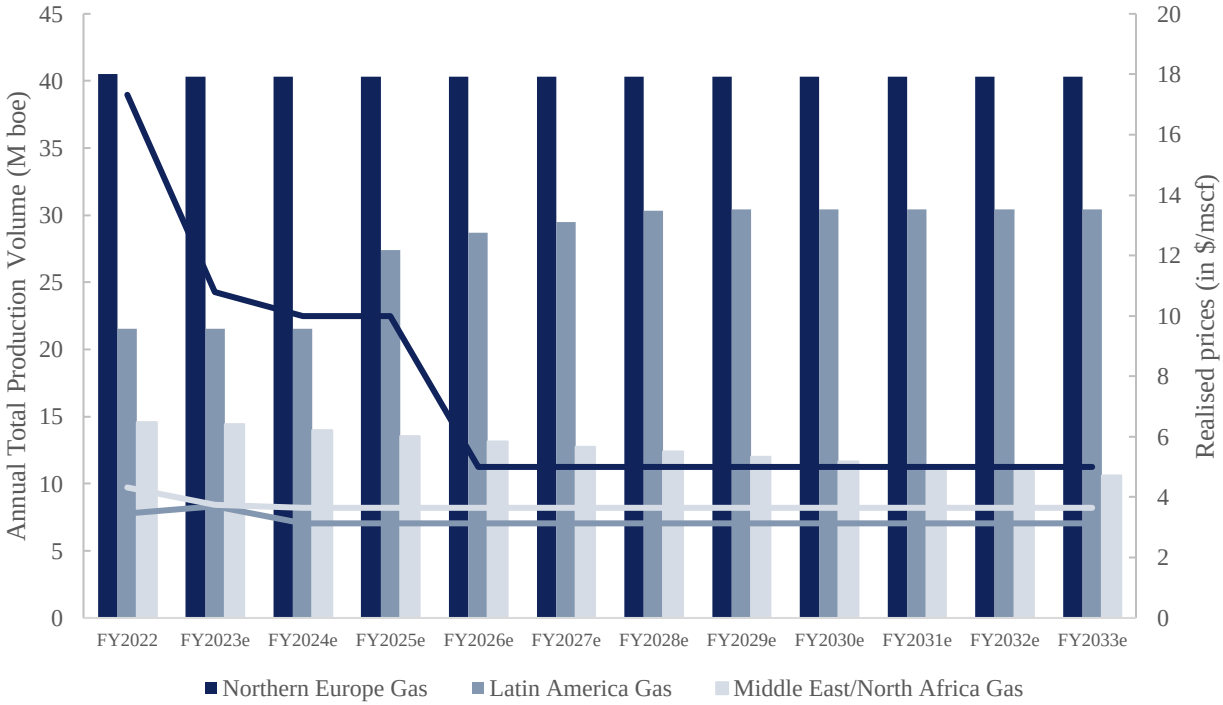
Source: IEA. 2020. 'The Oil and Gas Industry in Energy Transitions.

Figure 3: Oil and Gas Demand by Scenario



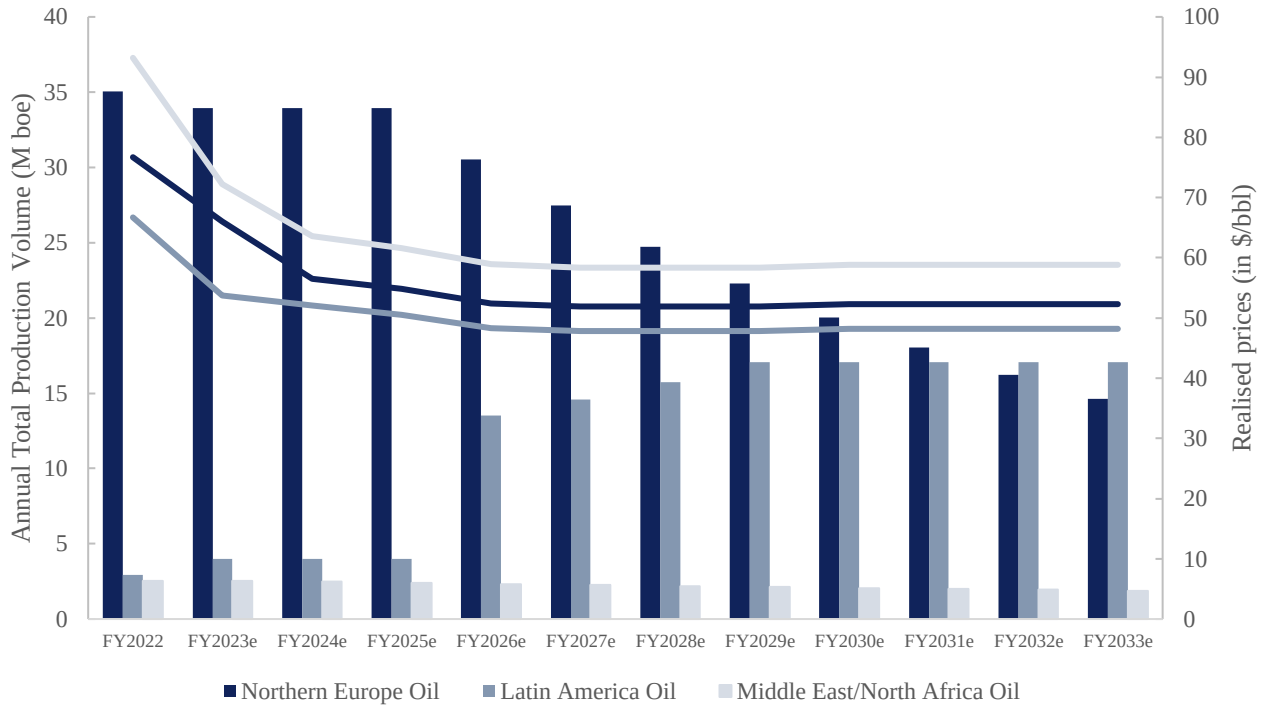
Source: IEA. 2020. 'The Oil and Gas Industry in Energy Transitions.

Figure 4: Annual E&P Production Forecast: Gas



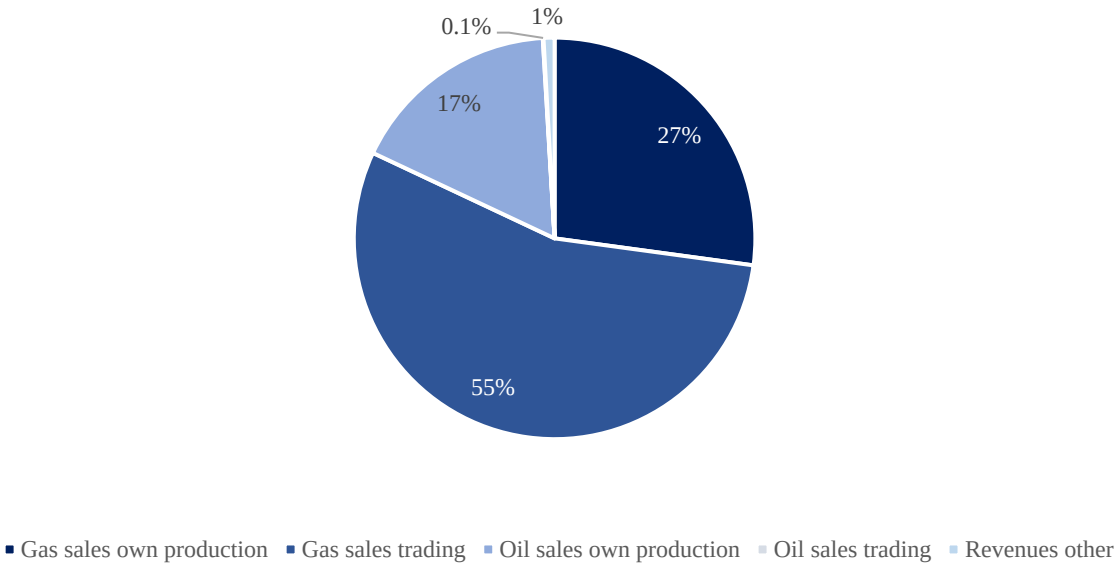
Source: Own illustration based on excel estimation

Figure 5: Annual E&P Production Forecast: Oil



Source: Own illustration based on excel estimation

Figure 6: Wintershall DEA's Revenue Breakdown (FY 2022)



Source: Wintershall 2022, Annual Report

Appendix B: Tables

Table 3: Key steps of DCF Valuation

Step	Result
(1) Assess performance drivers	Studying the target und determining key performance drivers identifies the critical factors influencing the target's profitability and growth potential
(2) Project Free Cash Flow (FCF)	Projecting the FCF provides an estimation of the cash the business will generate after covering its capital expenditures
(3) Calculate Weighted Average Cost of Capital (WACC)	WACC calculates the cost of financing the company's operations, essential for discounting future cash flows
(4) Determine Terminal Value (TV)	The TV estimates the company's value at the end of the forecast period, reflecting its long-term financial health
(5) Integrate and Value	The integration of all previous analyses in this step results in the total value of the company at the time of valuation

Source: Rosenbaum, Joshua, and Joshua Pearl (2020). Investment Banking: Valuation, LBOs, M&A, and IPOs.

Table 4: Key steps of CCA Valuation

Step	Result
(1) Select a Universe of Comparable Companies	Identifying and choosing a range of companies comparable to the target results in a curated list of companies that closely mirror the target company's business model and market sector
(2) Gathering Financial Information of Comparables	Obtaining necessary financial data for the selected comparable companies gives a comprehensive collection
(3) Derivation of Trading Multiples	Calculation of key trading multiples from the financial data yields specific financial ratios that reflect the market value and operational efficiency of the comparable companies
(4) Benchmarking Against the Target	Comparison of comparable companies with the target
(5) Establish Valuation Range	The step provides a valuation range for the target company, based on the performance of its closest industry peers

Source: Rosenbaum, Joshua, and Joshua Pearl (2020). Investment Banking: Valuation, LBOs, M&A, and IPOs.

Table 5: Key steps of CTA Valuation

Step	Result
(1) Identify Comparable Transactions	Results in a curated list of acquisitions similar to the target company in terms of sector and scale
(2) Gather Relevant Data for Past Deals	Key deal-related and financial information is obtained for each identified transaction
(3) Analysis of Key Metrics	This provides a detailed comparative analysis of key statistics, ratios, and transaction multiples from the chosen deals
(4) Filter for Recent Transactions	Focusing on transactions within a recent time frame ensures the data reflects the latest market trends and valuation norms in the sector
(5) Compute Implied Valuation Range	The outcome is a calculated valuation range for the target company, benchmarked against the market standards represented in the chosen comparables

Source: Rosenbaum, Joshua, and Joshua Pearl (2020). Investment Banking: Valuation, LBOs, M&A, and IPOs.

Table 6: Wintershall DEA - Historical Balance Sheet

FY ending 31.12.									
Annual Data (€ Million)	**FY2016***	**FY2017***	**FY2018***	**FY2019**	**FY2020**	**FY2021**	**FY2022**	**Q1 2023**	**Q2 2023**
Inventories	166	167	220	227	201	177	215	155	165
Financial receivables	0	22	29	181	141	65	19	19	26
Trade and other receivables	830	781	934	1,227	908	1,745	1,937	1,578	1,427
Derivative instruments	482	352	364	57	92	441	405	205	170
Income tax assets	1	11	0	83	296	4	24	15	6
Cash and cash equivalents	194	226	524	814	821	2,106	3,089	2,924	2,320
Assets held for sale	0	0	0			129	-		
Total Current Assets	**1,673**	**1,559**	**2,071**	**2,589**	**2,459**	**4,667**	**5,689**	**4,896**	**4,114**
Goodwill	0	0	0	2,580	2,298	2,435	2,156	2,121	2,122
Exploration assets	3,400	2,896	3,139	1,577	642	226	298	310	312
Other intangible assets	0	0	0	2,925	2,689	2,631	1,912	1,881	1,825
Property, plant and equipment and investment property	9,202	9,313	9,828	9,932	8,776	9,170	8,245	8,417	8,491
Equity-accounted investments	2,584	2,561	2,569	2,685	2,671	2,856	599	656	698
Other financial assets	72	75	4	5	16	13	261	260	260
Financial receivables	2,209	2,021	1,916	1,064	1,127	1,159	212	210	210
Derivative instruments	0	0	0	72	121	50	26	61	80
Other receivables	413	598	952	135	38	11	14	18	20
Deferred tax assets	277	269	180	96	140	234	189	235	257
Total Long-Term Assets	**18,157**	**17,733**	**18,588**	**21,071**	**18,518**	**18,785**	**13,912**	**14,169**	**14,275**
Total Assets	**19,830**	**19,292**	**20,659**	**23,660**	**20,977**	**23,452**	**19,601**	**19,065**	**18,389**
Decommissioning provisions	318	340	262	58	167	193	133	131	120
Other provisions	0	0	0	317	270	291	299	293	234
Financial debt	157	216	412	576	471	575	1,356	1,414	1,700
Trade and other payables	551	593	646	1,096	766	1,277	1,528	1,156	1,085
Derivative instruments	0	0	0	51	258	2,134	2,491	1,100	799
Income tax liabilities	214	158	346	79	36	661	1,750	1,598	926
Liabilities associated with assets classified as held for sa	100	232	237			5			
Other current liabilites	3,744	4,304	5,289						
Total Current Liabilities	**5,084**	**5,843**	**7,192**	**2,177**	**1,968**	**5,136**	**7,557**	**5,692**	**4,864**
Pension provisions	939	1,040	964	579	631	558	371	373	368
Decommissioning provisions	0	0	0	2,815	2,607	2,467	1,964	1,982	1,999
Other provisions	1,260	1,289	1,605	230	89	143	124	115	118
Financial debt	3,986	2,848	2,981	6,028	5,886	4,055	3,067	3,060	3,115
Derivative instruments	0	0	0	22	62	988	1,220	525	326
Income tax liabilities	26	26	26	8	18	27	36	15	15
Other liabilities	1,445	1,394	522	35	31	27	19	19	18
Deferred tax liabilities	2,057	1,821	2,060	3,477	3,250	2,198	1,713	3,091	3,433
Total Long Term Liabilities	**9,713**	**8,418**	**8,158**	**13,194**	**12,574**	**10,463**	**8,504**	**9,180**	**9,392**
Total Liabilities	**14,797**	**14,261**	**15,350**	**15,371**	**14,542**	**15,599**	**16,061**	**14,872**	**14,256**
Subscribed capital						189	189	189	189
Capital reserve						1,161	1,386	1,186	1,186
Retained earnings and other comprehensive income						4,976	441	1,309	1,237
Equity attributable to subordinated investors						1,525	1,525	1,509	1,520
Share Holder Equity	**5,033**	**5,031**	**5,307**	**8,289**	**6,435**	**7,852**	**3,541**	**4,194**	**4,132**
Total Liabilities And Share Holders Equity	**19,830**	**19,292**	**20,657**	**23,660**	**20,977**	**23,451**	**19,602**	**19,066**	**18,388**

