

Equity Valuation

# **The Linde Group**

**Master Thesis**

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## **Abstract**

This analysis provides a stock valuation of The Linde Group, a Germany based Industrial Gases company and one of the main players within this industry worldwide. After reviewing the most recent literature in terms of valuation, two different methods, namely the DCF Valuation and the Multiple Approach, are applied to determine the enterprise- and equity value of the company. Further insights are provided through a sensitivity analysis, giving more information about the main drivers for the obtained valuation of Linde. Finally, the results are compared to the estimations of Morgan Stanley, summarizing and explaining the main differences and their origins.

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## List of Abbreviations

APT	Arbitrage Pricing Theory
APV	Adjusted Present Value
$\alpha$	Alpha
$\beta$	Beta
CAGR	Compounded Annual Growth Rate
CapEx	Capital Expenditure
CAPM	Capital Asset Pricing Model
CoC	Cost of Capital
CoD	Cost of Debt
CoE	Cost of Equity
COGS	Cost of Goods Sold
CO <sub>2</sub>	Carbon Dioxide
CF	Cash Flow
DAX 30	Deutscher Aktienindex
DCF Valuation	Discounted Cash Flow Valuation
DPS	Dividend per Share
D&A	Depreciation & Amortization
D/V	Debt/Total Assets
EBIT	Earnings before Interest and Tax
EBITDA	Earnings before Interest, Tax, Depreciation and Amortization
EMEA	Europe, Middle East, Africa
ERP	Equity Risk Premium
EV	Enterprise value
E/V	Equity/Total Assets
FCFE	Free Cash Flow to Equity
FCFF	Free Cash Flow to the Firm
GDP	Gross Domestic Product
HPO	High Performance Organization
IP	Industrial Production
Linde	The Linde Group
LNG	Liquefied Natural Gas
$\lambda$	Lambda
MA	Multiple Approach
MS	Morgan Stanley
MRP	Market Risk Premium
NWC	Net Working Capital
OCF	Operating Cash Flow
PP&E	Property, Plant & Equipment
PV	Present Value

P/E	Price/Earnings ratio
R&D	Research & Development
$r_f$	Risk-Free Rate
$r_m$	Market Return
SG&S	Selling, General and Administrative Expenses
ST Investments	Short-Term Investments
TV	Terminal Value
V	Total Assets
WACC	Weighted Average Cost of Capital
YTM	Yield to Maturity



## Current positioning and outlook

### Market positioning of Linde

Among with its three main competitors, Linde is one of the global players in the industrial gases market

### Strategic focus on growth and efficiency

Clear focus on four core business lines, with growth to be achieved through capital expenditure and Acquisitions

### Acquisitions in healthcare in 2012

Increasing business activities in the healthcare market, mainly driven by acquisitions in the Americas and EMEA

### Positive LNG market outlook

Global demand for alternative energy to increase business potential in the gases and engineering divisions

### Key Financial Data

in € million	2013F	2014E	2015E	2016E	2017E	2018E
Total Sales	17,162	18,536	19,841	21,158	22,425	23,739
EBITDA	4,239	4,691	5,003	5,311	5,610	5,914
EBIT	2,450	2,740	2,935	3,130	3,316	3,511
Net Income	1,418	1,597	1,740	1,877	2,004	2,134
FCFF	1,486	1,582	1,689	1,820	1,924	2,063
DPS (€)	3.18	3.72	4.22	4.73	5.25	5.82
EV/Sales	2.40	2.22	2.08	1.95	1.84	1.73
EV/EBITDA	9.72	8.78	8.23	7.75	7.34	6.96
P/E	18.90	16.77	15.39	14.27	13.37	12.56

### Key Facts

Current Price (06.03.2014)\*: €148.20

Target price: €158.07

Recommendation: Buy

### Current Market Data

52 Week Range\*: €130.90 - €154.80

Shares outstanding\*: 185.65m

Free Float\*: 185.50m

Market capitalization\*: €27,290.39m

Enterprise Value: €40,457m

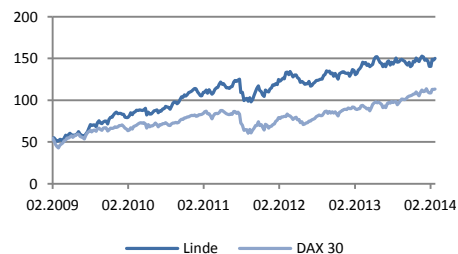
30 day Average Trading Volume\*: 480,417

1 year return\*: +8.19%

Bloomberg: LIN:GR

Reuters: LING.DE

### Stock Performance (Linde and DAX 30)



### Next Event

March 17<sup>th</sup> 2014:

Annual Results 2013 presentation

### Analyst

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\*Source: Bloomberg

**Strong business development despite economic downturn...**

Although the general economic conditions in 2012 presented themselves challenging, Linde was able to increase total sales from €13,787 in 2011 to €15,280m in 2012, representing an increase of 10.83%

**...mainly driven by acquisitions in the Americas in the healthcare sector**

Organic growth still existent but on lower levels than total growth. Regional growth rates for reportable segments of 2.8% (the Americas), 4.1% (EMEA) and 5.0% (Asia/Pacific). Main contribution through acquisitions in healthcare sector

**Ongoing HPO program implementation with first positive results visible**

In 2009, the company implemented the High Performance Organization Program, aiming to reduce operational costs. Accumulated savings of €780m until 2012, further expected savings of €750m - €900m until 2016

**Further business opportunities in the LNG market...**

New regulations in energy markets will increase business potential in the liquefied natural gases sector. Expected positive impacts on Linde's gases division in the liquefied gases and on-site business as well as increased orders in the engineering division

**...with huge regional differences in LNG prices to be considered**

LNG prices show a big disparity in Linde's reportable segments. While price levels in the Americas are comparably low, EMEA and Asia/Pacific prices are significantly higher. Increases are expected in the Americas, while for the other regions, prices might decrease within the next 5 years

**A strong player in the global industrial gases market...**

The company is focused on its main business areas since selling its refrigerating business. Strong business development to be expected in the industrial gases market caused by the company's cylinder and liquefied gases operations as well as through on-site and engineering contracts. Increased focus on healthcare is expected to influence the company's performance positively due to demographic change and the generally increased awareness of the population for healthcare services

**...with high dependency on industrial growth**

Although the company increased its exposure in the healthcare business, Linde's general business outlook is highly dependent on industrial growth as most customers are active in this market. Difficult economic conditions with long-term outlook to be hardly predictable bear several risks for the future business and might slow-down sales growth

**Valuation rationale and implications**

Considering all drivers explained, Linde is set to buy as the current price is assumed to be slightly below the company's intrinsic value. Positive aspects, like the increased focus on the healthcare market and the successful implementation of cost saving strategies, are expected to keep Linde in its strong market positioning for future periods. However, with the high dependency on the general industrial development, growth potential may be limited in future periods. This became already evident in 2012, when high growth rates were only achieved through acquisitions, while organic growth in the industrial gases and engineering segments remained on a strong but not extraordinary high level

**Balance Sheet**

in € million	2013E	2014F	2015F	2016F	2017F	2018F
Total Cash & ST Investm.	2,250	2,429	2,680	2,979	3,327	3,697
Total Receivables	3,838	4,145	4,437	4,732	5,015	5,309
Total Current Assets	7,383	7,930	8,572	9,256	9,992	10,745
Net PP&E	11,443	12,359	13,229	14,107	14,952	15,828
Total Non-Current Assets	28,172	29,227	30,248	31,289	32,307	33,368
<b>Total Assets</b>	<b>35,555</b>	<b>37,157</b>	<b>38,819</b>	<b>40,544</b>	<b>42,299</b>	<b>44,113</b>
Total Current Liabilities	7,559	7,791	8,035	8,282	8,519	8,766
Total Non-Cur. Liabilities	13,417	13,797	14,192	14,608	15,038	15,492
Total Common Equity	13,922	14,828	15,786	16,784	17,813	18,867
Total Equity	14,579	15,569	16,592	17,654	18,742	19,856
<b>Total Liab. and Equity</b>	<b>35,555</b>	<b>37,157</b>	<b>38,819</b>	<b>40,544</b>	<b>42,299</b>	<b>44,113</b>