Table 7: Wintershall DEA - Historical Income Statement

FY ending 31.12.									
Annual Data (€ Million)	**FY 2016*****	**FY 2017*****	**FY 2018****	**FY 2019***	**FY 2020**	**FY 2021**	**FY 2022**	**Q1 2023**	**Q2 2023**
Revenue	4,591	5,120	6,268	5,259	3,642	7,804	18,714	3,208	2,145
Cost Of Goods Sold	(3,614)	(3,443)	(2,554)	(2,301)	(1,957)	(4,094)	(10,923)	(2,042)	(1,177)
Gross Profit	**977**	**1,677**	**3,714**	**2,958**	**1,685**	**3,710**	**7,791**	**1,166**	**968**
SG&A Expenses	(332)	(284)	(315)	(694)	(277)	(429)	(451)	(116)	(95)
Other Operating Income Or Expenses	210	298	341	528	68	99	58	5	12
EBITDAX	**855**	**1,691**	**3,740**	**2,792**	**1,476**	**3,380**	**7,398**	**1,055**	**885**
Research And Development Expenses (Exploration)	(251)	(271)	(221)	(211)	(181)	(134)	(102)	(23)	(40)
EBITDA	**604**	**1,420**	**3,519**	**2,581**	**1,295**	**3,246**	**7,296**	**1,032**	**845**
Depletion (Impairment of assets)	(70)	(100)	(351)	(1,579)	(1,152)	(111)	(1,658)	-	-
Depreciation & Amortization	-	-	(1,168)	(1,485)	(1,438)	(1,456)	(1,429)	(274)	(321)
Operating Income (EBIT)	**534**	**1,320**	**2,000**	**(483)**	**(1,295)**	**1,679**	**4,209**	**758**	**524**
Total Non-Operating Income/Expense	7	1	129	143	182	285	93	61	40
Total Non-Recurring Income/Expense (Deconsolidation Russia)	-	-	-	-	-	-	(4,514)	-	-
Total Financial Income	224	186	186	167	220	182	360	74	73
Total Financial Expenses	(419)	(415)	(308)	(314)	(445)	(323)	(1,499)	(98)	(94)
Pre-Tax Income (EBT)	**346**	**1,092**	**2,007**	**(487)**	**(1,338)**	**1,823**	**(1,351)**	**795**	**543**
Income Taxes	25	(343)	(1,055)	(186)	499	(1,230)	(3,452)	(522)	(370)
Corporate Tax Rate	*-7%*	*31%*	*53%*	*-38%*	*37%*	*67%*	*-256%*	*66%*	*68%*
Income After Taxes	**371**	**749**	**952**	**(673)**	**(839)**	**593**	**(4,803)**	**273**	**173**
Net income/loss (-) attributable to subordinated notes investors	-	-		48	-	40	42	10	10
Net Income (to shareholders)	**371**	**749**	**952**	**(721)**	**(839)**	**553**	**(4,845)**	**263**	**163**
Net-Margin	*8%*	*15%*	*15%*	*-14%*	*-23%*	*7%*	*-26%*	*8%*	*8%*
EBITDAX	**855**	**1,691**	**3,740**	**2,792**	**1,476**	**3,380**	**7,398**	**1,055**	**885**
EBITDAX-Margin	*19%*	*33%*	*60%*	*53%*	*41%*	*43%*	*40%*	*33%*	*41%*
EBITDA	**604**	**1,420**	**3,519**	**2,581**	**1,295**	**3,246**	**7,296**	**1,032**	**845**
EBITDA-Margin	*13%*	*28%*	*56%*	*49%*	*36%*	*42%*	*39%*	*32%*	*39%*
EBIT	**534**	**1,320**	**2,000**	**(483)**	**(1,295)**	**1,679**	**4,209**	**758**	**524**
EBIT-Margin	*12%*	*26%*	*32%*	*-9%*	*-36%*	*22%*	*22%*	*24%*	*24%*

Table 8: Wintershall DEA - Taxes Breakdown

FY ending 31.12.	May-Dec (therefor deviating)								
Taxes Breakdown (€ Million)	**FY 2016*****	**FY 2017*****	**FY 2018****	**FY 2019***	**FY 2020**	**FY 2021**	**FY 2022**	**Q1 2023**	**Q2 2023**
Income/loss before tax	346	1,092	2,007	601	(1,338)	1,823	(1,351)	795	543
Expected income taxes based on German weighted average corp	**(104)**	**(328)**	**(602)**	**(180)**	**401**	**(547)**	**405**	**(239)**	**(163)**
Statutory tax rate	**30%**	**30%**	**30%**	**30%**	**30%**	**30%**	**30%**	**30%**	**30%**
Effect of deconsolidation and impairment of the Russian, Midstream and Brazilian business						-	(1,802)		
Effect of different tax rates on income of foreign Group companies				(33)	179	(580)	(1,711)		
Effect of different tax bases on income of foreign Group companies				(140)	135	29	(141)		
Effect of different tax rates and tax bases on income of foreign branches				10	(175)	23	24		
Effect from tax rate changes						(13)	-		
Taxes for prior years				31	9	(45)	(5)		
Withholding tax on dividends				(24)	(15)	(19)	(6)		
Tax effects on									
Gain from deconsolidation				128					
Expenses of German Group companies not deductible for tax purposes				(14)	(15)	(15)	(23)		
Changes in tax loss carryforwards				(30)	-	(43)	(265)		
Intangible and fixed asset impairments and reversal of impairments North Africa						(42)	37		
Goodwill impairments and disposal losses				(80)	(16)	(7)	(10)		
Financial asset impairment				-	(39)				
Losses from disposal and gains from reversal of impairments of investments in associates and joint ventures						(9)	-		
Net income from investments in associated companies and joint ventures				24	55	67	27		
Future dividends from subsidiaries and associates						(43)	45		
Miscellaneous				22	(20)	13	(16)		
Effective income taxes	**25**	**(343)**	**(1,055)**	**(286)**	**499**	**(1,230)**	**(3,441)**	**(522)**	**(370)**
Effective income tax rate in %	**-7%**	**31%**	**53%**	**48%**	**37%**	**67%**	**-255%**	**66%**	**68%**

Table 9: Wintershall DEA - 2P reserves

2P reserves in million boe	Total						
	Northern Europe	Russia	Latin America	Middle East/North Africa	Group Total	Developed	Undeveloped
2P reserves as of 31 Dec 2022	749	-	304	347	1,400	861	539
Thereof equity-accounted companies	4	-	-	-	4	4	-
Revisions and other changes	17	-	10	7	34	-	-
Maturation and discoveries	99	-	134	-	234	-	-
Purchase/sale of reserves	-8	-	-	-	-8	-	-
Production	-75	-	-24	-17	-117	-	-
2P reserves as of 31 Dec 2021	716	2,116	184	357	3,372	2,064	1,308

Table 10: Wintershall DEA - Forecasted Reformulated Balance Sheet

FY ending 31.12.															
Annual Data (€ Million)	**FY2019**	**FY2020**	**FY2021**	**FY2022**	**FY2023e**	**FY2024e**	**FY2025e**	**FY2026e**	**FY2027e**	**FY2028e**	**FY2029e**	**FY2030e**	**FY2031e**	**FY2032e**	**FY2033e**
Base Case															
Core Business															
Operating Cash	105	73	156	374	214	227	227	140	138	136	135	133	131	129	127
% of Sales	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*
Trade and other receivables	1,227	908	1,745	1,937	2,060	2,104	2,107	1,301	1,278	1,264	1,250	1,231	1,211	1,193	1,176
Average Collection Period	*85*	*91*	*82*	*38*	*70*	*68*	*68*	*68*	*68*	*68*	*68*	*68*	*68*	*68*	*68*
Inventories	227	201	177	215	346	395	396	244	240	237	235	231	228	224	221
Average Holding Period	*36*	*37*	*16*	*7*	*20*	*23*	*23*	*23*	*23*	*23*	*23*	*23*	*23*	*23*	*23*
Financial receivables (short term)	181	141	65	19	172	152	153	94	93	91	90	89	88	86	85
Average Collection Period	*13*	*14*	*3*	*0*	*6*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*
Derivative instruments (short term)	57	92	441	405	816	598	599	370	364	359	356	350	344	339	335
% of Total Sales	*1%*	*3%*	*6%*	*2%*	*8%*	*5%*	*5%*	*5%*	*5%*	*5%*	*5%*	*5%*	*5%*	*5%*	*5%*
Trade and other payables	(1,096)	(766)	(1,277)	(1,528)	(1,763)	(1,722)	(1,725)	(1,065)	(1,046)	(1,034)	(1,023)	(1,007)	(991)	(976)	(963)
Payable Period	*174*	*143*	*114*	*51*	*103*	*99*	*99*	*99*	*99*	*99*	*99*	*99*	*99*	*99*	*99*
Derivative instruments (short term)	(51)	(258)	(2,134)	(2,491)	(2,105)	(2,467)	(2,471)	(1,525)	(1,499)	(1,482)	(1,466)	(1,443)	(1,420)	(1,398)	(1,379)
% of Total Sales	*1%*	*7%*	*27%*	*13%*	*39%*	*22%*	*22%*	*22%*	*22%*	*22%*	*22%*	*22%*	*22%*	*22%*	*22%*
Decommissioning provisions (short term)	(58)	(167)	(193)	(133)	(547)	(363)	(364)	(225)	(221)	(218)	(216)	(213)	(210)	(206)	(204)
% of Revenues gas & oil	*1%*	*5%*	*3%*	*1%*	*5%*	*3%*	*3%*	*3%*	*3%*	*3%*	*3%*	*3%*	*3%*	*3%*	*3%*
Net Core Working Capital	**592**	**224**	**(1,020)**	**(1,202)**	**(807)**	**(1,076)**	**(1,078)**	**(665)**	**(654)**	**(646)**	**(639)**	**(630)**	**(619)**	**(610)**	**(602)**
Goodwill	2,580	2,298	2,435	2,156	1,725	1,697	1,698	1,698	1,698	1,380	1,357	1,358	1,358	1,358	1,104
Declining trend due to impairments															
Exploration assets	1,577	642	226	298	307	301	295	289	283	277	272	266	261	256	251
2020 onwards declining trend															
Property, plant and equipment and investment prc	9,932	8,776	9,170	8,245	8,454	8,915	8,693	8,475	8,263	8,057	7,855	7,659	7,467	7,281	7,099
2019 onwards declining trend															
Equity-accounted investments	2,685	2,671	2,856	599	658	658	658	658	658	658	658	658	658	658	658
Average after Deconsolidation of Russia															
Other intangible assets	2,925	2,689	2,631	1,912	1,812	1,776	1,740	1,705	1,671	1,638	1,605	1,573	1,541	1,511	1,480
2020 onwards declining trend															
Financial receivables (long term)	1,064	1,127	1,159	212	1,530	566	567	350	344	340	336	331	326	321	316
Average Collection Period	*74*	*113*	*54*	*4*	*52*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*
Derivative instruments (long term)	72	121	50	26	328	121	121	75	73	73	72	71	70	69	68
% of Total Sales	*1%*	*3%*	*1%*	*0%*	*3%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*
Miscellaneous Liabilities	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
constant															
Decommissioning provisions (long term)	(2,815)	(2,607)	(2,467)	(1,964)	(2,463)	(2,463)	(2,463)	(2,463)	(2,463)	(2,463)	(2,463)	(2,463)	(2,463)	(2,463)	(2,463)
2019 onwards average															
Derivative instruments (long term)	(22)	(62)	(988)	(1,220)	(1,877)	(550)	(551)	(340)	(334)	(330)	(327)	(322)	(317)	(312)	(308)
% of Total Sales	*0%*	*2%*	*13%*	*7%*	*18%*	*5%*	*5%*	*5%*	*5%*	*5%*	*5%*	*5%*	*5%*	*5%*	*5%*
Invested Capital Core Business	**18,590**	**15,879**	**14,052**	**9,062**	**9,666**	**9,944**	**9,679**	**9,781**	**9,539**	**8,982**	**8,726**	**8,501**	**8,282**	**8,067**	**7,603**
Non Core Business															
Income tax assets	83	296	4	24	193	169	169	104	103	101	100	99	97	96	94
% of Total Sales	*2%*	*8%*	*0%*	*0%*	*2%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*
Assets held for sale	--	--	129	-	0	0	0	0	0	0	0	0	0	0	0
constant															
Other financial assets	5	16	13	261	972	202	202	125	123	121	120	118	116	115	113
% of Total Sales	*0%*	*0%*	*0%*	*1%*	*9%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*
Other receivables	135	38	11	14	102	576	577	356	350	346	342	337	332	327	322
Average Collection Period	*9*	*4*	*1*	*0*	*3*	*19*	*19*	*19*	*19*	*19*	*19*	*19*	*19*	*19*	*19*
Deferred tax assets	96	140	234	189	1,200	497	497	307	302	298	295	291	286	282	278
% of Total Sales	*2%*	*4%*	*3%*	*1%*	*11%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*
Other provisions	(317)	(270)	(291)	(299)	(1,127)	(415)	(416)	(257)	(252)	(249)	(247)	(243)	(239)	(235)	(232)
% of Total Sales	*6%*	*7%*	*4%*	*2%*	*11%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*
Income tax liabilities	(79)	(36)	(661)	(1,750)	(632)	(632)	(632)	(632)	(632)	(632)	(632)	(632)	(632)	(632)	(632)
2019 onwards average															
Liabilities directly associated with assets classifie	--	--	(5)	--	0	0	0	0	0	0	0	0	0	0	0
constant															
Pension provisions	(579)	(631)	(558)	(371)	(1,763)	(1,560)	(1,562)	(965)	(948)	(937)	(927)	(913)	(898)	(884)	(872)
% of Total Sales	*11%*	*17%*	*7%*	*2%*	*16%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*
Other provisions	(230)	(89)	(143)	(124)	(540)	(1,312)	(1,314)	(812)	(797)	(788)	(780)	(768)	(755)	(744)	(734)
% of Total Sales	*4%*	*2%*	*2%*	*1%*	*5%*	*12%*	*12%*	*12%*	*12%*	*12%*	*12%*	*12%*	*12%*	*12%*	*12%*
Income tax liabilities	(8)	(18)	(27)	(36)	(68)	(47)	(47)	(29)	(28)	(28)	(28)	(27)	(27)	(27)	(26)
% of Total Sales	*0%*	*0%*	*0%*	*0%*	*1%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Other liabilities	(35)	(31)	(27)	(19)	(86)	(989)	(991)	(612)	(601)	(594)	(588)	(579)	(569)	(561)	(553)
% of Total Sales	*1%*	*1%*	*0%*	*0%*	*1%*	*9%*	*9%*	*9%*	*9%*	*9%*	*9%*	*9%*	*9%*	*9%*	*9%*
Deferred tax liabilities	(3,477)	(3,250)	(2,198)	(1,713)	(2,660)	(2,128)	(1,702)	(1,362)	(1,089)	(871)	(697)	(558)	(446)	(357)	(286)
2019 onwards average (declining trend)															
Invested Capital Non Core Business	**(4,406)**	**(3,835)**	**(3,519)**	**(3,824)**	**(4,408)**	**(5,639)**	**(5,218)**	**(3,774)**	**(3,471)**	**(3,233)**	**(3,040)**	**(2,874)**	**(2,735)**	**(2,621)**	**(2,527)**
Financing															
Excess of Cash	709	748	1,950	2,715	3,518	4,393	4,237	2,691	2,630	2,949	3,012	3,071	3,151	3,252	3,622
Avg. of Excess of Cash Portion of Total Cash					*84%*	*84%*	*84%*	*84%*	*84%*	*84%*	*84%*	*84%*	*84%*	*84%*	*84%*
Long- & Short-Term Debt	(6,604)	(6,357)	(4,630)	(4,423)	(4,645)	(4,566)	(4,566)	(4,566)	(4,566)	(4,566)	(4,566)	(4,566)	(4,566)	(4,566)	(4,566)
Permanent debt (bonds)															
Interest expenses	(314)	(445)	(323)	(1,499)	(149)	(149)	(147)	(147)	(147)	(147)	(147)	(147)	(147)	(147)	(147)
Interest Expenses (% of Total Debt PY)	*9.25%*	*7.00%*	*6.98%*	*33.89%*	*3.21%*	*3.21%*	*3.21%*	*3.21%*	*3.21%*	*3.21%*	*3.21%*	*3.21%*	*3.21%*	*3.21%*	*3.21%*
Net Debt and Other Claims	**(5,895)**	**(5,609)**	**(2,680)**	**(1,708)**	**(1,126)**	**(173)**	**(329)**	**(1,875)**	**(1,936)**	**(1,617)**	**(1,554)**	**(1,495)**	**(1,414)**	**(1,314)**	**(944)**
Equity															
Subscribed capital	--	--	189	189	189	189	189	189	189	189	189	189	189	189	189
Capital reserve	--	--	1,161	1,386	1,186	1,186	1,186	1,186	1,186	1,186	1,186	1,186	1,186	1,186	1,186
Retained earnings and other comprehensive inco	--	--	4,976	441	1,237	1,237	1,237	1,237	1,237	1,237	1,237	1,237	1,237	1,237	1,237
Equity attributable to subordinated investors	--	--	1,525	1,525	1,520	1,520	1,520	1,520	1,520	1,520	1,520	1,520	1,520	1,520	1,520
Equity	**8,289**	**6,435**	**7,852**	**3,541**	**4,132**	**4,132**	**4,132**	**4,132**	**4,132**	**4,132**	**4,132**	**4,132**	**4,132**	**4,132**	**4,132**