**Income Statement**

in € million	2013E	2014F	2015F	2016F	2017F	2018F
Revenue	17,162	18,536	19,841	21,158	22,425	23,739
<b>Cost Of Goods Sold</b>	<b>10,898</b>	<b>11,678</b>	<b>12,500</b>	<b>13,330</b>	<b>14,128</b>	<b>14,956</b>
Gross Profit	6,264	6,858	7,341	7,828	8,297	8,784
SG&A	4,119	4,449	4,762	5,078	5,382	5,697
R&D Exp.	113	123	131	140	148	157
Other Operating Income	323	349	374	399	423	447
Other Operating Expenses	224	242	259	276	293	310
<b>Operating Income</b>	<b>2,355</b>	<b>2,637</b>	<b>2,822</b>	<b>3,009</b>	<b>3,190</b>	<b>3,377</b>
Non Op. Income/Expenses	95	104	112	121	126	134
<b>EBIT</b>	<b>2,450</b>	<b>2,740</b>	<b>2,935</b>	<b>3,130</b>	<b>3,316</b>	<b>3,511</b>
Net Interest Income	(507)	(551)	(549)	(558)	(570)	(586)
Income Tax Expense	441	497	542	584	624	664
Minority Interest	84	95	103	111	119	126
<b>Net Income</b>	<b>1,418</b>	<b>1,597</b>	<b>1,740</b>	<b>1,877</b>	<b>2,004</b>	<b>2,134</b>
Dividends	590	691	783	878	975	1,080

**Discounted Cash Flow Valuation**

in € million	2014F	2015F	2016F	2017F	2018F
EBIT	2,740	2,935	3,130	3,316	3,511
Taxes	497	542	584	624	664
+Deprec. and amortization	1,951	2,069	2,181	2,294	2,403
<b>CF from Operations</b>	<b>4,194</b>	<b>4,462</b>	<b>4,727</b>	<b>4,986</b>	<b>5,250</b>
-Change in NWC	136	147	138	151	137
-CapEx	2,476	2,626	2,768	2,912	3,050
<b>FCFF</b>	<b>1,582</b>	<b>1,689</b>	<b>1,820</b>	<b>1,924</b>	<b>2,063</b>
Present Value	1,487	1,492	1,513	1,503	
Terminal Value				35,550	
<b>Enterprise Value</b>	<b>41,546</b>				

**Equity Value**

<b>Enterprise Value</b>	<b>41,546</b>
<b>Additions</b>	
Cash & Short Term Investments	2,250
Contingent Liabilities	816
<b>Subtractions</b>	
Market Value of Debt	11,214
Provisions	3,404
Contingent Liabilities	63
Preferred Equity	0
Total Minority Interest	657
<b>Equity Value</b>	<b>29,338</b>
Shares Issued	186
<b>Price per Share</b>	<b>158.07 €</b>

**Weighted Average Cost of Capital**

Input	Value	Derivation
Risk-Free Rate	2.59%	Average 10 year YTM of German Government Bund
Country Risk Premium	0.00%	
Subtotal	2.59%	
Equity Risk Premium	9.59%	Weighted average for all Linde business countries
Beta	0.87	Adjusted raw beta (regression of Linde stock against DAX 30)
<b>Cost of Equity</b>	<b>10.93%</b>	
<b>Cost of Debt</b>	<b>4.02%</b>	Linde traded bonds average YTM
Tax	22.71%	Linde average tax rate 2008 - 2012
After Tax Cost of Debt	3.11%	
D/V	58.32%	Target capital structure based on previous years' development
E/V	41.68%	
<b>WACC</b>	<b>6.37%</b>	

**Multiple Valuation**

Linde Valuation Comparison			
Method	Enterprise Value	Equity Value	Price per Share (€)
Multiple Valuation	54,149	30,021	161.75
DCF Valuation	41,546	29,338	158.07
Delta	-12,603	-683	-3.68

**Sensitivity Analysis (I/III)**

WACC and Terminal Growth

	WACC					Terminal Growth				
Input	5.5%	6.0%	6.5%	7.0%	7.5%	1.0%	1.5%	2.0%	2.5%	3.0%
Price	211.78	178.02	151.49	130.11	112.50	128.36	144.99	165.43	191.16	224.54

**Sensitivity Analysis (II/III)**

Change in Industrial Growth

Change	-2.0%	-1.5%	-1.0%	-0.5%	0.0%	0.5%	1.0%	1.5%	2.0%
Price (€)	141.33	145.40	149.54	153.77	158.07	162.45	166.92	171.46	176.09

**Sensitivity Analysis (III/III)**

Change in Cost of Goods Sold

Change	-2.0%	-1.6%	-1.0%	-0.6%	0.0%	0.6%	1.0%	1.6%	2.0%
Price (€)	195.33	187.87	176.70	169.25	158.07	146.89	139.44	128.26	120.81

## 1. Introduction

Finding the right approach to determine a company's value might be one of the biggest challenges financial companies have to face within the last decades. The difficulties arising depend on various factors like company type, industry or market expectations. Due to that, the valuation process requires both a solid and comprehensive understanding of the company's strengths and weaknesses and additionally the application of state of the art valuation models and techniques. Especially within the still ongoing financial crisis, projections are difficult to make and assumptions must be based on market and company knowledge to enable a valuation as accurate as possible. This thesis will apply all the tools necessary to evaluate The Linde Group ("Linde") and give deeper insights into the rationale behind the results obtained.

The first section starts with a literature review, giving an overview of the recent standards in valuation methodologies and their practical application. Following this chapter, an overview of Linde is provided, including a general company description and a short presentation of the company's main business areas. The overview is completed by an industry analysis, giving information about the main drivers in the industrial gases market, a short presentation of the main competitors and a short-term market outlook. Section three represents the core paragraph of this report, covering a detailed valuation of Linde. The chapter is introduced by an historical analysis of the balance sheet and the income statement to guarantee and in depth understanding of the company's development within the past five years. Based on those findings, a Discounted Cash Flow Valuation ("DCF Valuation") is applied. The following paragraph enhances the previous analysis with the valuation based on the Multiple Approach, giving more intuition about the plausibility and accuracy of the previously obtained results. Additionally, a sensitivity analysis is performed to present the main valuation drivers and their impact on the calculated company value. Finally, the equity value of Linde, calculated based on the DCF Valuation

and the Multiple Approach, is compared to the estimations of Morgan Stanley and eventual differences are explained (Mackey, Walsh, & Stiefel, 2013).

## **2. Literature Review**

This literature review will provide an overview of the general valuation techniques used by practitioners. All methods are described in the necessary detail, including model description and application with the main focus still being on the models that will be applied in the upcoming valuation of Linde.

### **2.1 The Discounted Cash Flow Valuation Models**

Although not the most uncomplicated way of determining a company's value, the DCF Valuation is widely accepted as one of the most common approaches in equity valuation (Havnaer, 2012). This is mainly due to its conceptual focus, relying on the future cash flow perspective of the company rather than on actual reported numbers. The main idea of the DCF models is the estimation of an enterprise's intrinsic value based on its fundamentals (Damodaran, Investment Valuation: Second Edition, 2002). Basically, this process includes three main variables to be determined, namely the future cash flows, the terminal value and the cost of capital which are used to calculate the present value ("PV") of the forecasted cash flows. Depending on the DCF model used, the basic concept of discounting cash flows remains unchanged, while the cash flows and the discount factors may vary (Damodaran, Investment Valuation: Second Edition, 2002). The DCF Valuation can be divided into various models, all being applied depending on the company type, the industry and the capital structure, with the models being different in terms of what part of the company is actually evaluated.

The first approach to be presented is the evaluation of the entire company, not considering any payment to debt and equity holders and consequently using the cost of

capital (“CoC”) as discount factor. This process can be described as follows (Koller, Goedhart, & Wessels, Valuation: Measuring and Managing the Value of Companies, 2010):

1. Discount of operating cash flows using weighted average cost of capital (“WACC”)
2. Summarize operating and non-operating assets to calculate enterprise value
3. Valuation of debt and other non-equity claims
4. Derivation of equity value by deducting non-equity financials claims from enterprise value

Besides this entity approach, which will be applied for the valuation of Linde as can be seen in the corresponding section of this thesis, a company can also be valued using an equity based methodology, meaning that the future cash flows are discounted at the cost of equity (CoE) (Damodaran, Discounted Cash Flow Valuation: Basics). This approach is mainly applied when dividends are used to forecast cash flows as those are only attributable to shareholders. Finally, a valuation can also be based on the Adjusted Present Value (“APV”) model, which first considers the company as entirely equity financed, adjusting the derived value for tax benefits and expected bankruptcy costs afterwards to calculate the equity value (Jenter, 2003).

Although all models may be different in their way of estimating the company’s value, the arising problems and assumptions to be made during the valuation process can mainly be applied to all of them. Due to that, the following paragraph provides an overview of the main input parameters, their derivation and their influence on the final company value.

### **2.1.1 Free Cash Flow**

Relevant future cash flows to be calculated are free cash flows to the firm (“FCFF”), meaning cash flows being distributable to all types (i.e. debt and equity) investors. We will

follow the most common approach for the calculation of the FCFF, providing the following formula (Damodaran, Investment Valuation: Second Edition, 2002):

$$FCFF = EBIT * (1 - tax\ rate) + depreciation - capital\ expenditure \\ - change\ in\ working\ capital$$

As previously stated, the FCFF represents the firm's generated capital before debt repayments. Due to its high importance for an accurate company valuation, the projection of future cash flows is due to the application of appropriate growth rates.

According to recent literature a sustainable, meaning a value creating, growth rate can only be achieved if the return on invested capital (ROIC) exceeds the cost of capital (Koller, Goedhart, & Wessels, Valuation: Measuring and Managing the Value of Companies, 2010).

Following that rationale the relationship between growth and ROIC is presented as follows (Damodaran, Investment Valuation: Second Edition, 2002):

$$Growth\ rate = ROIC * Reinvestment\ rate$$

with

$$Reinvestment\ rate = \frac{Capex - Depreciation + change\ in\ working\ capital}{Operating\ income}$$

Applying these formulas provides an appropriate estimation of growth rates and allows the projection of future cash flows. One can conclude that the higher the proportion of a company's earnings invested into projects, generating a higher return than cost of capital caused, the higher the growth rates.

### 2.1.2 Terminal Value

Although the previously discussed estimation of future cash flows is one of the key issues to be considered in DCF Valuation, an accurate calculation of the terminal value (“TV”) might even be considered as more important, due to its significant influence on the equity/enterprise value (Damodaran, Growth Rates and Terminal Value).

From a conceptual basis, the TV represents the company’s long-term sustainable growth rate, meaning that we assume the company’s lifetime to be infinite. Still, three models can be applied to calculate TV, depending on the underlying assumptions and the company profile:

#### Stable Growth Model

One of the models to calculate TV presented by Damodaran (2002) is the stable growth model, which can be described as the most common practice and which is calculated as follows:

$$\text{Terminal value} = \frac{FCFF_{\text{last forecasted period}}}{\text{Cost of capital} - \text{growth rate}}$$

As can be obtained from the formula, cash flows are not computed into infinity (which would neither be possible nor realistic, as an accurate prediction for several years may hardly be possible). Instead, TV is calculated based on the last projected period.

Although the aforementioned stable growth model may be the most common one (and the one that will also be applied in the upcoming valuation of Linde), two more approaches are presented in the upcoming chapter.

## Liquidation Model

In contrast to the stable growth model, the liquidation model expects the company to finish its operations and liquidate its assets at that point of time. Following the literature two ways of calculating liquidation value are presented (Damodaran, Investment Valuation: Second Edition, 2002): One approach evaluates the book value of the assets at the point of liquidation and adjusts this value for inflation, raising the question of sufficient accuracy, as only the book value of the assets is considered, ignoring the earnings generated from these assets. This issue is addressed, using the second approach of liquid value calculation, meaning that the earnings generated by the assets are valued as follows:

*Liquidation value =*

$$\text{Cash flow generated by asset} * \frac{(1 - \frac{1}{(1 + \text{Cost of capital})^{\text{period until liquidation}}})}{\text{Cost of capital}}$$

Finally, the estimated liquidation value has to be corrected for outstanding debt, as the liquidation value should only reflect the cash flow attributable to shareholders.

## Multiple Approach

The third way to calculate terminal value is the Multiple Approach. In contrast to the previously presented models, this approach uses multiples (i.e. revenue, earnings, etc.) to calculate terminal value. As will be shown in the following paragraph, multiples can be an appropriate method for company valuation. Nevertheless, for the terminal value calculation, this approach may not be the first choice due to its mixture of comparable

company and discounted cash flows valuation (Damodaran, Investment Valuation: Second Edition, 2002).

Summarizing the different terminal value calculation models, it can be stated that the stable growth and the liquidation value model may give the best estimations of terminal value, as they represent an intrinsic value, whereas the Multiple Approach mixes relative and discounted cash flow valuation. Due to the aforementioned high influence of the terminal value onto the final company valuation, one should stick to the DCF models, which consequently results in the application of the stable growth model for Linde.

### 2.1.3 Cost of Capital Calculation

The CoC represent the opportunity costs an investor faces for his investment, meaning that the expected future cash flows are discounted to calculate the PV (Koller, Goedhart, & Wessels, Valuation: Measuring and Managing the Value of Companies, 2010). CoC are calculated using WACC, assuming a stable capital structure of the company (Pratt & Grabowski, 2008):

$$WACC = \frac{D}{V} * k_d * (1 - T_m) + \frac{E}{V} * k_e$$

The formula shows the main components of the WACC, namely the cost of debt ( $k_d$ ), the cost of equity ( $k_e$ ), the debt to enterprise ratio ( $D/V$ ), the equity to enterprise ratio ( $E/V$ ) and the marginal tax rate ( $T_m$ ). Each of the components has to be defined precisely:

## Cost of Debt

Assuming a company having issued bonds, the CoD can be calculated using the yield to maturity (“YTM”) of the company’s long-term, liquid and option-free bonds. As the cost of debt will also consider the tax shield, the YTM has to be adjusted for the marginal tax rate to finally compute after tax cost of debt (Koller, 2010).

Applying YTM for companies below investment grade might be inconsistent, as YTM represents a promised rate, which is not necessarily consistent with the expected returns of the company. However, for investment grade companies, which is the case for Linde this approach is reasonable, as one can assume that all coupon payments are made and debt is fully repaid (The Linde Group, Investor Relations: Credit Ratings, 2014).

For companies not meeting the criteria (i.e. companies not having traded investment grade bonds), other approaches to calculate CoD are provided, dividing these costs into the risk-free rate (“ $r_f$ ”) (1), the default risk (and default spread) (2) and the tax shield (3) (Damodaran, Investment Valuation: Second Edition, 2002). While the derivation of  $r_f$  will be discussed later on in the CoE section and the tax shield might be rather intuitive as it can be obtained from the company’s income statement, the calculation of the default risk will be presented in more detail.

In case companies are rated by rating agencies (such as Standard & Poor’s, Moody’s or Fitch), one can calculate the default spread comparing the company’s rating with the return being paid for treasury bills, where the difference between the interest rates represents the default spread.

For unrated, private companies this approach may not be applicable. Two approaches to calculate CoD for such companies are provided (Damodaran, Investment Valuation:

Second Edition, 2002). The first method to compute CoD is the consideration of the company's borrowing history (i.e. interest paid for capital borrowed from financial institutions). While this approach might be rather straight forward, the synthetic rating model might be estimated as a more complicated but still applicable method to calculate CoD. In case a third party rating is not available due to the aforementioned reasons, one can derive a company's rating, using financial ratios. Looking at the financial ratios of related, rated firms, one can apply those ratings to the small company that has to be valued.

For the valuation of Linde, the after-tax YTM will be used to calculate CoD, as Linde is a publicly traded, investment grade company with bonds outstanding, guaranteeing a sufficient liquidity and consistence between expected returns and promised rate as described previously.

### **Cost of Equity**

As WACC is calculated based on CoD and CoE, the latter have to be calculated considering several parameters. The following presentation of the latest standards in cost of equity derivation will again mainly follow the approaches of Koller, Goedhart, & Wessels (2010) and Damodaran (2002), as this literature is expected to cover the most relevant approaches used by practitioners.

The calculation of CoE requires three variables to be defined, namely  $r_f$ , the market risk premium ("MRP") and the beta, adjusting the returns for market risk (Koller, Goedhart, & Wessels, Valuation: Measuring and Managing the Value of Companies, 2010). Three models, all of them considering those factors, can be applied to compute cost of equity: The capital asset pricing model ("CAPM"), the Fama-French three factor model and the arbitrage pricing theory ("APT"). While the last two models will be presented shortly in

appendices 1 and 2, the CAPM will be discussed in more detail, as it can be described as the most common approach in terms of WACC calculation (which will also be applied in the upcoming Linde valuation).

## **The CAPM**

The most common and basic CAPM formula includes the following input parameters (Baeza-Yates, Glaz, Gzyl , Hüsler, & Palacios, 2005):

$$E(r_i) = r_f + \beta_i * (E(r_m) - r_f)$$

where  $r_f$  is the risk-free rate as will be defined afterwards,  $\beta_i$  represents the market risk,  $r_m$  reflects the market return (and with  $r_f$  deducted the market risk premium) and  $E(r_i)$  is the expected return based on those inputs. The underlying CAPM assumptions are presented in the appendix. As can be obtained, the CAPM, puts the company's cost of equity in a relationship between the risk-free return and the company's risk profile in relation to the market.

## **Risk-Free Rate**

The derivation of the risk-free rate, mainly consists of two variables to be defined. First it has to be ensured that the rate chosen represents a risk-free return, meaning that the expected beta is equal to zero. Although the beta of government default free zero bonds is not necessarily equal to zero, it can be assumed to be on a very low level which qualifies those bonds to be used as a proxy for the  $r_f$ . The second factor to be considered when choosing  $r_f$  is the selected maturity. Although Koller, Goedhart , & Wessels (2010) give intuition about the theoretical idea of applying  $r_f$ , matching the maturity of each cash flow to be discounted, the more common approach, due to its simplicity, is the application of a

zero-bond with one fixed maturity for all cash flows. Further, it can be concluded that a maturity of 10 years gives the best indication for the risk-free rate as lower maturities do not consider the investors reinvestment opportunity and due to that short term rates are estimated as being too low.