Table 11: Wintershall DEA - Forecasted Reformulated Income Statement

FY ending 31.12.															
Annual Data (in € Million)	**FY 2019***	**FY 2020**	**FY 2021**	**FY 2022**	**FY2023e**	**FY2024e**	**FY2025e**	**FY2026e**	**FY2027e**	**FY2028e**	**FY2029e**	**FY2030e**	**FY2031e**	**FY2032e**	**FY2033e**
Base Case															
Core Business															
Revenue	5,259	3,642	7,804	18,714	10,721	11,339	11,358	7,012	6,890	6,812	6,739	6,635	6,526	6,429	6,340
Revenue gas and oil	4,664	3,314	7,611	18,549	10,689	11,313	11,337	6,996	6,877	6,801	6,730	6,628	6,521	6,424	6,337
Revenue Gas Production					3,127	2,868	2,961	1,866	1,872	1,879	1,873	1,866	1,859	1,852	1,846
Revenue Gas Trading					5,134	6,345	6,345	2,936	2,936	2,936	2,936	2,936	2,936	2,936	2,936
Revenue Oil Production					2,420	2,094	2,027	2,191	2,067	1,984	1,920	1,825	1,725	1,636	1,555
Revenue Oil Trading					8	6	5	4	3	3	2	2	1	1	1
Revenue others	595	328	193	165	32	26	20	16	13	10	8	7	5	4	3
Cost Of Goods Sold (Production and Operating)	(2,301)	(1,957)	(4,094)	(10,923)	(6,273)	(6,323)	(6,334)	(3,911)	(3,843)	(3,799)	(3,758)	(3,700)	(3,640)	(3,585)	(3,536)
Average (%) of revenues	*44%*	*54%*	*52%*	*58%*	*58.5%*	*55.8%*	*55.8%*	*55.8%*	*55.8%*	*55.8%*	*55.8%*	*55.8%*	*55.8%*	*55.8%*	*55.8%*
SG&A Expenses	(694)	(277)	(429)	(451)	(406)	(713)	(714)	(441)	(433)	(428)	(424)	(417)	(410)	(404)	(399)
Average (%) of revenues	*13%*	*8%*	*5%*	*2%*	*3.8%*	*6.3%*	*6.3%*	*6.3%*	*6.3%*	*6.3%*	*6.3%*	*6.3%*	*6.3%*	*6.3%*	*6.3%*
Research And Development Expenses (Exploration)	(211)	(181)	(134)	(102)	(192)	(387)	(388)	(240)	(235)	(233)	(230)	(227)	(223)	(220)	(217)
Average (%) of revenues	*4%*	*5%*	*2%*	*1%*	*1.8%*	*3.4%*	*3.4%*	*3.4%*	*3.4%*	*3.4%*	*3.4%*	*3.4%*	*3.4%*	*3.4%*	*3.4%*
Depletion (Impairment of assets)	(1,579)	(1,152)	(111)	(1,658)	(950)	(1,002)	(977)	(953)	(929)	(906)	(883)	(861)	(840)	(819)	(798)
Average (%) of PP&E	*17%*	*13%*	*1%*	*20%*	*11.2%*	*11.2%*	*11.2%*	*11.2%*	*11.2%*	*11.2%*	*11.2%*	*11.2%*	*11.2%*	*11.2%*	*11.2%*
Depreciation & Amortization	(1,485)	(1,438)	(1,456)	(1,429)	(1,324)	(1,185)	(1,156)	(1,127)	(1,099)	(1,071)	(1,044)	(1,018)	(993)	(968)	(944)
Average (%) of PP&E	*16%*	*16%*	*15%*	*17%*	*14.8%*	*13.3%*	*13.3%*	*13.3%*	*13.3%*	*13.3%*	*13.3%*	*13.3%*	*13.3%*	*13.3%*	*13.3%*
Core Result Before Taxes	**(1,010)**	**(1,362)**	**1,581**	**4,152**	**1,576**	**1,728**	**1,789**	**342**	**352**	**376**	**400**	**412**	**422**	**434**	**448**
Statutory Taxes (30%)	303	409	(474)	(1,246)	(473)	(518)	(537)	(103)	(106)	(113)	(120)	(124)	(127)	(130)	(134)
Tax Adjustments	(1,948)	128	(573)	(1,849)	(190)	(215)	(223)	(43)	(44)	(47)	(50)	(51)	(53)	(54)	(56)
Average (%) of tax adjustments excl. non-recurring effects	*1047%*	*26%*	*47%*	*54%*	*40%*	*42%*	*42%*	*42%*	*42%*	*42%*	*42%*	*42%*	*42%*	*42%*	*42%*
Core Result	**(2,655)**	**(826)**	**533**	**1,057**	**913**	**995**	**1,030**	**197**	**203**	**216**	**230**	**237**	**243**	**250**	**258**
Non-Core Business															
Other Operating Income Or Expenses	528	68	99	58	94	428	429	265	260	257	254	250	246	243	239
Average (%) of revenues	*10%*	*2%*	*1%*	*0%*	*0.9%*	*3.8%*	*3.8%*	*3.8%*	*3.8%*	*3.8%*	*3.8%*	*3.8%*	*3.8%*	*3.8%*	*3.8%*
Total Non-Operating Income/Expense	143	182	285	93	215	228	229	141	139	137	136	134	131	129	128
Average (%) of revenues	*3%*	*5%*	*4%*	*0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*
Total Non-Recurring Income/Expense (Deconsolidation Russia) *constant*	-	-	-	(4,514)	-	-	-	-	-	-	-	-	-	-	-
Total Financial Income	167	220	182	360	499	420	420	259	255	252	249	246	242	238	235
Average (%) of revenues	*3%*	*6%*	*2%*	*2%*	*4.7%*	*3.70%*	*3.7%*	*3.7%*	*3.7%*	*3.7%*	*3.7%*	*3.7%*	*3.7%*	*3.7%*	*3.7%*
Non-Core Result Before Taxes	**838**	**470**	**566**	**(4,003)**	**808**	**1,076**	**1,078**	**665**	**654**	**646**	**639**	**629**	**619**	**610**	**602**
Statutory Taxes (30%)	(251)	(141)	(170)	1,201	(242)	(323)	(323)	(200)	(196)	(194)	(192)	(189)	(186)	(183)	(180)
Tax Adjustments	1,616	(30)	(111)	(1,997)	(111)	(52)	(52)	(32)	(32)	(31)	(31)	(31)	(30)	(30)	(29)
Average (%) of tax adjustments excl. non-recurring effects	*-869%*	*-6%*	*9%*	*58%*	*46%*	*16%*	*16%*	*16%*	*16%*	*16%*	*16%*	*16%*	*16%*	*16%*	*16%*
Non-Core Result	**2,203**	**299**	**285**	**(4,799)**	**455**	**701**	**702**	**433**	**426**	**421**	**416**	**410**	**403**	**397**	**392**
Financing Business															
Total Financial Expenses (Interest Expenses)	(314)	(445)	(323)	(1,499)	(676)	(833)	(835)	(515)	(506)	(501)	(495)	(488)	(480)	(472)	(466)
Average (%) of revenues	*6%*	*12%*	*4%*	*8%*	*6.3%*	*7.3%*	*7.3%*	*7.3%*	*7.3%*	*7.3%*	*7.3%*	*7.3%*	*7.3%*	*7.3%*	*7.3%*
Financial Result Before Taxes	**(314)**	**(445)**	**(323)**	**(1,499)**	**(676)**	**(833)**	**(835)**	**(515)**	**(506)**	**(501)**	**(495)**	**(488)**	**(480)**	**(472)**	**(466)**
Statutory Taxes (30%)	94	134	97	450	203	250	250	155	152	150	149	146	144	142	140
Tax Adjustments (0% expected)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Financial Result	**(220)**	**(312)**	**(226)**	**(1,049)**	**(473)**	**(583)**	**(584)**	**(361)**	**(354)**	**(350)**	**(347)**	**(341)**	**(336)**	**(331)**	**(326)**
Net Income	(672)	(838)	593	(4,791)	895	1,112	1,147	270	274	287	300	306	310	316	323