Taking into account the aforementioned information, US based companies should be valued using 10 year US government STRIPS. For European companies, 10 year German government bonds should be used as proxy for the risk-free rate due to their higher liquidity and their lower credit risk, when compared to other European countries (Koller, Goedhart, & Wessels, Valuation: Measuring and Managing the Value of Companies, 2010).

## **Beta**

A company's beta (i.e. its market risk) can be calculated using three different ways, namely based on historical prices, on fundamental characteristics or on accounting data. According to Damodaran (2002), the best proxy for the beta calculation is the regression analysis based on historical prices. This approach will also be presented and applied for the upcoming equity valuation and can be described as follows:

The beta derivation can be based on the company's stock returns and compare them with the returns of a market portfolio (i.e. stock indices, such as S&P 500 or DAX 30). To estimate the beta based on those data, a regression analysis using the market model is applied (Koller, Goedhart, & Wessels, Valuation: Measuring and Managing the Value of Companies, 2010):

$$R_i = \alpha + \beta R_m + \varepsilon$$

While the raw beta is calculated using the aforementioned approach, this beta only holds for well-defined industries with a significant number of comparable companies. With less comparable companies existing, the raw beta has to be adjusted to reduce the influence of extreme values and by that converging the beta to an average value. The most common smoothing process is the Bloomberg approach, calculated as follows (Koller, Goedhart, & Wessels, Valuation: Measuring and Managing the Value of Companies, 2010):

$$\text{Adjusted Beta} = 0.33 + 0.67 (\text{Raw Beta})$$

The regression analysis will also be used for the calculation of Linde's beta.

### **Market Risk Premium**

The last CAPM variable to be defined is the market risk premium. While the calculations for the risk-free rate and the beta resulted in relatively clear models, the discussion of the which model to use for the estimation of the market risk premium is not as straightforward, as no universal standard is applied until today (Koller, Goedhart, & Wessels, Valuation: Measuring and Managing the Value of Companies, 2010). Still Koller, Goedhart, & Wessels (2010) present three approaches to calculate the market risk premium: The first approach calculates the risk premium through an extrapolation of historical returns. Model two predicts the premium based on current market variables (i.e. dividend-to-price ratio), using a regression analysis. Finally, the last approach uses a DCF-valuation combined with estimates on return on investment and growth to reverse engineer cost of capital. For all of those models the authors conclude that the market risk premium ranges between 4.5% and 5.5%.

## 2.2 The Multiple Approach

Besides the presented DCF Valuation models, multiples are another widely common opportunity to evaluate a company (Schreiner, 2007). While the aforementioned approach values the company based on estimated future cash flows, the multiple valuation uses financial ratios to determine equity- or enterprise value. As shown, although the DCF Valuation might be the most accurate approach to evaluate the company, the dependency on various assumptions and their influence on the company's valuation has to be considered and might be critical in case of an inappropriate selection of values. Due to that, a multiple valuation, as an addition to the DCF Valuation, can be useful to check the calculated value for plausibility and further it can increase the valuation's accuracy (Koller, Goedhart, & Wessels, Valuation: Measuring and Managing the Value of Companies, 2010).

The Multiple Valuation is mainly based on two assumptions: Multiple and peer group selection. The right multiple is critical for the derivation of the equity/enterprise value. Damodaran (2002) finds two categories of multiples, namely equity and enterprise multiples. The former express the value of a company based on the entire enterprise, including the value of all claims of the business. In contrast to that, the latter represents the equity value, meaning the value of the shareholders' claims. The following table gives an overview of the most common equity and enterprise multiples (Suozzo, Cooper, Sutherland, & Deng , 2001):

Multiple	
Enterprise	Equity
EV/Sales	Price/Earnings
EV/EBITDA	Price/Cash Earnings
EV/EBIT	Price/Book Value
EV/NOPLAT	Price/Earnings Growth
EV/Operating FCF	Dividend Yield

Koller, Goedhart, & Wessels (2010) also state that besides the enterprise- and equity multiples, one can also consider non-financial data based multiples (i.e. market-value to customer multiples, etc.). As these multiples are mainly applied to internet companies, this approach will not be analyzed in more detail as Linde is an industrial company, making the application of nonfinancial multiples obsolete.

Before providing more information on selected equity- and enterprise multiples, a general overview of the main advantages and disadvantages of the application of the Multiple Valuation is provided:

Advantages	Disadvantages
<p><b>Simplicity</b> Easy application enables usage of multiple valuation to verify results obtained through other valuation techniques</p>	<p><b>Simplicity</b> Conversion of a lot of information into single numbers lacks detailed information</p>
<p><b>Usefulness</b> Indicator for company value and value judgements</p>	<p><b>Static value</b> Company snapshot, not covering market and company dynamics</p>
<p><b>Relevance</b> Focus on key statistic provides relevant company valuation and investor focus</p>	<p><b>Limited comparability</b> Peer group may operate in the same industry, but multiples may be different due to accounting policies etc.</p>

Source: Suozzo, Cooper, Sutherland, & Deng , 2001

In terms of equity multiples the Price/Earnings ratio ratio, which can be considered as the most common one, is calculated as follows (Damodaran, Investment Valuation: Second Edition, 2002):

$$PE = \frac{\text{Market price per share}}{\text{Earnings per share}}$$

Regarding enterprise multiples, Damodaran (2002) presents EV/EBITDA as the multiple to use and names the low percentage of companies with negative EBITDA, differences in depreciation methods and finally applicability among companies with different financial leverage as main reasons for the applicability of this multiple. Although both multiples might be appropriate, depending on the type of company evaluated, Suozzo, Cooper, Sutherland, & Deng (2001) give indications why enterprise multiples should be preferred over equity multiples. First, enterprise multiples provide a higher comprehensiveness, as the whole company is evaluated while equity multiples only value the equity shareholders' claims. Second, the capital structure and accounting differences do not affect the valuation as the company's value is measured unlevered and possible differences in depreciation standards are excluded. Finally, non-core assets are excluded when applying an enterprise multiple, which is not the case for equity multiples which include earnings attributable to those assets. Additionally forward multiples deliver more accurate results than trailing multiples (Koller, Goedhart, & Wessels, The right role for multiples in valuation, 2005). Taking into account this information, the Linde Multiple Valuation will be based on forward enterprise multiples such as EV/EBITDA.

Regarding the right peer group selection, Koller, Goedhart, & Wessels (2010) give indications about using companies operating in the same industry and additionally analyze the company's overall outlook and ROIC. Average multiples can be applied when ensuring that the company's overall performance is comparable and its underlying characteristics, (i.e. production methodology, distribution channels, etc.) are also matching.

As previously stated, the Multiple Valuation will be applied as an addition to Linde's DCF Valuation to check the results for accuracy and general appropriateness.

## **2.3 The Option Based Valuation**

As the previous paragraphs indicated, the various types of DCF Valuations can be described as the most common ways to evaluate a company. Multiple Valuations support the obtained values of the DCF model and give indication of possible assumption errors. For companies with finite lifecycles, i.e. mining companies, a DCF Valuation may not be applicable due to its terminal value assumption (Rudenno, 2012). In those cases, an option based valuation can be used to calculate the value for the company's operations. With Linde, being an industrial company, meaning that it does not meet those criteria, this approach will not be discussed in more detail.

## **3. Company Overview and Market Analysis**

### **3.1 The Linde Group**

#### **3.1.1 Historical Background**

Linde is one of today's worldwide leaders in the areas of gases and engineering and was founded 132 years ago by Carl von Linde in Munich (The Linde Group, Growing together, 2007). Focusing on the construction of refrigeration machines, Linde became the market leader in Europe within few years and was also present in the US through a licensee. The business was expanded when the company invented the Air Liquefaction, a method enabling the separation of air into oxygen, nitrogen and inert gases. Due to this invention, it started to establish its engineering division by setting up gas production plants besides its core business in the refrigerating technology.

Beginning in 1929, Linde further enhanced its activities by starting not only to set up production plants but also by acting as a distributor of industrial gases. Furthermore, its first acquisitions took place at that time, a strategy that remains present up until today

and that will also play a role in the valuation section. After WWII, on one hand the high demand for gases and large plant engineering enabled Linde to significantly increase its sales and to expand. On the other hand Linde faced declining sales in the refrigerating segment caused by price-driven competition and leading to a step by step withdrawal from this segment, starting in 1965 and finally ending with the disposal of the division in 2004. The other divisions grew rapidly and with the continuing set-up of production plants worldwide Linde was able to further increase its market share.

In the 1990s the company started several acquisitions in the industrial gases sector and due to those, was able to improve its market position in this segment. One of the most important acquisitions took place in 2001 when Linde bought AGA's healthcare business, making it one of the biggest gas suppliers worldwide, especially in the area of medical gases. Now, being fully focused on the industrial gases and production plant segment, Linde acquired the British gas supplier BOC in 2006, leading to the rebranding into "The Linde Group" (The Linde Group, The Linde Group: Corporate History, 2014).

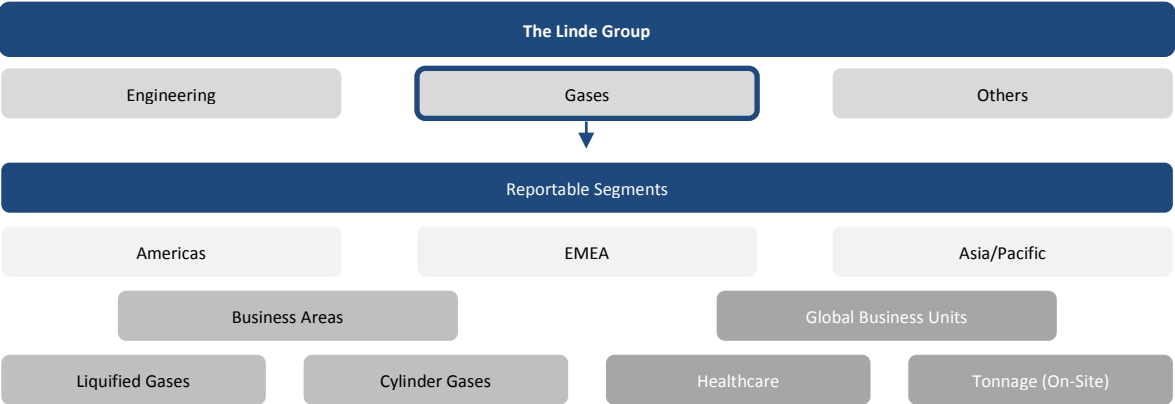
Today Linde has more than 63.000 employees and is active in more than 100 countries worldwide.

### **3.1.2 Organizational Structure and Product Overview**

Linde's business activities are divided into three different segments. The engineering division comprises production and engineering services. While the first one includes the worldwide construction of production plants (i.e. process plants like chemical or hydrogen plants), the latter offers process and system engineering services, enabling the optimization and effective control of the plants. The other division represents only a small part of the whole company and consists mainly of Gist, a logistics service provider, with main activities in the UK.

The gases division, representing Linde’s core business, includes the production and distribution of industrial and healthcare gases, offering a broad range of compressed, liquefied and chemical gases to all types of industries (i.e. chemistry, electronics and healthcare). A general customer overview is attached in appendix 3. The following figure presents the organizational structure of Linde in detail:

**Figure 1: Linde Organizational Structure**



Source: The Linde Group, Annual report, 2012

Liquefied and cylinder gases among with tonnage are part of Linde’s industrial gases business and contribute c. 80% of its total gases division revenue in 2012 (The Linde Group, Annual report, 2012). The healthcare business presents itself slightly different, due to its customer focus as Linde provides gases for hospitals and patients at home (homecare). Cylinder and on-site business can be described as stable while the liquefied gases and healthcare markets are of high strategic interest, as both represent areas with high future growth potential to be expected (Economy Watch) (Avaldsnes, 2013). Due to that, those product segments will be analyzed in more detail in the following chapter.

### 3.1.3 Strategic Focus

Linde's business strategy is based on the generation of increasing profits due to a sustainable growth model. This includes the expansion of the international business, the creation of innovative products and services and the increase of the customers' usage when buying Linde products. Due to this policy, Linde acquired the homecare business (a subdivision of the medical gases segment) of Air Products and the whole business of Lincare in 2012, enabling the company to become the worldwide leader in this segment. Although these acquisitions were the largest within the last years, Linde's focuses not only on organic growth but also on consolidation as can be observed when looking at the following table:

**Table 1: Linde Acquisition Overview 2008 – 2012 by Reportable Segments**

Company	Date	Acquisition cost (€m)	Reportable Segment
Auscom	10.2008	263	Asia
Sigas	01.2009	68	Asia
Ceylon Oxygen	10.2010	23	Asia
Uraltech Gases	01.2011	10	EMEA
Easter Oxygen Industries	08.2011	45	Asia
Hefei	05.2012	13	Asia
PSG	05.2012	10	Asia
Dahua	06.2012	15	Asia
Puyang	04.2012	60	Asia
Air Products Homecare	04.2012	535	EMEA
Lincare	08.2012	2,458	Americas

Source: The Linde Group, Annual reports, 2008 - 2012

Besides this consolidation strategy Linde drives its business through a constant investment policy, represented by a long-term capital expenditure ("CapEx") target of 13% compared to total revenue (The Linde Group, Annual report, 2012). Additionally, Linde presents itself with a strong strategic focus on its actual business areas. This strategy led to the sale of

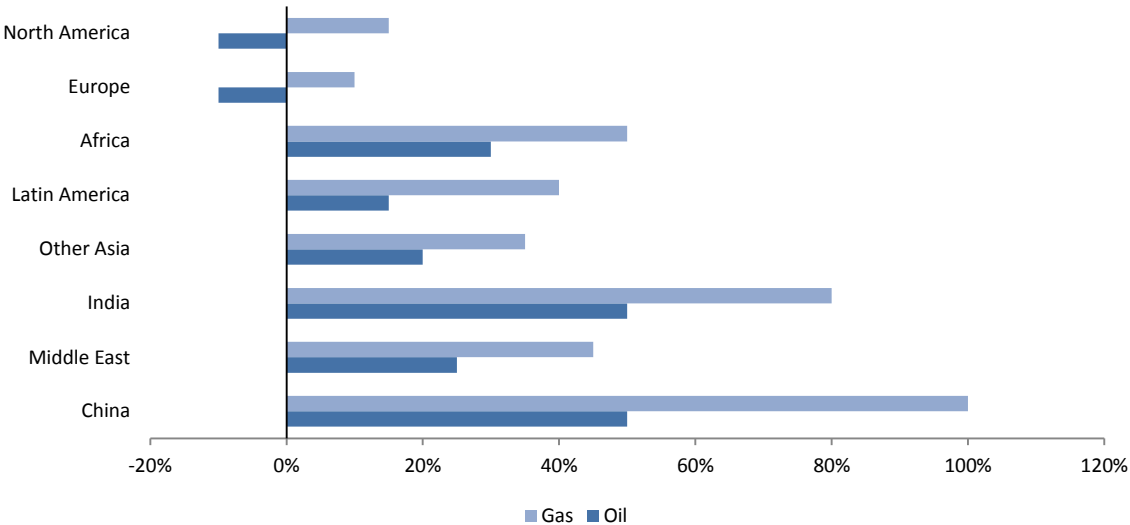
the company's historical core business, the refrigeration division, to US based Carrier Corporation in 2004 (Linde AG, 2004).

As previously stated, market trends are expected to drive growth in certain product areas, namely LNG and healthcare, which both represent core areas of Linde's business. While growth for the first area is mainly driven by changes in the energy market, sales of the latter products will be influenced by structural factors like demographic change and higher living expectations of the population (Ernst & Young, 2011).

Looking at the industrial environment, clean energy in terms of CO<sub>2</sub> reduction will increase its importance constantly, leading to an expected global market size of €2 - €3bn in 2020 according to Linde estimations (The Linde Group, Full year results 2012: Determination, 2013). Further, the growing LNG market can also be described as an important driver for Linde's business, not only for gases but also for the engineering division, as increasing demand for LNG will also drive the division's activities in terms of building LNG plants and terminals.

Generally, the shortage of oil and the pricing mechanism will lead to a significant increase in demand for natural gas in the future as can be obtained from the following figure:

**Figure 2: Gas and Oil Demand Comparison by Geographies between 2011 and 2025**



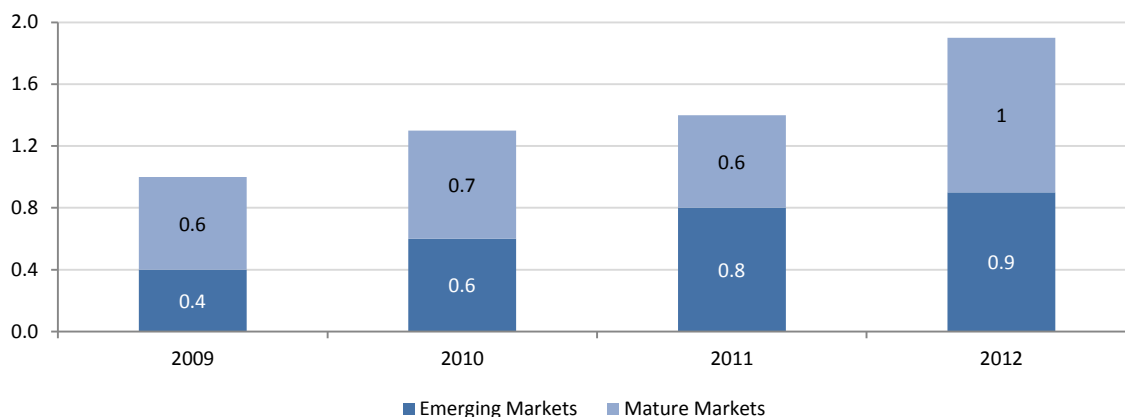
Source: Avaldsnes, 2013

Taking a glance at the chart, it can be obtained that besides the generally increasing demand for gas, the main growth drivers are the developments in the emerging markets, leading to another strategic focus of Linde:

The company presents significant investments in those markets, with reported revenues of €4.5bn in 2012 (The Linde Group, Business & Governance: Business Opportunities, 2012).