Table 12: Wintershall DEA - Unlevered Free Cash Flow

Free Cash Flow (in € Million)	**FY 2020**	**FY 2021**	**FY 2022**	**Q1 2023**	**Q2 2023**	**Q3 2023e**	**Q4 2023e**	**FY2023e**	**FY2024e**	**FY2025e**	**FY2026e**	**FY2027e**	**FY2028e**	**FY2029e**	**FY2030e**	**FY2031e**	**FY2032e**	**FY2033e**
Base Case																		
Revenues	3,642.0	7,804.0	18,714.0	3,208.0	2,145.0	2,544.0	2,544.0	10,721.3	11,338.8	11,357.9	7,012.5	6,890.3	6,811.6	6,738.8	6,634.6	6,526.5	6,428.7	6,340.0
Revenue gas and oil	3,314.0	7,611.0	18,549.0	3,190.0	2,147.0	2,536.0	2,536.0	10,689.3	11,313.2	11,337.4	6,996.1	6,877.2	6,801.1	6,730.5	6,627.9	6,521.1	6,424.4	6,336.6
Revenue others	328.0	193.0	165.0	18.0	(2.0)	8.0	8.0	32.0	25.6	20.5	16.4	13.1	10.5	8.4	6.7	5.4	4.3	3.4
Revenue growth		*114%*	*140%*	*-83%*	*-33%*	*19%*	*0%*	*-43%*	*6%*	*0%*	*-38%*	*-2%*	*-1%*	*-1%*	*-2%*	*-2%*	*-1%*	*-1%*
EBITDA	**1,697.8**	**3,713.6**	**7,749.8**	**1,167.7**	**958.6**	**1,347.2**	**1,013.1**	**4,658.4**	**4,991.7**	**5,000.1**	**3,087.4**	**3,033.6**	**2,999.0**	**2,967.0**	**2,921.1**	**2,873.5**	**2,830.4**	**2,791.4**
EBITDA margin	*47%*	*48%*	*41%*	*36%*	*45%*	*53%*	*40%*	*43%*	*44%*	*44%*	*44%*	*44%*	*44%*	*44%*	*44%*	*44%*	*44%*	*44%*
Depreciation, Amortization & Depletion	2,590.0	1,567.0	3,087.0	511.6	558.6	590.4	613.4	2,274.0	2,187.7	2,133.0	2,079.7	2,027.7	1,977.0	1,927.6	1,879.4	1,832.4	1,786.6	1,742.0
over revenue	*71%*	*20%*	*16%*	*16%*	*26%*	*23%*	*24%*	*21%*	*19%*	*19%*	*30%*	*29%*	*29%*	*29%*	*28%*	*28%*	*28%*	*27%*
EBIT	**(892.2)**	**2,146.6**	**4,662.8**	**656.1**	**400.0**	**756.8**	**399.8**	**2,384.3**	**2,804.0**	**2,867.1**	**1,007.7**	**1,005.9**	**1,021.9**	**1,039.4**	**1,041.7**	**1,041.1**	**1,043.8**	**1,049.5**
EBITDA margin	*-24%*	*28%*	*25%*	*20%*	*19%*	*30%*	*16%*	*22%*	*25%*	*25%*	*14%*	*15%*	*15%*	*15%*	*16%*	*16%*	*16%*	*17%*
Taxes	499.0	(1,230.0)	(3,452.0)	(522.0)	(370.0)	(237.8)	(147.5)	(813.4)	(858.8)	(885.0)	(222.7)	(225.5)	(234.6)	(244.2)	(248.2)	(251.1)	(255.1)	(260.1)
Tax rate	*37%*	*67%*	*-256%*	*94%*	*121%*	*47%*	*75%*	*48%*	*44%*	*44%*	*45%*	*45%*	*45%*	*45%*	*45%*	*45%*	*45%*	*45%*
Unlevered Net Income	**(393.2)**	**916.6**	**1,210.8**	**134.1**	**30.0**	**519.0**	**252.3**	**1,571.0**	**1,945.2**	**1,982.1**	**785.0**	**780.4**	**787.3**	**795.2**	**793.5**	**790.0**	**788.7**	**789.3**
Plus: Depreciation, Amortization & Depletion	2,590.0	1,567.0	3,087.0	511.6	558.6	590.4	613.4	2,274.0	2,187.7	2,133.0	2,079.7	2,027.7	1,977.0	1,927.6	1,879.4	1,832.4	1,786.6	1,742.0
over PP&E	*30%*	*17%*	*37%*	*6%*	*7%*	*7%*	*7%*	*27%*	*25%*	*25%*	*25%*	*25%*	*25%*	*25%*	*25%*	*25%*	*25%*	*25%*
Less: Capital Expenditures	1,237.0	952.0	869.0	214.0	268.0	356.0	356.0	1,500.4	1,586.8	1,589.5	981.4	964.3	953.2	943.1	928.5	913.3	899.7	887.3
over revenue	*34%*	*12%*	*5%*	*7%*	*12%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*
Net Working Capital	223.8	(1,019.9)	(1,201.7)	(365.8)	(173.1)	(357.7)	(345.8)	(807.4)	(1,075.6)	(1,077.5)	(665.2)	(653.7)	(646.3)	(639.4)	(629.6)	(619.4)	(610.1)	(601.7)
Less: Increase in NWC	(368.3)	(1,243.8)	(181.8)	835.9	192.7	(184.6)	11.8	394.3	(268.2)	(2.0)	412.4	11.5	7.4	6.8	9.8	10.2	9.3	8.4
Unlevered Free Cash Flow	**1,328.1**	**2,775.4**	**3,610.6**	**(404.2)**	**127.9**	**938.0**	**497.8**	**1,950.3**	**2,814.3**	**2,527.6**	**1,471.0**	**1,832.3**	**1,803.7**	**1,772.9**	**1,734.6**	**1,698.8**	**1,666.4**	**1,635.7**

Table 13: Wintershall DEA - E&P Production Forecast

E&P Production Forecast	FY 2022	Q1 2023	Q2 2023	Q3 2023e	Q42023e	FY 2023e	FY 2024e	FY 2025e	FY 2026e	FY 2027e	FY 2028e	FY 2029e	FY 2030e	FY 2031e	FY 2032e	FY 2033e	FY 2034e
				shortterm					longterm								
Production Volume Total (million boe/d)	**0.321**	**0.318**	**0.322**	**0.320**	**0.320**	**0.320**	**0.319**	**0.333**	**0.352**	**0.348**	**0.345**	**0.340**	**0.333**	**0.326**	**0.320**	**0.315**	**0.310**
Northern Europe Gas	0.111	0.117	0.104	0.111	0.111	0.111	0.111	0.111	0.111	0.111	0.111	0.111	0.111	0.111	0.111	0.111	0.111
Latin America Gas	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.075	0.079	0.081	0.083	0.083	0.083	0.083	0.083	0.083	0.083
Argentina Fenix Development								0.043	0.048	0.053	0.059	0.059	0.059	0.059	0.059	0.059	0.059
Share Wintershall 37,5%								0.016	0.018	0.020	0.022	0.022	0.022	0.022	0.022	0.022	0.022
Mexico Zama Developemnt									0.009	0.009	0.011	0.012	0.012	0.012	0.012	0.012	0.012
Share Wintershall 19,83%									0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Middle East/North Africa Gas	0.040	0.040	0.039	0.040	0.040	0.040	0.038	0.037	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028
Northern Europe Oil	0.096	0.088	0.098	0.093	0.093	0.093	0.093	0.093	0.084	0.075	0.068	0.061	0.055	0.049	0.044	0.040	0.036
Latin America Oil	0.008	0.007	0.015	0.011	0.011	0.011	0.011	0.011	0.037	0.040	0.043	0.047	0.047	0.047	0.047	0.047	0.047
Mexico Zama Developemnt									0.131	0.146	0.162	0.180	0.180	0.180	0.180	0.180	0.180
Share Wintershall 19,83%									0.026	0.029	0.032	0.036	0.036	0.036	0.036	0.036	0.036
Middle East/North Africa Oil	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.005	0.005	0.005	0.005
Production Volume Total year (million boe)	**117.17**	**29.02**	**29.38**	**29.20**	**29.20**	**116.80**	**116.29**	**121.67**	**128.57**	**126.89**	**125.75**	**124.22**	**121.57**	**119.16**	**116.95**	**114.94**	**113.11**
Northern Europe Gas	40.52	10.68	9.49	10.08	10.08	40.33	40.33	40.33	40.33	40.33	40.33	40.33	40.33	40.33	40.33	40.33	40.33
Latin America Gas	21.54	5.38	5.38	5.38	5.38	21.54	21.54	27.41	28.68	29.47	30.35	30.44	30.44	30.44	30.44	30.44	30.44
Middle East/North Africa Gas	14.60	3.65	3.56	3.60	3.60	14.42	13.98	13.57	13.16	12.76	12.38	12.01	11.65	11.30	10.96	10.63	10.31
Northern Europe Oil	35.04	8.03	8.94	8.49	8.49	33.95	33.95	33.95	30.55	27.50	24.75	22.27	20.04	18.04	16.24	14.61	13.15
Latin America Oil	2.92	0.64	1.37	1.00	1.00	4.02	4.02	4.02	13.51	14.57	15.74	17.04	17.04	17.04	17.04	17.04	17.04
Middle East/North Africa Oil	2.56	0.64	0.64	0.64	0.64	2.56	2.48	2.40	2.33	2.26	2.19	2.13	2.06	2.00	1.94	1.88	1.83

Table 14: Wintershall DEA - E&P Price Forecast

	FY 2022	Q1 2023	Q2 2023	Q3 2023e	Q42023e	FY 2023e	FY 2024e	FY 2025e	FY 2026e	FY 2027e	FY 2028e	FY 2029e	FY 2030e	FY 2031e	FY 2032e	FY 2033e	FY 2034e
Realised Prices																	
Northern Europe Gas (in $/mscf)	17.32	13.66	9.84														
Upside				10.82	10.82	11.29	11.00	11.00	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50
Base				9.84	9.84	10.80	10.00	10.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Downside				8.86	8.86	10.30	9.00	9.00	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
Latin America Gas (in $/mscf)	3.45	3.3	3.83														
Upside				4.21	4.21	3.89	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83
Base				3.83	3.83	3.70	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13
Downside				3.45	3.45	3.51	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03
Middle East/North Africa Gas (in $/mscf)	4.32	4.09	3.62														
Upside				3.98	3.98	3.92	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32
Base				3.62	3.62	3.74	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65
Downside				3.26	3.26	3.56	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78
Northern Europe Oil (in $/bbl)	76.70	67.60	65.50														
Upside				72.05	72.05	69.30	62.19	60.32	57.65	57.10	57.10	57.10	67.03	67.03	67.03	67.03	67.03
Base				65.50	65.50	66.03	56.54	54.84	52.41	51.91	51.91	51.91	52.32	52.32	52.32	52.32	52.32
Downside				58.95	58.95	62.75	50.88	49.35	47.17	46.72	46.72	46.72	28.61	28.61	28.61	28.61	28.61
Latin America Oil (in $/bbl)	66.70	53.30	53.90														
Upside				59.29	59.29	56.45	57.31	55.58	53.12	52.61	52.61	52.61	61.77	61.77	61.77	61.77	61.77
Base				53.90	53.90	53.75	52.10	50.53	48.29	47.83	47.83	47.83	48.21	48.21	48.21	48.21	48.21
Downside				48.51	48.51	51.06	46.89	45.48	43.46	43.05	43.05	43.05	26.36	26.36	26.36	26.36	26.36
Middle East/North Africa Oil (in $/bbl)	93.20	78.10	70.20														
Upside				77.22	77.22	75.69	69.91	67.81	64.81	64.19	64.19	64.19	75.36	75.36	75.36	75.36	75.36
Base				70.2	70.20	72.18	63.56	61.65	58.92	58.35	58.35	58.35	58.82	58.82	58.82	58.82	58.82
Downside				63.18	63.18	68.67	57.20	55.48	53.03	52.52	52.52	52.52	32.16	32.16	32.16	32.16	32.16

Table 15: Wintershall DEA - WACC calculation

Weighted Average Cost of Capital (WACC)

Target Capital Structure Calculation

	Net Debt	Market Cap	EV	D / (D+E)	E / (D+E)
Apache Corporation	5,208.0	10,490.2	15,698.2	33%	67%
Woodside Petroleum	-94.0	43,590.9	43,496.9	-0.22%	100.22%
Devon Energy Corporation	5,243.0	30,985.9	36,228.9	14%	86%
Inpex	7,507.2	15,354.0	22,861.2	33%	67%
ConocoPhillips	7,400.0	124,072.0	131,472.0	6%	94%
Hess Corporation	5,995.0	41,744.9	47,739.9	13%	87%
Var Energi	2,730.5	6,799.9	9,530.4	29%	71%
Coterra Energy	1,525.0	19,163.6	20,688.6	7%	93%
Equinor	-7,148.0	92,481.1	85,333.1	-8%	108%
Diamondback Energy	6,091.0	23,542.5	29,633.5	21%	79%
Denbury	28.5	4,353.8	4,382.3	1%	99%
Murphy Oil	1,331.2	5,978.6	7,309.7	18%	82%
Ithaca	1,017.1	1,930.8	2,947.9	35%	65%
Aker BP	2,657.5	14,850.4	17,508.0	15%	85%

High				35%	108.38%
Low				-8.38%	65%
Median				15%	85%
Mean				15%	84.63%

Beta Calculation (De-Levered to Re-Levered β)

	Observed Beta	Tax Rate	Market Cap	Net Debt	D/E	Delev Beta
Apache Corporation	3.5	29%	10,490.2	5,208.0	50%	2.59
Woodside Petroleum	1.19	28%	43,590.9	-94.0	-0.22%	1.19
Devon Energy Corporation	2.34	22%	30,985.9	5,243.0	17%	2.07
Inpex	1.73	69%	15,354.0	7,507.2	49%	1.50
ConocoPhillips	1.9	34%	124,072.0	7,400.0	6%	1.83
Hess Corporation	1.52	40%	41,744.9	5,995.0	14%	1.40
Var Energi	1.57	84%	6,799.9	2,730.5	40%	1.48
Coterra Energy	0.32	21%	19,163.6	1,525.0	8%	0.30
Equinor	1.04	63%	92,481.1	-7,148.0	-8%	1.07
Diamondback Energy	1.88	21%	23,542.5	6,091.0	26%	1.56
Denbury	1.11	13%	4,353.8	28.5	1%	1.10
Murphy Oil	2.24	21%	5,978.6	1,331.2	22%	1.91
Ithaca	1.15	36%	1,930.8	1,017.1	53%	0.86
Aker BP	1.87	82%	14,850.4	2,657.5	18%	1.81

Average Delev Beta	**1.48**
EV Weighted Average	**1.52**
Marginal Tax Rate Wintershall	**44%**
Net Debt / Equity	**21%**
Relevered Beta	**1.65**

WACC	15.68%
Cost of Equity	18.03%
Cost of Debt	5%
Target D/V ratio	15%
Beta_e	1.65
Market Risk Premium	5%
Company Risk Premium	5%
Tax rate	44%
Risk-free rate	4.78%

Table 16: Wintershall DEA - Discounted Cash Flow Analysis (Base Case)