Those results are based on Linde’s constant investment strategy in its emerging market business, being evident when looking at the company’s CapEx composition:

**Figure 3: Capital Expenditure in Emerging and Developed Markets in €m**



Source: The Linde Group, Full year results 2012: Determination, 2013

As can be obtained, Linde constantly increased its investments in emerging markets and in 2012 almost 50% of its total CapEx was invested in those economies, indicating the strategic importance of these regions for the company's actual and future activities. As a result, Linde presents itself as the market leader in all major growth markets, including Eastern Europe, Greater China, Southeast Asia and South Africa (The Linde Group, Full year results 2012: Determination, 2013). For other regions, Linde also holds top 3 positions, with the exception of Canada, Spain and Italy where the company doesn't have significant activities until today. With Compounded Annual Growth Rates ("CAGR") for industrial and medical gases consumption of 4% (mature markets) and 10% (emerging markets) from 2010 until 2012, Linde can be described as well positioned in those regions. Increased industrialization and wealth is expected to drive those growth rates in the emerging markets also for future periods (The Linde Group, Full year results 2012: Determination, 2013).

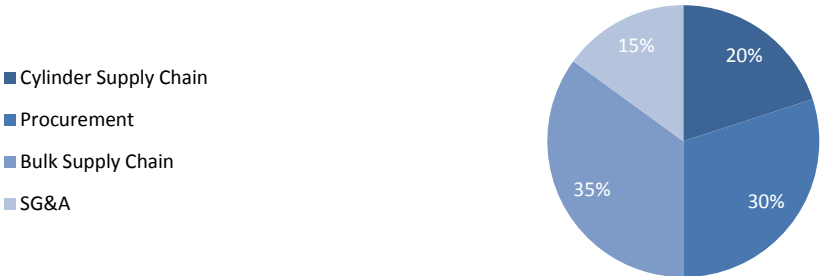
Besides organic and external growth, Linde is also focused on increased efficiency. This strategic focus led to the implementation of the High Performance Organization ("HPO") program, which was initiated in 2009 and which is planned to enable significant cost

savings until 2016. In 2012, Linde reported cost savings of €780m that were achieved through this program and expects further cost saving potentials up to €900m until 2016 (The Linde Group, Annual report, 2012). The main mechanics to enable this decrease in expected costs to be named are:

- Standardization and automation of filling plants
- Product standardization and global roll-out of e-procurement
- Optimization of total production and distribution cost
- Shared service centers

The total amount of saving based on those strategies is expected to be divided as follows:

**Figure 4: Expected Cost Savings by Segments**

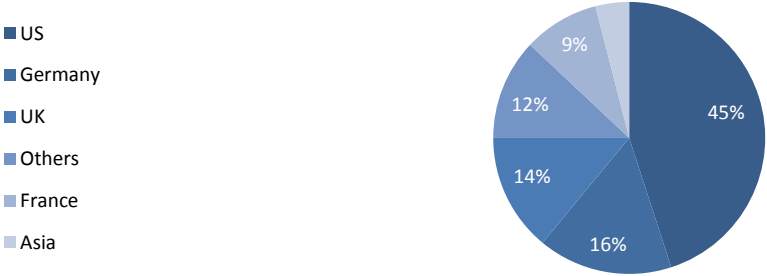


Source: The Linde Group, Full year results 2012: Determination, 2013

**3.1.4 Stock Information**

Linde is a publicly traded company with a stock price of €148.20 (06.03.2014) and a market capitalization of more than €27.2bn (Bloomberg, Bloomberg Markets, 2014). The stocks are mainly held by institutional shareholders (81%) whereas only 19% of the shares are owned by private investors. As can be obtained, shareholders are based all over the world, with the majority being Americans or Germans:

Figure 5: Linde Shareholder Structure by Regions

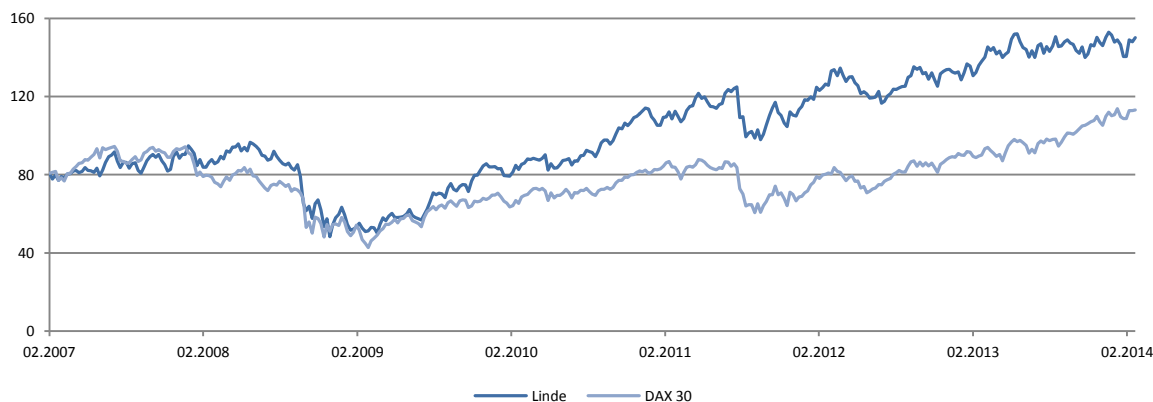


Source: The Linde Group, Annual report, 2012

Looking at Linde’s historical performance, a clear upwards trend can be observed considering the last five years. After a weaker timeframe within the 2008 financial crisis, the stock recovered constantly since 2009 and reached an all-time high of more than €153 in May 2013 and remains strong until today. In 2012, Linde’s stock closed at €132.00 on December 31<sup>st</sup>, representing an increase of 14.8% when compared to the previous year. The stocks are traded at all major German stock exchanges and in Zurich. Linde is also listed in the DAX 30.

The following figure presents the development of the Linde stock in comparison with the return of the DAX 30 from February 2007 until February 2014:

**Figure 6: Linde and DAX 30 Historical Price Developments from 2007 – 2014 in €**



Source: Bloomberg

One can observe that the general development of the DAX 30 and the Linde stock is almost identical until February 2009. Afterwards, Linde returns are constantly higher but still the general trend of the chart in terms of increases and decreases remains quite comparable. Consequently, it can be concluded that the Linde stock generally follows the movements of the DAX but with higher returns since 2009.

### **3.2 The Industrial Gases Industry**

Although Linde's business activities are divided into gas, engineering and others, Linde is mainly part of the industrial gases industry, represented by 80% of Linde total sales being generated within this sector (2012) as previously presented. After the economic crisis in recent years the industry recovered in 2012, enabling Linde a sales growth of 11,1% compared to the previous period. Still this growth is also attributable to Linde's acquisitions, which will be analyzed in the historical financials development paragraph. Industrial gases are used in all of the major industries and can be divided into several categories, as described previously.

The industry can be characterized as stable, whereas the medical gases sector (being part of the industrial gases) can be considered a rapidly growing market due to demographic developments and the increasing demand for healthcare services (Ernst & Young, 2011). Although this sector is of high strategic interest for Linde it only accounts for 20% of the company's sales in gases division (as of 2012). Consequently, the upcoming forecast will not be specifically focused on the healthcare market, as the general growth potential in this segment is considered in the sales impact of the acquisition of Lincare in 2012. Generally, the industrial gases market is expected to reach \$58.4bn in 2018, which equals a CAGR of 6.3% since 2012. Growth drivers to be mentioned, causing this development are the generally increased demand for industrial gases and the economic growth in emerging markets. Challenges are expected in terms of increasing transportation and storage costs, making efficiency increases one of the challenges that have to be faced in the future (Transparency Market Research, 2013).

The market has many competitors, many of them being local companies, but regarding worldwide market shares, four big global players namely Linde, Air Liquide, Praxair and Air Products can be identified (Lecorvasier, 2010). With a market share of 22%, Air Liquide is the largest company worldwide, followed by Linde (Kamp, 2012).