Discounted Cash Flow Analysis

wintershall dea

Base Case

Date of Valuation: 01.07.2023	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5
DCF (in m€)	**H2 FY2023e**	**FY2024e**	**FY2025e**	**FY2026e**	**FY2027e**	**FY2028e**	**FY2029e**	**FY2030e**	**FY2031e**	**FY2032e**	**FY2033e**
Revenues	5,088	11,339	11,358	7,012	6,890	6,812	6,739	6,635	6,526	6,429	6,340
Revenue gas and oil	5,072	11,313	11,337	6,996	6,877	6,801	6,730	6,628	6,521	6,424	6,337
Revenue Gas Production	1,461	2,868	2,961	1,866	1,872	1,879	1,873	1,866	1,859	1,852	1,846
Revenue Gas Trading	2,407	6,345	6,345	2,936	2,936	2,936	2,936	2,936	2,936	2,936	2,936
Revenue Oil Production	1,200	2,094	2,027	2,191	2,067	1,984	1,920	1,825	1,725	1,636	1,555
Revenue Oil Trading	4	6	5	4	3	3	2	2	1	1	1
Revenue others	16	26	20	16	13	10	8	7	5	4	3
EBITDA	**2,360**	**4,992**	**5,000**	**3,087**	**3,034**	**2,999**	**2,967**	**2,921**	**2,873**	**2,830**	**2,791**
- Depreciation, Amortization & Depletion	1,204	2,188	2,133	2,080	2,028	1,977	1,928	1,879	1,832	1,787	1,742
EBIT	**1,157**	**2,804**	**2,867**	**1,008**	**1,006**	**1,022**	**1,039**	**1,042**	**1,041**	**1,044**	**1,049**
- Taxes	(385)	(859)	(885)	(223)	(226)	(235)	(244)	(248)	(251)	(255)	(260)
Unlevered Net Income (NOPLAT)	**771**	**1,945**	**1,982**	**785**	**780**	**787**	**795**	**793**	**790**	**789**	**789**
+ Depreciation, Amortization & Depletion	1,204	2,188	2,133	2,080	2,028	1,977	1,928	1,879	1,832	1,787	1,742
- Capital Expenditures	712	1,587	1,589	981	964	953	943	928	913	900	887
+/- Δ NWC	394	(268)	(2)	412	11	7	7	10	10	9	8
Unlevered FCF	**869**	**2,814**	**2,528**	**1,471**	**1,832**	**1,804**	**1,773**	**1,735**	**1,699**	**1,666**	**1,636**
Discount factor	1.08	1.24	1.44	1.66	1.93	2.23	2.58	2.98	3.45	3.99	4.61
Discounted FCF	**808**	**2,262**	**1,757**	**884**	**952**	**810**	**688**	**582**	**493**	**418**	**355**
Present Value	**10,008**										

Valuation	
WACC	15.67%
Cost of Equity	18.02%
Cost of Debt	4.88%
Target D/V ratio	15.37%
Beta_e	1.65
Market Risk Premium	5.00%
Company Risk Premium	5.00%
Tax rate	44.00%
Risk-free rate	4.78%
Growth rate	1.0%

Summary	
Sum PV FCF	10,008
Terminal Value	2,442
Entity value	12,450
Net Debt	2,538
Equity Value	9,912
BASF Share Value (73%)	7,236

Equity Value Base Case

WACC \ *Perpetuity*	-0.5%	0.0%	0.5%	1.0%	1.5%	2.0%	2.5%
13.7%	8,183.84 €	8,275.07 €	8,373.24 €	8,479.15 €	8,593.77 €	8,718.21 €	8,853.79 €
14.2%	7,871.20 €	7,952.75 €	8,040.26 €	8,134.42 €	8,236.01 €	8,345.94 €	8,465.30 €
14.7%	7,578.64 €	7,651.71 €	7,729.95 €	7,813.90 €	7,904.23 €	8,001.69 €	8,107.15 €
15.2%	7,304.25 €	7,369.89 €	7,440.01 €	7,515.07 €	7,595.63 €	7,682.30 €	7,775.81 €
15.7%	7,046.36 €	7,105.46 €	7,168.45 €	7,235.74 €	7,307.78 €	7,385.09 €	7,468.26 €
16.2%	6,803.50 €	6,856.82 €	6,913.55 €	6,974.01 €	7,038.60 €	7,107.74 €	7,181.95 €
16.7%	6,574.36 €	6,622.57 €	6,673.76 €	6,728.22 €	6,786.27 €	6,848.27 €	6,914.65 €
17.2%	6,357.80 €	6,401.47 €	6,447.76 €	6,496.91 €	6,549.20 €	6,604.94 €	6,664.47 €
17.7%	6,152.78 €	6,192.41 €	6,234.35 €	6,278.80 €	6,326.01 €	6,376.23 €	6,429.75 €

Table 17: Wintershall DEA - Discounted Cash Flow Analysis (Upside Case)

Discounted Cash Flow Analysis

wintershall dea

Upside Case

Date of Valuation: 01.07.2023	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5
DCF (in m€)	**H2 FY2023e**	**FY2024e**	**FY2025e**	**FY2026e**	**FY2027e**	**FY2028e**	**FY2029e**	**FY2030e**	**FY2031e**	**FY2032e**	**FY2033e**
Revenues	5,690	12,586	12,620	7,842	7,709	7,624	7,544	7,759	7,622	7,498	7,385
Revenue gas and oil	5,674	12,561	12,599	7,826	7,696	7,614	7,535	7,753	7,617	7,494	7,382
Revenue others	16	26	20	16	13	10	8	7	5	4	3
EBITDA	**2,639**	**5,541**	**5,555**	**3,453**	**3,394**	**3,357**	**3,321**	**3,416**	**3,356**	**3,301**	**3,251**
- Depreciation, Amortization & Depletion	1,292	2,227	2,171	2,117	2,064	2,012	1,962	1,913	1,865	1,818	1,773
EBIT	**1,347**	**3,314**	**3,385**	**1,336**	**1,330**	**1,345**	**1,360**	**1,503**	**1,491**	**1,483**	**1,479**
- Taxes	(454)	(1,039)	(1,068)	(338)	(339)	(348)	(357)	(411)	(410)	(410)	(412)
Unlevered Net Income (NOPLAT)	**894**	**2,275**	**2,317**	**998**	**991**	**997**	**1,003**	**1,092**	**1,081**	**1,073**	**1,067**
+ Depreciation, Amortization & Depletion	1,292	2,227	2,171	2,117	2,064	2,012	1,962	1,913	1,865	1,818	1,773
- Capital Expenditures	796	1,761	1,766	1,097	1,079	1,067	1,056	1,086	1,067	1,049	1,033
+/- Δ NWC	384	(371)	(3)	452	12	8	8	(20)	13	12	11
Unlevered FCF	**1,006**	**3,112**	**2,725**	**1,566**	**1,964**	**1,934**	**1,902**	**1,940**	**1,866**	**1,830**	**1,796**
Discount factor	1.08	1.24	1.44	1.66	1.93	2.23	2.58	2.98	3.45	3.99	4.61
Discounted FCF	**935**	**2,502**	**1,894**	**941**	**1,020**	**868**	**738**	**651**	**541**	**459**	**389**
Present Value	**10,939**										

Valuation	
WACC	15.67%
Cost of Equity	18.02%
Cost of Debt	4.88%
Target D/V ratio	15.37%
Beta_e	1.65
Market Risk Premium	5.00%
Company Risk Premium	5.00%
Tax rate	44.00%
Risk-free rate	4.78%
Growth rate	2.00%

Summary	
Sum PV FCF	10,939
Terminal Value	2,906
Entity value	13,844
Net Debt	2,538
Equity Value	11,307
BASF Share Value (73%)	8,254

Equity Value Upside Case

WACC \ *Perpetuity*	0.5%	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%
13.7%	9,333.53 €	9,449.81 €	9,575.65 €	9,712.26 €	9,861.11 €	10,023.90 €	10,202.70 €
14.2%	8,969.28 €	9,072.66 €	9,184.19 €	9,304.88 €	9,435.92 €	9,578.68 €	9,734.83 €
14.7%	8,629.89 €	8,722.06 €	8,821.23 €	8,928.22 €	9,044.01 €	9,169.72 €	9,306.68 €
15.2%	8,312.84 €	8,395.24 €	8,483.68 €	8,578.84 €	8,681.50 €	8,792.60 €	8,913.21 €
15.7%	8,015.94 €	8,089.81 €	8,168.90 €	8,253.77 €	8,345.08 €	8,443.61 €	8,550.23 €
16.2%	7,737.28 €	7,803.66 €	7,874.57 €	7,950.48 €	8,031.95 €	8,119.60 €	8,214.17 €
16.7%	7,475.20 €	7,534.99 €	7,598.72 €	7,666.79 €	7,739.67 €	7,817.88 €	7,902.02 €
17.2%	7,228.23 €	7,282.19 €	7,339.60 €	7,400.79 €	7,466.15 €	7,536.13 €	7,611.22 €
17.7%	6,995.05 €	7,043.86 €	7,095.68 €	7,150.81 €	7,209.58 €	7,272.35 €	7,339.55 €

Table 18: Wintershall DEA - Discounted Cash Flow Analysis (Downside Case)

Discounted Cash Flow Analysis

wintershall dea

Downside Case

Date of Valuation: 01.07.2023	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5
DCF (in m€)	**H2 FY2023e**	**FY2024e**	**FY2025e**	**FY2026e**	**FY2027e**	**FY2028e**	**FY2029e**	**FY2030e**	**FY2031e**	**FY2032e**	**FY2033e**
Revenues	4,486	10,029	10,021	6,105	5,993	5,919	5,854	5,116	5,055	4,999	4,949
Revenue gas and oil	4,470	10,003	10,001	6,089	5,979	5,908	5,845	5,109	5,049	4,995	4,945
Revenue others	16	26	20	16	13	10	8	7	5	4	3
EBITDA	**2,081**	**4,415**	**4,412**	**2,688**	**2,639**	**2,606**	**2,577**	**2,253**	**2,226**	**2,201**	**2,179**
- Depreciation, Amortization & Depletion	1,292	2,227	2,171	2,117	2,064	2,012	1,962	1,913	1,865	1,818	1,773
EBIT	**790**	**2,189**	**2,241**	**572**	**575**	**594**	**616**	**340**	**361**	**383**	**406**
- Taxes	(243)	(636)	(658)	(64)	(69)	(79)	(90)	5	(6)	(17)	(28)
Unlevered Net Income (NOPLAT)	**547**	**1,553**	**1,583**	**507**	**506**	**515**	**525**	**345**	**355**	**366**	**378**
+ Depreciation, Amortization & Depletion	1,292	2,227	2,171	2,117	2,064	2,012	1,962	1,913	1,865	1,818	1,773
- Capital Expenditures	628	1,403	1,402	854	839	828	819	716	707	700	693
+/- Δ NWC	471	(217)	1	370	11	7	6	70	6	5	5
Unlevered FCF	**740**	**2,593**	**2,351**	**1,399**	**1,720**	**1,692**	**1,662**	**1,472**	**1,507**	**1,480**	**1,454**
Discount factor	1.08	1.24	1.44	1.66	1.93	2.23	2.58	2.98	3.45	3.99	4.61
Discounted FCF	**688**	**2,084**	**1,633**	**841**	**894**	**760**	**645**	**494**	**437**	**371**	**315**
Present Value	**9,162**										

Valuation	
WACC	15.67%
Cost of Equity	18.02%
Cost of Debt	4.88%
Target D/V ratio	15.37%
Beta_e	1.65
Market Risk Premium	5.00%
Company Risk Premium	5.00%
Tax rate	44.00%
Risk-free rate	4.78%
Growth rate	0.00%

Summary	
Sum PV FCF	9,162
Terminal Value	2,012
Entity value	11,174
Net Debt	2,538
Equity Value	8,636
BASF Share Value (73%)	6,304

Equity Value Downside Case

WACC \ *Perpetuity*	-1.5%	-1.0%	-0.5%	0.0%	0.5%	1.0%	1.5%
13.7%	7,128.96 €	7,199.55 €	7,275.12 €	7,356.22 €	7,443.48 €	7,537.62 €	7,639.50 €
14.2%	6,862.98 €	6,926.36 €	6,994.07 €	7,066.55 €	7,144.34 €	7,228.04 €	7,318.33 €
14.7%	6,613.07 €	6,670.12 €	6,730.93 €	6,795.88 €	6,865.42 €	6,940.04 €	7,020.33 €
15.2%	6,377.81 €	6,429.26 €	6,484.00 €	6,542.35 €	6,604.67 €	6,671.39 €	6,743.00 €
15.7%	6,155.91 €	6,202.42 €	6,251.80 €	6,304.33 €	6,360.32 €	6,420.14 €	6,484.17 €
16.2%	5,946.27 €	5,988.38 €	6,033.02 €	6,080.41 €	6,130.84 €	6,184.58 €	6,241.99 €
16.7%	5,747.86 €	5,786.06 €	5,826.49 €	5,869.34 €	5,914.85 €	5,963.25 €	6,014.85 €
17.2%	5,559.80 €	5,594.52 €	5,631.20 €	5,670.02 €	5,711.16 €	5,754.85 €	5,801.33 €
17.7%	5,381.28 €	5,412.88 €	5,446.22 €	5,481.45 €	5,518.73 €	5,558.24 €	5,600.20 €

Table 19: Wintershall DEA - Comparable Companies Overview

Note: Financials based on last fiscal year/ Market cap based on 01.07.2023/USD		Market Data				Descriptive Stats			Valuation				
		Price	Market Cap	Net Debt	EV	1P	BOE/D	R/P	EV/EBITDA	V/EBITDAX	EV/EBIT	EV/1P	EV/BOE/D
Company Name	**Geographic Region**	*($/share)*	*($M)*	*($M)*	*($M)*	*mmboe*	mmboe	years	x	x	x	x	x
	Geographically Diversified												
APA CORPORATION (XFRA:2S3)	USA/UK/Offshore Latin America	34	10,490	5,208	15,698	890	0.396	6	2.5x	2.3x	3.1x	17.6x	39641.9x
WOODSIDE ENERGY GROUP LTD (XASX:WDS)	Australia/Mexico/Senegal	23	43,591	-94	43,497	2385	0.611	11	3.6x	3.4x	4.8x	18.2x	71189.7x
MURPHY OIL CORPORATION (XNYS:MUR)	USA/Mexico/Canada/Asia	38	5,979	1,331	7,310	697	0.167	11	3.1x	2.7x	4.5x	10.5x	43770.9x
INPEX CORPORATION (XFRA:I8U)	Middle East/Africa/Asia	11	15,354	7,507	22,861	3700	0.390	26	1.9x	1.9x	2.4x	6.2x	58573.4x
CONOCOPHILLIPS (XNYS:COP)	Broadley diversified	104	124,072	7,400	131,472	6600	1.798	10	4.0x	3.9x	5.2x	19.9x	73121.3x
HESS CORPORATION (XNYS:HES)	USA/Offshore Latin America/Malaysia	136	41,745	5,995	47,740	1260	0.344	10	8.6x	8.1x	12.4x	37.9x	138778.9x
Equinor ASA (XNYS:EQNR)	Norway/USA/Americas	29	92,481	-7,148	85,333	5191	2.039	7	1.0x	1.0x	1.1x	16.4x	41850.5x
	USA												
DEVON ENERGY CORPORATION (XNYS:DVN)	USA	48	30,986	5,243	36,229	1800	0.610	8	3.6x	3.3x	4.6x	20.1x	59391.7x
DIAMONDBACK ENERGY, INC. (XNAS:FANG)	USA	131	23,543	6,091	29,634	2033	0.391	14	3.8x	3.8x	4.5x	14.6x	75711.6x
DENBURY INC. (XNYS:DEN)	USA	86	4,354	28	4,382	202	0.092	6	4.9x	4.9x	5.9x	21.7x	47576.1x
Coterra Energy Inc. (XNYS:CTRA)	USA	25	19,164	1,525	20,689	2398	0.634	10	3.0x	2.8x	3.9x	8.6x	32631.8x
	Northern Europe												
Var Energi ASA (XOSL:VAR)	Northern Europe Offshore	3	6,800	2,731	9,530	673	0.220	8	1.1x	1.1x	1.3x	14.2x	43320.0x
Aker BP ASA (XOSL:AKRBP)	Norway Offshore	23	14,850	2,658	17,508	1251	0.400	9	1.5x	1.5x	1.8x	14.0x	43769.9x
ITHACA ENERGY PLC (XLON:ITH)	Northern & Central North Sea and West of She	2	1,931	1,017	2,948	149	0.071	6	1.6x	1.6x	2.6x	19.8x	41287.1x

Table 20: Wintershall DEA - CCA Valuation Multiples

	Valuation				
	EV/EBITDA	EV/EBITDAX	EV/EBIT	EV/1P	EV/BOE/D
Multiples	x	x	x	x	x
Comparables (ex Northern Europe)					
Average	3.6x	3.5x	4.8x	17.4x	62021.6x
75th Percentile	3.9x	3.8x	5.0x	20.0x	72155.5x
Median	3.6x	3.3x	4.5x	17.6x	58573.4x
25th Percentile	2.7x	2.5x	3.5x	12.5x	42810.7x
Comparables (Northern Europe)					
Average	1.4x	1.4x	1.9x	16.0x	42792.4x
75th Percentile	1.6x	1.5x	2.2x	17.0x	43545.0x
Median	1.5x	1.5x	1.8x	14.2x	43320.0x
25th Percentile	1.3x	1.3x	1.5x	14.1x	42303.6x

Table 21: Wintershall DEA - CCA BASF Share Valuation

	Valuation				
	EV/EBITDA	EV/EBITDAX	EV/EBIT	EV/1P	EV/BOE/D
BASF Share Valuation	x	x	x	x	x
Implied Enterprise Value					
Average	11,178	11,310	8,635	18,751	13,736
75th Percentile	12,410	12,463	9,938	19,743	13,978
Median	11,835	11,758	8,047	16,931	13,906
25th Percentile	10,274	10,382	7,038	16,849	13,579
Implied Equity Value					
Average	8,408	8,540	5,865	15,980	10,966
75th Percentile	9,640	9,693	7,168	16,973	11,208
Median	9,064	8,988	5,276	14,161	11,135
25th Percentile	7,504	7,611	4,268	14,078	10,809
Implied Share Value (in € M)					
BASF Share Value (73%) 75th Percentile	6,447	6,482	4,793	11,351	7,495
BASF Share Value (73%) 25th Percentile	5,018	5,090	2,854	9,415	7,229

Table 22: Wintershall DEA - Global E&P Multiple Analysis (Median)

	EV/EBITDA	EV/EBIT	EV/Sales
Asia Pacific (n=40)	3.1	4.7	1.6
Europe (n=19)	2.1	3.0	1.0
North America (n=33)	2.9	3.9	1.7

Table 23: Wintershall DEA - Comparable Transaction Analysis

Comparable Transcation Analysis

wintershall dea

Date	Company Name		Valuation			
	Target	Acquirer	EV	EV/Sales	EV/EBITDA	EV/EBIT
			x	x	x	x
August 1, 2023	Pipestone Energy Corp	Strathcona Resources Ltd	755.69	1.79	3.00	4.81
May 22, 2023	PDC Energy Inc	Chevron Corp	7,631.38	1.79	2.27	2.98
February 28, 2023	Ranger Oil Corp	Baytex Energy Corp	2,530.75	1.28	1.59	2.16
January 12, 2023	Esso (Thailand) PCL	Bangchak Corp PCL	2,170.68	0.27	4.92	6.08
June 14, 2022	Continental Resources Inc	Omega Acquisition Inc	31,053.13	3.23	4.01	5.25
March 7, 2022	Whiting Petroleum Corp	Oasis Petroleum Inc	3,479.87	2.26	3.20	3.95
October 18, 2021	Senex Energy Ltd	K-A Energy 1 Pty Ltd	742.49	8.60	17.68	38.75
July 20, 2021	Oil Search Ltd	Santos Ltd	8,881.94	5.27	7.82	11.41
May 24, 2021	Cimarex Energy Co	Cabot Oil & Gas Corp	8,854.21	5.02	8.75	21.16
May 10, 2021	Extraction Oil & Gas Inc	Bonanza Creek Energy Inc	1,614.49	7.72	6.38	14.28
July 14, 2020	Polskie Gornictwo Naftowe I Gazownictwo Sa	Polski Koncern Naftowy ORLEN SA	11,046.92	0.35	1.77	2.28
October 1, 2019	Roan Resources Inc	Citizen Energy Operating LLC	961.52	2.31	4.20	20.64
July 29, 2019	Sabine Oil & Gas Corp	Osaka Gas USA Corp	610.00	1.31	1.77	4.10
April 24, 2019	Anadarko Petroleum Corp	Occidental Petroleum Corp	53,989.51	4.03	6.84	15.55
December 31, 2018	Ophir Energy PLC	Medco Energi Global PTE Ltd	538.38	1.88	3.56	11.25
November 26, 2018	Faroe Petroleum PLC	DNO ASA	725.25	2.59	9.45	16.12
November 19, 2018	Resolute Energy Corp	Cimarex Energy Co	1,519.65	4.46	9.36	28.06
November 1, 2018	Newfield Exploration Co	Encana Corp	7,734.30	3.12	4.89	7.67
November 1, 2018	Jerusalem Oil Exploration Ltd	Equital Ltd	2,957.74	3.13	4.03	4.46
October 10, 2018	Blackpearl Resources Inc	International Petroleum Corp	522.08	4.18	8.57	19.63
August 27, 2018	Rex Energy Corp	PennEnergy Resources LLC	830.13	3.38	9.08	26.56
August 14, 2018	Energen Corp	Diamondback Energy Inc	9,100.18	6.87	9.70	21.85
June 18, 2018	Raging River Exploration Inc	Baytex Energy Corp	1,408.52	4.31	6.15	16.00
April 16, 2018	Spartan Energy Corp	Vermilion Energy Inc	1,068.19	3.58	6.61	79.59
November 12, 2017	National Petroleum Services Co Ksc	National Energy Services Reunited Corp	1,065.84	10.57	29.08	33.54
December 6, 2016	Ultra Petroleum Corp	Creditors	13,498.73	17.25	26.44	35.10
May 3, 2016	Petrobras Argentina SA	Pampa Energia SA	1,514.79	0.92	3.11	5.28
February 1, 2016	Questar Corp	Dominion Resources Inc	6,068.27	5.35	9.97	15.76
July 13, 2015	MarkWest Energy Partners LP	MPLX LP	22,845.32	11.32	24.84	68.56
May 26, 2015	Legacy Oil + Gas Inc	Crescent Point Energy Corp	1,174.81	2.86	4.71	38.08
March 17, 2015	Dragon Oil PLC	Emirates National Oil Co Ltd	4,169.64	4.16	4.95	7.55
December 16, 2014	Talisman Energy Inc	Repsol SA	13,081.55	3.00	6.15	43.84
November 21, 2014	Salamander Energy PLC	Ophir Energy PLC	666.28	1.37	1.87	2.74
Mean				**4.23x**	**7.78x**	**19.24x**
Median				**3.23x**	**6.15x**	**15.55x**
75th percentile (as of 2022-23)				**2.14x**	**3.81x**	**5.14x**
25th percentile (as of 2022-23)				**1.41x**	**2.45x**	**3.23x**
Implied Enterprise Value						
75th percentile				**35,967.65**	**30,328.11**	**23,598.73**
25th percentile				**23,573.11**	**19,500.62**	**14,819.70**
Implied Equity Value						
75th percentile				**33,197.28**	**27,557.73**	**20,828.36**
25th percentile				**20,802.74**	**16,730.25**	**12,049.33**
BASF Share Value (73%) (in € Million)						
75th percentile				**22,200.78**	**18,429.32**	**13,929.03**
25th percentile				**13,911.89**	**11,188.41**	**8,058.03**

Appendix C: Text

Appendix C1: Wintershall DEA's efforts towards less carbon intensity

The company aims to intensify efforts to decrease its Scope 1 and Scope 2 emissions, which are the CO2 emissions produced during gas and oil production (Wintershall DEA 2022a). Scope 1 pertains to direct emissions from the oil and gas industry itself, such as those from drilling rigs and transport ships. Scope 2 covers emissions from energy purchased by the industry. Scope 3 focuses on emissions when end users combust the fuel (IEA 2020). Wintershall DEA aims to reduce 20-30 million tons of CO2 annually by 2040, focusing on Carbon Capture and Storage (CCS) and low-CO2 hydrogen production from natural gas. Key initiatives include the NOR-GE partnership for a CO2 pipeline from Germany to Norway and the "BlueHyNow" hydrogen hub on the German North Sea coast. These projects are part of Wintershall DEA's strategy to adapt to Europe's decarbonization shift and meet the growing demand for technologies enabling industry decarbonization (Wintershall DEA 2022a).

Appendix C2: Macroeconomic and Risk Analysis

Globally, oil and gas operations contribute to approximately 15% of energy-related emissions, translating to 5.1 billion tons of greenhouse gases. According to the International Energy Agency's scenario for achieving net-zero emissions by 2050, the emissions intensity from these activities must decrease by half within the decade (IEA 2023). In line with a Boston Consulting Group survey, "What Institutional Investors Think About the Future of Oil and Gas", long-term investor sentiment is mixed due to environmental sustainability concerns, with 66% of investors predicting peak oil demand by 2030 and 60% of investors facing pressure from their clients to completely exclude oil and gas investments (BCG 2022). On the other hand, according to McKinsey's Global Energy Perspective 2022 (McKinsey & Company 2022), fuels such as oil and natural gas will continue to make up a significant share of the energy mix by 2050, partly

because of how they combine affordability and security of supply. Arguments for a good position to play a meaningful role in the energy transition are the global scale of oil and gas companies, the risk appetite of their investors, their large balance sheets and cash positions, and their long-standing relationships with energy customers and stakeholders. Also, their unique capabilities related to offshore projects and hydrogen and sustainable fuel production and transport need to be taken into account.

Nevertheless, the changing societal and regulatory sentiment brings two main risks for the oil and gas industry, which are loss of financial profitability and loss of societal acceptance. These risks can be further examined by looking at different possible scenarios. The first three scenarios of concern are **(I)** the overinvestment in oil and/or natural gas, which could lead to oversupply and potential financial loss; **(II)** underinvestment in oil or gas, potentially causing shortages and price spikes; and **(III)** underinvestment in low-carbon alternatives, which could impede efforts to combat climate change. Furthermore, as global climate policy tightens, there is a growing risk of stranded oil and gas assets (IEA 2020) These scenarios depend to a large extent on the developments regarding the energy transition. The *Sustainable Development Scenario* (SDS) aligns with the Paris Agreement's goals to limit global temperature rise, while the *Stated Policies Scenario* (STEPS) is based on current energy policies, which fail to reach sustainability targets. STEPS indicates that current efforts for clean energy transitions are insufficient against the backdrop of a growing global economy and population (IEA 2020).

As stated in Figure 2, the outlook for global oil and gas demand is closely linked to the speed of technological advancements, the goals of energy strategies, and societal shifts. The required average annual change in demand by region states that to limit global temperature rise to well below two °C (SDS scenario), oil consumption must fall by 2 Mmbbl/d each year from 2030 onwards. In addition to the advanced economies, this also includes China, India and other developing countries that need to significantly reduce their oil consumption. Natural gas, on the

other hand, plays varying roles in global energy transitions due to differences in regional energy needs, infrastructure, and decarbonization goals. For advanced economies in the SDS scenario, gas consumption will decline by 2040 due to improvements in electricity, renewables, and efficiency. However, in developing countries, especially in Asia, gas consumption increases to replace more polluting fuels like coal, especially in sectors such as heavy industry. As these countries are short of gas resources, this also means that the gas trade will shift away from pipeline gas to the transportation of *liquified natural gas* (LNG). The main reason is that it offers more flexibility when looking at changing global gas demand dynamics (IEA 2020). Figure 3 shows how these demand dynamics by region for the scenarios affect the overall demand forecast for oil and gas.

From the regulators' point of view, however, the effects of a strong future demand restriction must also be considered. Efforts to reduce future demand for fossil fuels may paradoxically increase current consumption, but repurposing them for climate-friendly uses could mitigate this "Green Paradox" and alter market dynamics (Konrad 2022). The scenario analysis in relation to the various possibilities of the speed of the energy transition shows that oil and gas companies like Wintershall DEA are well advised to actively diversify their portfolios in a sustainable manner, regardless of the scenario drawn by the IEA that occurs. This change will, of course, have a profound impact on the business model. While oil and gas have historically provided strong dividends for shareholders, the shift towards low-carbon energy may not offer the same high returns, at least in the short term.