The following table presents an overview of Linde's main competitors which will also represent the peer group for the upcoming Multiple Valuation:

**Table 2: Linde - Main Competitors Key Data**

in € million	Air Liquide	Praxair	Air Products
<b>Financials (2012)</b>			
Revenues	15,326	8,491	7,272
EBIT	2,610	1,844	1,160
EBIT Margin	17.0%	21.7%	16.0%
Net Income	1,609	1,280	883
Profit Margin	10.5%	15.1%	12.1%
<b>General Information</b>			
<b>Geographies</b>			
Americas	✓	✓	✓
EMEA	✓	✓	✓
Asia/Pacific	✓	✓	✓
<b>Products</b>			
Gases	✓	✓	✓
Chemicals			✓
Equipment	✓	✓	✓
Services	✓	✓	✓
<b>Market Information (05.03.2014)</b>			
Share Price (€)	99.26	95.32	89.14
Shares Outstanding	312.89	293.97	211.67
Market Capitalization	31,057	28,021	18,868
Cash Dividend (€)	2.55	0.47	0,52

Sources: Bloomberg; Air Liquide, 2012; Praxair, 2012; Air Products, 2012

#### 4. Valuation

Before presenting the details of the valuation of Linde, a general note has to be made, as this thesis is delivered on March 10<sup>th</sup> 2014. Linde will publish its 2013 annual report on March 17<sup>th</sup> 2014, meaning that historical financial data for the entire 2013 fiscal year were not available. Due to that, the historical numbers analysis will only consider the period from 2008 – 2012, while the forecasted data will include the estimations for 2013. Nevertheless, information provided by the company in the Q3 Interim Report 2013 is considered in this report and is in line with the estimations made for the 2013 fiscal year. However, the 2013 financials will not be considered for the DCF Valuation, as these values

are assumed to be historical for valuation purposes. Nevertheless, for the upcoming transition from enterprise value to equity value, the 2013 data will be considered as the forecast will be made from 2014 – 2018, meaning that the 2013 numbers will be the latest “historical” data available.

The estimation of Linde’s price per share will be based on two different valuation techniques, namely the DCF Valuation and the Multiple Approach, using selected peer group multiples to estimate Linde’s value. Due to a better understanding of the relevant growth drivers within the company, a detailed historical data analysis based on the financial years 2008 – 2012 is presented ahead of the actual forecast of the financials. Additionally, these data will give insights into Linde’s strengths and potential weaknesses and through that allow a more detailed and straight to the point company analysis. After the aforementioned valuations, a sensitivity analysis will provide further insights into selected valuation positions and their impact onto the final result.

#### **4.1 Historical Data Analysis**

Understanding Linde’s financial data will be crucial for the valuation process. Due to that, selected balance sheet and income statement items will be presented and analyzed to enable an overview of the company’s business activities. Starting with the balance sheet, the following table provides an overview of Linde’s historical development of its main assets:

#### 4.1.1 Balance Sheet – Historical Performance Overview

**Table 3: Balance Sheet 2008 – 2012 (Assets)**

in € million	2008	2009	2010	2011	2012
Cash and Equivalents	1,002	831	1,159	1,000	1,218
Short Term Investments (Securities)	20	17	17	1,073	823
Trade Receivables	1,641	1,607	1,855	2,030	2,599
Other Receivables	678	577	641	705	944
Inventory	986	966	956	1,036	1,098
<b>Total Current Assets</b>	<b>4,327</b>	<b>3,998</b>	<b>4,628</b>	<b>5,844</b>	<b>6,682</b>
% of total	18.2%	16.4%	17.2%	20.2%	20.0%
Growth		-7.6%	15.8%	26.3%	14.3%
Net Property, Plant & Equipment	7,162	7,566	8,723	9,030	10,188
Long-term Investments	535	559	678	754	816
Goodwill	6,893	7,297	7,799	7,868	10,620
Accumulated Deferred Tax	227	251	306	368	469
Other Intangible Assets	3,177	3,318	3,506	3,300	3,580
Other Long-Term Assets	1,503	1,392	1,248	1,751	1,122
<b>Total Non-Current Assets</b>	<b>19,497</b>	<b>20,383</b>	<b>22,260</b>	<b>23,071</b>	<b>26,795</b>
% of total	81.8%	83.6%	82.8%	79.8%	80.0%
Growth		4.5%	9.2%	3.6%	16.1%
<b>Total Assets</b>	<b>23,824</b>	<b>24,381</b>	<b>26,888</b>	<b>28,915</b>	<b>33,477</b>
Growth		2.3%	10.3%	7.5%	15.8%

Source: The Linde Group, Annual reports, 2008 - 2012

Taking a glance at the 2012 numbers, it can be observed that Linde reports total assets of €33,477m, divided into current and non-current assets, with the latter representing the major asset class with a total share of 80%. Nevertheless, current assets showed slightly lower growth rates within the selected period, resulting in a growth of 14.3% in 2012 for current- and 16.1% for non-current assets. Concerning the entire period considered, total assets showed a continuous growth since 2009 with a slight decrease in 2011 and a low in 2009, caused by the outbreak of the global financial crisis.

Current assets mainly include cash & short term investments, receivables and inventory. While the cash position remains rather constant, short term investments increased significantly from 2010 to 2011. This increase is mainly due to Linde's investments into available for sale and held to maturity securities totaling €1,073m in 2011. Although this value slightly decreased in 2012 due to the Group financing its acquisitions, short term investments still remain at €823m (Linde annual report, 2012). Regarding receivables, trade receivables represent the major position in Linde's balance sheet with a value of €2,599m in 2012 and include receivables from percentage of completion contracts (€222m in 2012) and other trade receivables of €2,377m. Inventory mainly includes work in progress goods and finished goods totaling to €1,098m in 2012. It can be concluded that short-term assets showed a constant growth within the last years, mainly based on trade receivables and investments into securities in 2011 and 2012.

Concerning non-current assets, tangible assets, intangible assets and goodwill represent the major positions to be analyzed. Tangible assets include land, land rights and buildings (€1,528m), technical equipment and machinery (€6,843m), fixtures, furniture and equipment (€352m) as well as plants under construction (€1,465), totaling to a net book value of €10,188m in 2012 and representing a growth of 12.8% compared to 2011. The growth in 2012 is mainly due to additions as a result of CapEx in the gases division for on-site projects, rising from €1,439m in 2011 to €1,901m in 2012 and affected technical equipment and machinery. Linde's intangible assets increased from €3,300m to €3,580m in 2012. As will be presented for goodwill, this is mainly due to the company's acquisitions that have taken place within the past period. This strategy led to rises in customer relationships and brand names by €344m in the reported timeframe. After a rather small increase in precedent years, goodwill grew significantly in 2012. Main drivers for this development to be named are again the acquisition of Lincare, resulting in an increase in goodwill of €2,605m and the acquisition of Air Products' Continental European homecare

business. Further, goodwill is based on the acquisition of BOC group in 2006 (€4,843m) and €3,064m for other previous acquisitions.

**Table 4: Balance Sheet 2008 – 2012 (Liabilities)**

in € million	2008	2009	2010	2011	2012
Trade Payables	2,120	2,133	2,564	2,712	2,790
Short Term Financial Debt	1,290	381	459	1,277	1,262
Current Provisions	1,482	1,468	1,515	1,455	1,565
Other Current Liabilities	1,129	1,030	1,094	1,112	1,194
<b>Total Current Liabilities</b>	<b>6,021</b>	<b>5,012</b>	<b>5,632</b>	<b>6,556</b>	<b>6,811</b>
% of total liabilities	38.7%	33.0%	36.3%	39.1%	34.4%
Growth		-16.8%	12.4%	16.4%	3.9%
Long Term Financial Debt	6,155	6,586	6,214	6,491	8,862
Other Liabilities	3,399	3,596	3,680	3,724	4,146
<b>Total Non-Current Liabilities</b>	<b>9,554</b>	<b>10,182</b>	<b>9,894</b>	<b>10,215</b>	<b>13,008</b>
% of total liabilities	61.3%	67.0%	63.7%	60.9%	65.6%
Growth		6.6%	-2.8%	3.2%	27.3%
<b>Total Equity</b>	<b>8,249</b>	<b>9,187</b>	<b>11,362</b>	<b>12,144</b>	<b>13,658</b>
% of total	34.6%	37.7%	42.3%	42.0%	40.8%
Growth		11.4%	23.7%	6.9%	12.5%
<b>Total Liabilities &amp; Equity</b>	<b>23,824</b>	<b>24,381</b>	<b>26,888</b>	<b>28,915</b>	<b>33,477</b>
Growth		2.3%	10.3%	7.5%	15.8%

Source: The Linde Group, Annual reports, 2008 - 2012

In terms of liabilities, Linde reported current liabilities of €6,811m and non-current liabilities of €13,008m in 2012, where the first represents 34.4% and the latter 65.6% of the group's total debt. Current debt comprises mainly accounts payable (€2,790m in 2012) and other current provisions of €1,565m. In terms of non-current liabilities, long-term debt arises mainly from subordinated and other bonds due in more than 1 year, which can be observed as largest position within that area. Regarding equity, the company presents a stable growth position since 2008 with a low in 2011. While common stock remained

almost constant within the considered period, retained earnings and comprehensive income can be named as main drivers for the increase of this position.