Appendix C3: Wintershall DEA: Reformulated Forecasted Income Statement

Forecasting a company’s financial statements is one of the most crucial elements of an extensive analysis as it enables to encapsulate a firm’s future prospects and value into single component statistics, often by linking forecast items to key industry-specific drivers (Rosenbaum and Pearl

2020). Beyond that, depending on the company's firm size and history (historical financial statements), a reformulation of the financial statements can sharpen the analysis significantly as the core operating activities are separated by non-core and financing activities, giving a more holistic view of the company's performance (Koller, Goedhart, and Wessels 2020).

For Wintershall DEA, the reformulation and forecast of its financial statements is based on both the quarterly reports and the annual closing reports, reported in accordance with the German Commercial Code (HGB) (§§ 290). Before the merger of Wintershall Holding GmbH und Deutsche Erdöl AG, the fiscal financial statements are consolidated based on own approximation assumptions, leading to a better understanding of the merged entities past performance. Quarterly reports have been taken into consideration after the merger to harmonize extraordinary effects like the Covid-19 pandemic or the Ukrainian war. Annual closing reports are reported as of the 31st of December of a given year. The forecast takes place on the 1st of July, taking into consideration the first half of FY2023.

Revenue Forecast

On the reformulated income statement (IS), Wintershall DEA's core value driver is revenue, which can be further distinguished into revenue from oil & gas production as well as trading and revenue from other sources (see Figure 6).

In the case of Wintershall DEA, the forecast of these revenues extends well beyond the approximation of top-line growth (CAGR), as various factors play a crucial role. On the one hand, the prediction of future revenues must be somewhat decoupled from historical revenues, as the entire Russian business activities, due to the war that broke out in Ukraine, has led to a write-off of two-thirds of all 2P reserves. On the other hand, companies operating in the E&P-sector are subject to fluctuations in oil and gas prices due to macroeconomic influences that the company itself cannot determine. Thus, in FY2022, the company experienced a record revenue, which, however, was not due to a historical high in sales volume but rather to a historical high

in oil and gas prices.

Breaking down the revenue sources into the respective parts, future production revenues can be estimated by assessing the existing 2P reserves and determining the duration over which these reserves will be depleted at the current annual production rate (Damodaran 2012). Doing so, the historical daily production volumes for oil and gas in the respective regions in which Wintershall DEA operates (excluding Russia since FY2023) must first be considered (see Table 13). The expected daily production volume for FY2023 in the respective region is based on the mean daily production of Q1 and Q2 so far. The future daily production levels for Northern Europe Gas and Oil are projected to remain consistent with those of FY2023. This stability is expected as new assets from Norway will compensate for the diminishing output of German assets, maintaining a conservative yet steady production rate (Wintershall DEA 2023b). With Norway being one of the key growth areas for Wintershall DEA to maintain an oil and gas weighted portfolio, the company expects six new assets to come on stream from FY2026e onwards (Wintershall DEA 2023b). For the regions Middle East and North Africa, a yearly decline from FY2023 levels in oil and gas production of 3% is modeled based on the company's strategy to decrease further exploration investments beyond its core operating regions (Wintershall DEA 2023b). Beyond these regions, Wintershall DEA's investments in the exploration and development of new producing assets future projects in Northern Europe and Latin America coming on stream must be considered. Looking at asset development in Latin America, the "Fenix" gas field in Argentina is expected to start producing in FY2025e. Wintershall holds a 37.5% share in the project and expects a maximum daily production of around 10 million cubic meters of gas (58,858 boe) (Wintershall DEA 2022). Projects "Fenix" gas production is modeled with 16 mboe/day in FY2025e, growing with a CAGR of 11.1% until reaching the peak in FY2028e and remaining steady onwards. Another asset coming on stream is the "Zama" oil and gas field in Mexico, where Wintershall DEA holds a 19.83% share

(Wintershall DEA 2023a). Peak production capacity of up to 180,000 barrels of oil and 70.35 million cubic feet of gas per day (11,725 boe) is expected to be achieved by FY2029e. This contributes significantly to the Latin American oil production. The production is estimated to start in end of FY2025e (Offshore Technology 2023). The “Zama” Wintershall oil production is modeled with 26 mboe/day in FY2026e, growing with a CAGR of 11.1% until reaching the peak in FY2029e and remaining steady onwards. The new Latin American assets are modeled to add on FY2023 Latin American daily production. Overall, the production of the existing oil and gas fields with the development of new fields in Wintershall DEA’s core areas will lead to a constant production level of between 110 and 130 million barrels of oil equivalent in the medium to long term until FY2033e.

To derive an approximation of future oil and gas revenues by multiplying the production volume with the respective realized price, assumptions must first be made about future oil and gas prices. For the forecast of the realized oil prices in the three respective regions, Northern Europe, Latin America, and Middle East/North Africa, in Q3 and Q4 of FY2023, the realized prices from Q2 FY2023 are used with a 10% price band for the upside and downside scenario. The resulting prices range from 58.95 to 72.05 $/bbl for Northern Europe, from 48.51 to 59.29 $/bbl for Latin America, and from 63.18 to 77.22 $/bbl for Middle East/North Africa. For oil prices from FY2024e until FY2027e in the respective regions, the Refinitiv oil poll is considered (Refinitiv Eikon 2023). It’s a survey conducted among economists and analysts to forecast oil prices and market trends. Considering that historically, the full Brent crude price was never realized in the three regions, the Refinitiv oil poll Brent price is multiplied by the respective mean value from FY2019 to FY2022 of the realization share in the respective region. For the upside and downside scenarios, again, a price band of 10% is modeled. The resulting prices for FY2024e until FY2027e in the base case are therefore 56.54/54.84/52.41 and 51.91 $/bbl for Northern Europe, 52.10/50.53/48.29 and 47.83 $/bbl for Latin America and

63.56/61.65/58.92 and 58.35 $/bbl for Middle East/North Africa. For FY2028e and FY2029e, the prices are held steady on FY2027e levels for each of the respective regions. The base, upside, and downside oil price forecasts for FY2030 and beyond are based on the three pricing scenarios outlined in Table 14, which reflect varying rates of energy transition as projected by the International Energy Association (IEA 2022). As in the previous section, the fact that historically different proportions of the full price were realized in the three regions is also considered here. In terms of gas prices, prices in FY2023 Q3 and Q4 will remain at the Q2 level with a 10% price band for upside and downside scenarios. The resulting prices range from 8.86 to 10.82 $/mscf for Northern Europe, from 3.45 to 4.21 $/mscf for Latin America, and from 3.26 to 3.98 $/mscf for Middle East/North Africa. For gas prices from FY2024e onwards in Latin America and Middle East/North Africa, the historically realized average minimum and maximum prices are modeled for the base, downside, and upside scenarios. The resulting prices range from 2.03 to 3.83 $/mscf for Latin America and from 2.78 to 4.32 $/bbl for Middle East/North Africa. With regard to future gas prices in the Northern Europe region, the price forecast from Fitch Ratings is used with a price band of 10% for downside and upside scenarios resulting in 10 $/mscf for FY2024e/FY2025e and 5 $/mscf from FY2026e onwards (Fitch Ratings 2023).

Beyond revenues from production, Wintershall DEA's trading revenues make up a significant share. Trading revenues refer to the income generated from buying and selling oil and gas commodities. These transactions can range from spot market trades, where immediate delivery of commodities occurs at current market prices, to more complex financial dealings involving futures, options, and derivatives (Wintershall DEA 2023b). The activities are crucial for energy companies to manage risk, capitalize on price fluctuations, and optimize their market positions. Upon analyzing the relationship between trading revenues and realized prices, it has been observed that there is a strong correlation between the two. In a performed regression analysis,

the European realized gas prices significantly explain the variation in gas trading revenues, as evidenced by an R^2 value of 0.97. This high degree of correlation suggests that the European realized gas prices can be a valid and reliable predictor for forecasting trading revenues. Consequently, incorporating prices in forecasting the trading volumes offers a robust basis for estimating future trading income for Wintershall DEA.

Lastly, revenues from other sources historically only made up a minor share of Wintershall DEA's overall revenue (ca. 1%), therefore also forecasted at a very low level in the future.

Concluding the revenue forecast, overall revenues experience a decrease from the record year FY2022, stabilizing in the medium term (FY2023e to FY2025e) due to above-average gas prices. FY2026e and beyond, gas prices are lower due to an assumed declining gas demand, which is attributable to increased energy efficiency, electrification, and renewable energy implementation, reducing revenues to a constant level of €6bn to €7bn until FY2033e.

Cost Forecast

Focusing on the cost side of Wintershall DEA, Costs of Goods Sold (COGS), including production and operating expenses, as well as Selling, General, and Administrative (SG&A) expenses, are closely linked to the companies' total sales. As the past does not indicate significant fluctuations in the proportion, the two are assumed to follow their historical trend and develop flat in relative terms with 56.00% and 6.00%, respectively. Besides that, expenses in research and development (R&D) play a crucial role in successfully align the company in the long term. Past expenses in R&D were mainly allocated to the exploration of new oil and gas fields for the protection of future production. These expenses have been significantly decreased in FY2021 and FY2022 in absolute terms, leading to a relative proportion of 1.72% to 0.55% of total sales, respectively. With Wintershall DEA's transition strategy in mind, while incorporating and securing the existing organic business, an increased relative share of 3.40% exploration expenses to total sales is expected until FY2033e. Moreover, the impairment of

assets (depletion) stands out as a distinctive characteristic in the oil and gas business due to its remarkable level (relative to PP&E). Due to the volatility in commodity prices and the dependence on oil and gas prices, it leads to significant fluctuations in the value of the existing assets. Nevertheless, the position is relatively stable as a share of PP&E in the past (FY2019 to FY2022). Therefore, the percentage average of PP&E is assumed, leading to a level of 11.2%. In addition, is also proving to be overall stable in relation to PP&E, forecasting a historical average of 13.3%.

Subtracting the costs of Wintershall DEA's core business from its core revenues, successful years (FY2023e until FY2025e) are expected in the short term with core-business EBIT between €1.58bn and €1.79bn. These are mainly driven by stable high commodity prices for oil, and going forward, the EBIT will decrease significantly in FY2026e, stabilizing at a level where the company struggles to break even.

Non-core items

For a better understanding of Wintershall DEA's profitability in its core business activities, a distinction between core and non-core items has been made (Koller, Goedhart, and Wessels 2020). An important item, allocated as non-core (not be expected event), was the deconsolidation of the Russian business activities. This led to a harmonization of FY2022 core results, where the company has been very successful within its core business activities. Besides that, Other Operating Income, Non-Operating Income, and Total Financial Income have been recognized as non-core items. All items have been stable in past years and are assumed to follow their past trend, using the average proportion to total sales of 3.77%, 2.01%, and 3.70%, respectively. Concluding, the non-core result increases the overall profitability of the entire business before interest and taxes.

Financing activities

According to Koller, Goedhart, and Wessels (2020), it is necessary to consider financing

activities in order to obtain a holistic view of the reformulated income statement. Since Wintershall DEA aims to maintain a constant debt structure, financial expenses, i.e. interest expenses, have been stable over time. Assuming this proportion remains constant, it is anticipated that interest expenses will represent 7.35% of total sales until FY2033e.

Tax Considerations

As last crucial step, it is essential to calculate the income by deducting the effective tax expenses. The tax dynamics for Wintershall DEA have unique characteristics, therefor playing a special position in the analysis of the company. Post-merger, a detailed breakdown of tax payments indicates that taxes paid often surpassed the statutory tax rate of 30% (see Table 8). This increase can be attributed primarily to two factors; special effects and deferred tax accounting for D&A and depletion (HGB §253 3 – 5; EstG §7 §12). Specifically, in the case of Wintershall DEA, the magnitude of depreciation and depletion has resulted in a high relative tax rate. The factors are inherent to the E&P industry indicating that they will continue to have an eminent impact on increasing the tax rate. As a result, the effective tax rate is expected to be around 44% based on past financial data.

Appendix C4: Wintershall DEA: Reformulated Forecasted Balance Sheet

Following the approach of Koller, Goedhart, and Wessels (2020), Wintershall DEA's Balance Sheet (BS) has been reformulated. This aims to provide an evaluation of how efficiently the company utilizes its capital for generating revenues. The forecasted reformulation, presented in Table 6, offers a more differentiated view of on the company's assets and liabilities, leading to a more accurate estimation of its value.

Core Invested Capital

Regarding the company's core invested capital, Net Working Capital (NWC) was firstly determined, including operating cash, trade and financial receivables inventories, trade and other payables as well as short term derivative instruments (Damodaran 2012). Operating cash was calculated based on the benchmark of 2% of the company's sales recommended by Koller, Goedhart, and Wessels (2020). Predictions for trade and financial receivables are based on collection periods – 68 days for trade receivables and 5 days for financial receivables.

Similarly, the forecast for trade and other payables is linked to the duration of payables outstanding which amounts to 99 days. The forecast for inventories is based on the average past holding period – 23 days. Derivative instruments and provisions for decommissioning are calculated as a percentage of revenues, leading to the projected working capital until FY2033e.

Moving beyond NWC, it is crucial to examine other significant components of Wintershall DEA's core invested capital. These components include goodwill, exploration assets, PP&E, other intangible assets, and long-term provisions for decommissioning. Notably, Wintershall DEA's goodwill has remained relatively stable since the merger in FY2019, with a valuation of €2.2 billion fluctuating within a range of ±3%. This valuation is expected to slightly decrease annually due to impairments until reaching a value of €1.1bn in FY2033.

On the contrary, exploration assets have exhibited volatility since FY2016, when they peaked at €3.4 billion but declined significantly to around €0.3 billion in FY2022. This trend aligns

with Wintershall DEA's increasing focus on fossil energy sources and greater investments in shareholdings (Wintershall DEA 2023b). Therefore, it is projected that the decreased value of exploration assets will persist through FY2033e.

Similar to the way Wintershall DEA's goodwill has evolved, the value of PP&E has remained relatively constant at around €8.5 billion. However, there has been a marginal downward trend since FY2016. To forecast values of PP&E, we have considered the decline observed during FY2019-22, reflecting the trend over the past four years. The value of other intangible assets, such as exploration rights and licenses, as well as contracts and agreements, has also been decreasing. Currently, they represent two-thirds of their value in FY2019. This downward pattern is expected to continue with a decline rate of 2% until FY2033e.

In addition, decommissioning (long-term) provisions must be regarded as a significantly important element, as they stand for an average value of €2.46bn in the past fiscal years. They reflect the company's acknowledgment of costs associated with responsibilities and regulatory obligations for decommissioning oil and gas facilities. These provisions are crucial for ensuring that the company is prepared for these future expenditures. It is anticipated that the value of these provisions will remain stable until the end of FY2033e since the company plans to continue operating oil and gas facilities until this date and beyond.

Non-Core Invested Capital

When analyzing Wintershall DEA's non-core invested capital, it is observed that most non-core items on their balance sheet are relatively small and are determined based on a historical percentage of sales. However, there are exceptions, such as pension provisions and tax liabilities, including both income and deferred taxes. The future pension provisions are estimated based on the percentage of total sales, indicating a downward trend until FY2033e. This aligns with Wintershall DEA's strategy to reduce personal costs in the coming years (Wintershall DEA 2023b). According to the forecast, these provisions will gradually decrease

below €1 billion. In terms of tax liabilities, considering the tax nature of Wintershall DEA, both income and deferred tax liabilities are exceptionally high. In FY2022 alone, they amounted to €1.75bn and €1.71bn, respectively. These values are expected to remain relatively high with a decline projected in the absence of factors like the deconsolidation of Russia that are not expected to recur in the future.

Financing Activities

Moving on to financing activities, Wintershall DEA engages in activities that result in generating surplus cash while also taking on short-term and long-term debts along with associated interest costs. The projected estimates for the years up until FY2025 suggest that Wintershall DEA will experience highly profitable periods. This will be driven by elevated prices in the oil and gas industry as well as consistent production levels. As a result, high cash flows are expected, that will lead to an increased surplus of cash until FY2025. However, after that point, a gradual decline of surplus cash is expected. To maintain a permanent debt structure, Wintershall DEA issued €4bn worth of bonds maturing by FY2029. The company also intends to maintain bank debt. This build-up of debt gives us confidence in predicting a stable level of debt until FY2033e, along with stable interest payments. Lastly, in terms of equity, which includes subscribed capital, capital reserves, retained earnings, and equity attributable to investors, we anticipate stability without changes until FY2033.

Appendix C5: Additional Risk Premium for Wintershall DEA's Cost of Equity

Considering the deconsolidation of its Russian business and the resulting loss of two thirds of its existing 2-P reserves, along with uncertainties surrounding future regulatory environments and macroeconomic instabilities, the traditional equilibrium model (CAPM) has been augmented with a company specific risk premium CRP_i. Applying increased discount rates for companies with high-risk characteristics proves to be an important adjustment, as suggested by Altman (1968), Pettit (1972) and Damodaran (2006). They emphasize the need to tailor models to accurately reflect individual company risks, especially when standard models may not fully capture the complexities of a company's risk profile.

For Wintershall DEA, these specific considerations are further compounded by the insights of Short, Packey, and Holt (1995), who highlight the volatility in the energy sector and advocate for a risk premium. Their analysis is particularly relevant for Wintershall DEA as it faces the challenges and volatility of the E&P industry and beyond. Additionally, given macroeconomic uncertainties, such as shifts towards renewable energy and recent reserve losses, there is a need for an additional risk premium. Considering the principle of risk-return trade-off for investors, it is justified to establish Wintershall DEA's CRP_i to 5%. This adjustment aligns with the scale of challenges faced by Wintershall DEA.

Appendix C6: Beta Estimation for Wintershall DEA

As Wintershall DEA is not publicly listed, the approach suggested by Damodaran (2012a) is followed to derive an estimation of the company's systematic risk - ß - to ultimately compute the cost of equity. The ß for a private firm can be estimated by looking at the average betas for publicly traded companies in the same industry. To derive an unlevered beta β_U for each of the industry companies using *Equation 4*, the 5-year monthly beta, market capitalization, cash, total debt, and tax rate are retrieved using Refinitiv (Refinitiv Eikon 2023). The tax rate used for companies that have had low variability in tax rate over the last five years is the median tax rate. For companies with more variable tax rates, it is a blend of the company's median tax rate over the last five years and the country's or region median effective tax rate. According to Damodaran (2012a) the cash a company holds must also be considered when computing the β_U for each of the peers. The intuition is that cash is invested to close to riskless investments with a beta of 0. The unlevered beta β_U corrected for cash is computed as follows:

$$\beta_{U,CC} = \frac{\beta_U}{(1 - \frac{Cash}{EV})}$$

where $\beta_{U,CC}$ is the cash corrected unlevered beta for each firm. When deriving the relevered beta for a private company, it's essential to consider not only the peer average unlevered beta but also the enterprise value weighted average unlevered beta. This dual approach ensures a more accurate and representative beta calculation. The weighted average accounts for the size and capital structure of the comparable companies, providing a nuanced perspective that aligns more closely with real market conditions. However, if the difference between the normal average and the weighted average is marginal, it is practical and justifiable to use the normal average. When adjusting the derived industry average unlevered beta $\beta_{U,CC}$ for financial leverage of Wintershall DEA, one faces the challenge of not having a market value-based debt-to-equity ratio for Wintershall DEA. This ratio is crucial in determining the levered beta β_L,

which represents the firm's risk profile, including its financial structure. Based on Damodaran (2012a), an industry average approach should be utilized. The approach assumes that the firms market leverage is similar to the industry average. However, it is important to calculate the leverage as a debt-to-equity ratio by summing up all companies' debt and dividing it by the market value across all companies. Simply taking an average of debt-to-equity ratios would be too sensitive to outliers. Therefore, we can compute the re-levered beta β_L for the firm with the industry average denoted as $\frac{D}{E}_{IA}$ by the following equation:

$$\beta_L = \beta_{iU}(1 + (1 - T_c) * \frac{D}{E}_{IA})$$

Appendix D: Regression Results

ESG Dynamics and Their Valuation Implications in the Oil & Gas Industry

Table 2.1: Rationale of hypotheses

Hypothesis	Variable	Expected direction	Rational
H_1	Emissions	positive	It is hypothesized that a higher Emissions Score, reflecting better performance in emissions reduction efforts, will positively impact the market valuation of oil and gas companies.
H_2	Management	positive	It is anticipated that a higher Management Score, indicating effective management practices in sustainability and governance, will be positively associated with the market valuation of oil and gas firms.
H_3	CSR	positive	The hypothesis is that a higher CSR Score, denoting a stronger commitment to corporate social responsibility, will have a positive influence on the market valuation of oil and gas companies.
H_4	Capital Expenditures (%)	positive	It is hypothesized that a large proportion of capital expenditures to total assets, which is indicative of a company's investment in long-term growth and sustainability, will be associated with a high market valuation.

Table 2.2: Regression analysis assumptions

Number	Assumption
1	Linear Relationship
2	Independence of observations
3	Homoscedasticity
4	Normal Distribution of Residuals
5	No or Little Multicollinearity
6	No Auto-correlation
7	No Endogeneity

Gujarati and Porter (2009)

Table 2.3: Summary statistics sample selection

Variables	N	Mean	Std. dev.	Min	Max
(1) Emissions Score	150	65.24	25.53	2.70	99.83
(2) Management Score	150	62.79	25.53	4.55	99.81
(3) CSR Score	150	70.27	24.39	0.63	99.39
(4) CapEx / Total Assets	150	0.09	0.08	0.001	0.47
(5) Current Ratio	150	1.68	2.08	0.29	15.99
(6) ROTA	150	0.20	0.14	-0.09	0.67
(7) Tobin's Q	150	1.39	1.67	0.22	6.76

Table 2.4: Summary statistics Europe

Variables	N	Mean	Std. dev.	Min	Max
(1) Emissions Score	28	82.56	18.33	30.24	99.83
(2) Management Score	28	69.24	28.83	15.31	99.57
(3) CSR Score	28	69.34	26.83	4.35	97.96
(4) CapEx / Total Assets	28	0.06	0.03	0.00	0.13
(5) Current Ratio	28	2.09	2.30	0.52	10.25
(6) ROTA	28	0.20	0.14	-0.06	0.67
(7) Tobin's Q	28	1.06	0.42	0.22	2.66

Table 2.5: Summary statistics North America

Variables	N	Mean	Std. dev.	Min	Max
(1) Emissions Score	80	54.94	24.78	2.70	96.51
(2) Management Score	80	62.39	25.42	9.90	99.81
(3) CSR Score	80	68.71	23.38	6.60	99.36
(4) CapEx / Total Assets	80	0.11	0.09	0.00	0.47
(5) Current Ratio	80	1.60	2.40	0.29	16.00
(6) ROTA	80	0.25	0.14	-0.05	0.66
(7) Tobin's Q	80	1.64	2.20	0.82	6.76

Table 2.6: Summary statistics Asia Pacific

Variables	N	Mean	Std. dev.	Min	Max
(1) Emissions Score	42	73.31	22.03	5.91	98.82
(2) Management Score	42	59.25	28.87	4.55	99.71
(3) CSR Score	42	73.85	24.81	0.63	99.39
(4) CapEx / Total Assets	42	0.05	0.04	0.00	0.20
(5) Current Ratio	42	1.53	1.01	0.60	5.96
(6) ROTA	42	0.10	0.08	-0.08	0.34
(7) Tobin's Q	42	1.13	0.64	0.48	4.35

Table 2.7: Pairwise correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Emissions Score	1.000						
(2) Management Score	0.349*	1.000					
	(0.000)						
(3) CSR Score	0.627*	0.327*	1.000				
	(0.000)	(0.000)					
(4) CapEx/Assets	-0.383*	-0.055	-0.161*	1.000			
	(0.000)	(0.504)	(0.050)				
(5) CurrentRatio	-0.138*	-0.212*	-0.153	-0.182*	1.000		
	(0.093)	(0.009)	(0.062)	(0.026)			
(6) ROTA	-0.181*	0.153	-0.032	0.393*	-0.044	1.000	
	(0.027)	(0.062)	(0.702)	(0.000)	(0.591)		
(7) Tobin's Q	-0.167*	-0.064	0.026	-0.014	0.535*	0.334*	1.000
	(0.042)	(0.435)	(0.756)	(0.863)	(0.000)	(0.000)	

P-values in parentheses (* $p<0.05$)

Table 2.8: Test results

Diagnostic test	Applied Test	Result	Solution
Linearity	Scatterplot with fit line	No non-linear patterns	n.a.
Homoscedasticity	Breusch-Pagan Test	Heteroscedasticity	Robust Standard Errors & Clustered Standard Errors (Intra-cluster correlation)
Normality of Residuals	Q-Q plot	Residuals do not deviate from line	n.a.
Multicollinearity	Variance Inflation Factor (VIF >5)	All variables <5	n.a.
Omitted variable bias	Ramsey RESET Test	No omitted variable bias	n.a.

Table 2.9: Variance inflation factors (VIF)

Variable	VIF	1/VIF
Emissions Score	2.04	0.490
CSR Score	1.77	0.566
CapEx / Total Assets	1.46	0.687
Return on Total Assets	1.33	0.750
Management Score	1.25	0.800
Current Ratio	1.14	0.880
Mean VIF	1.50	

Table 3.2: CAPM Regression Tests

Diagnostic test	Applied Test	Result
Linearity	Scatterplot with fit line	No non-linear patterns observable
Homoscedasticity	Breusch-Pagan Test	Homoscedasticity (Breusch-Pagan test is insignificant at the 10% level)
Normality of Residuals	Q-Q plot	The residuals mostly fall along the straight line, indicating normality. There are a few points at the ends that deviate slightly, which could suggest mild outliers.

Table 3.3: Fama French 5 Factor Q1 Regression Tests

Diagnostic test	Applied Test	Result
Linearity	Scatterplot with fit line	No non-linear patterns observable
Homoscedasticity	Breusch-Pagan Test	Homoscedasticity (Breusch-Pagan test is insignificant at the 1% level)
Normality of Residuals	Q-Q plot	Residuals do not deviate from line
Multicollinearity	Variance Inflation Factor (VIF >5)	All variables <5 (see Table 3.3)

Table 3.4: Variance Inflation Factor Test

Variable	VIF	1/VIF
HML	4.95	0.20
CMA	3.98	0.25
RMW	1.99	0.50
MktRF	1.34	0.75
SMB	1.29	0.78
Mean VIF	2.71	

Table 3.5: Fama French 5 Factor Q4 Regression Tests

Diagnostic test	Applied Test	Result
Linearity	Scatterplot with fit line	No non-linear patterns observable
Homoscedasticity	Breusch-Pagan Test	Homoscedasticity (Breusch-Pagan test is insignificant at the 1% level)
Normality of Residuals	Q-Q plot	The residuals mostly fall along the straight line, indicating normality. There are a few points at the ends that deviate slightly, which could suggest mild outliers.
Multicollinearity	Variance Inflation Factor (VIF >5)	All variables <5 (see Table 3.3)

Table 3.5: Regression Output

Variables	(1) Q1_excess	(2) Q4_excess	(3) Q1_excess	(4) Q4_excess
MktRF	1.032***	1.701***	1.149***	1.673***
	(0.129)	(0.225)	(0.114)	(0.218)
SMB			0.0427	1.293*
			(0.342)	(0.656)
HML			0.767**	1.438**
			(0.305)	(0.586)
RMW			-0.490	-0.406
			(0.423)	(0.812)
CMA			0.485	-0.151
			(0.439)	(0.842)
Constant	0.810	0.622	0.921*	1.175
	(0.591)	(1.029)	(0.468)	(0.898)
N	93	93	93	93
R^2	0.412	0.386	0.675	0.587
Adjusted R^2	0.406	0.379	0.656	0.564
F	63.88	57.23	36.15	24.77
p	0.000	0.000	0.000	0.000

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1