As the general capital structure will be important for the upcoming valuation, specifically for the computation of the WACC, some selected debt ratios are provided to enable a better understanding of the company's capital structure and its development within the previous periods:

**Table 5: Historical Debt Ratio Development**

in € million	2008	2009	2010	2011	2012
Debt ratio	65.4%	62.3%	57.7%	58.0%	59.2%
Shareholders' ratio	33.0%	35.8%	40.3%	40.1%	39.1%
Solvability ratio	53.0%	60.5%	73.2%	72.4%	68.9%

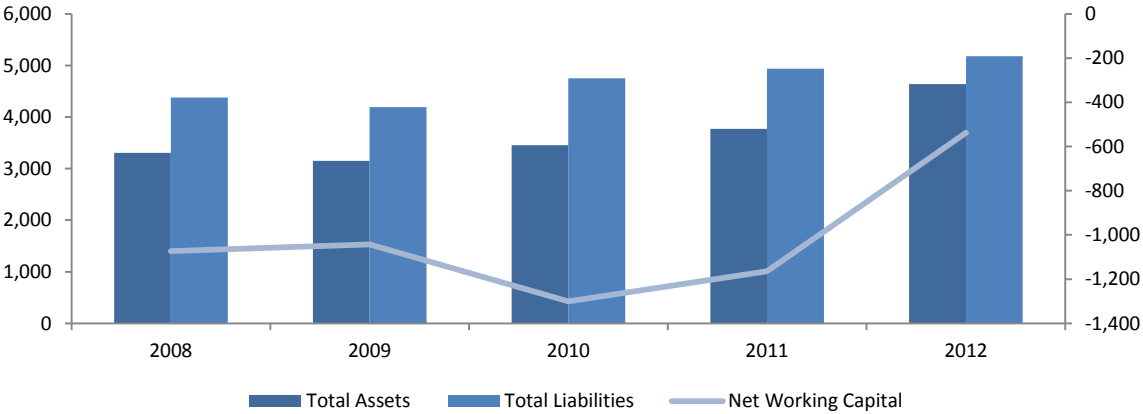
Source: The Linde Group, Annual reports, 2008 - 2012

Looking at the data above it becomes evident, that Linde's debt ratio mainly ranges around 60% with some up-and downward movements within the last years. This value further gives some insight into the company's financial position, showing that assets almost double the company's debt, which might be an indication of Linde's risk profile. The shareholder ratio, calculated by dividing total equity through total assets, also reflects the improvements made in terms of debt ratio since 2009, leading to an increase from 33% (2008) up to 39.1% in 2012. Also Linde's solvability ratio (equity/total liabilities) gives an intuition about the company's increased equity in 2010 and further shows the company's ability to cover almost 70% of its liabilities through equity, representing an improvement of 15.9% since 2008.

Another important aspect to be considered is the Working Capital development of Linde, as it will give insights into the company's financing structure and further have an impact onto the DCF Valuation.

The following chart presents the historical working capital as reported by Linde:

**Figure 7: Net Working Capital (2008 – 2012)**



Source: The Linde Group, Annual reports, 2008 - 2012

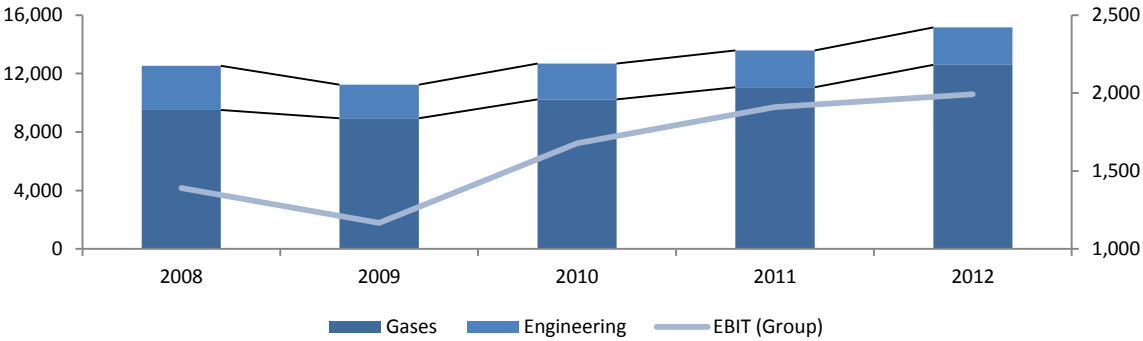
In terms of net working capital (“NWC”) calculation, it has to be stated that cash is excluded from current assets as it is not considered to be needed for Linde’s daily operations. According to that current assets include trade receivables, other receivables and inventory while current liabilities include trade payables and other payables. As can be observed, NWC presents a negative value throughout the whole period considered. Still, Linde’s approach trying to change its short-term financing structure becomes evident when looking at the precedent years. Current assets grew significantly (14.3%, 2012) in comparison to current liabilities (3.9%, 2012), leading to an overall reduction of the dependency on short-term financing. This increase may be of higher relevance for the company’s future strength as, although Linde is able to finance its short-term assets through short-term liabilities at the moment, a scenario of further economic downturn may lead to serious problems in case of customers not giving Linde the credit terms they agreed on so far. This may further be an important aspect to be monitored, also when looking at the negative net cash position of Linde, making it impossible to finance its short-term financial needs through cash (appendix 4). Additionally, NWC also gives

information about the company’s long-term financing strategy. The given situation clearly shows the high dependency on customer credit of Linde and consequently long-term debt is smaller than long-term assets (€13,008m, debt; €26,795m, assets; 2012).

**4.1.2 Income Statement – Historical Performance Overview**

Among the balance sheet items, the income statement also plays a major role in the upcoming company valuation. Again, the most relevant positions’ development will be presented in this paragraph to give an intuition about Linde’s main results achieved within the last 5 years:

**Figure 8: Revenue Development by Division and Group EBIT (2008 – 2012)**

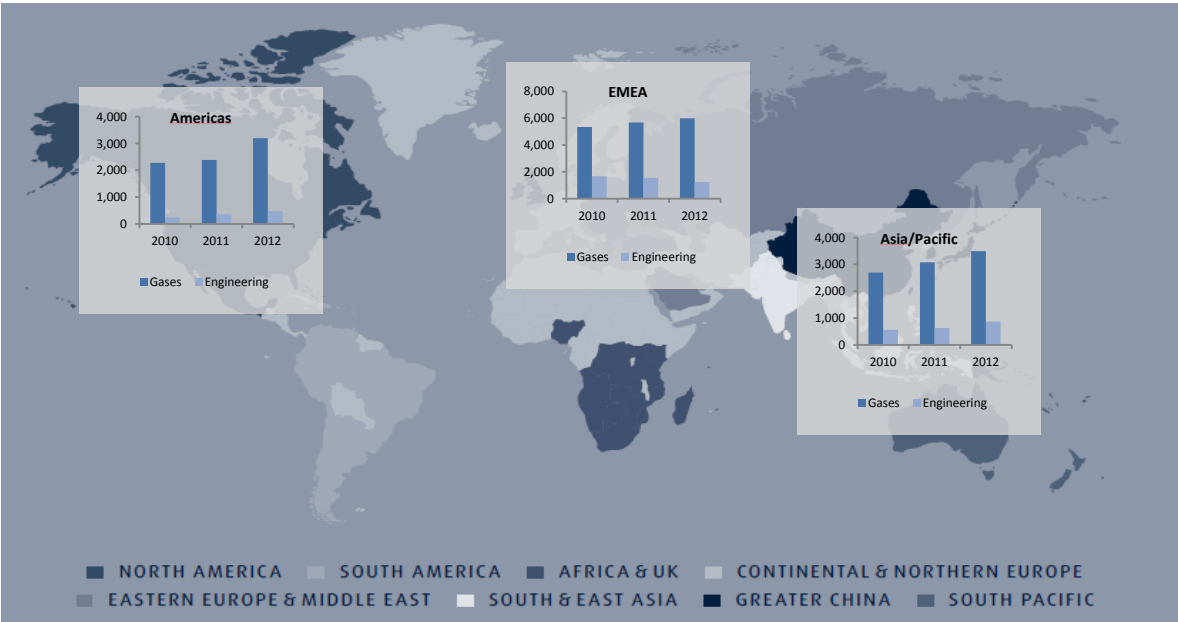


Source: The Linde Group, Annual reports, 2008 - 2012

Primarily, it has to be stated that only gases and engineering activities are presented in this chart, as other activities cannot be described as significant for Linde’s overall operational performance due to its total sales contribution of 3.8% in 2012. Additionally, the chart indicates the company’s increased focus on its gases operations, also decreasing the impact of the engineering activities in terms of revenue and EBIT. For the precedent years Linde was able to increase revenues and EBIT constantly, with the exception of the financial crisis in 2009, which affected business operations negatively, resulting in a drop in sales and EBIT. Besides this decrease, the main growth driver to be named within the

company is the gases division, showing stable growth rates and stable operating margins of round about 27% throughout the whole period considered. In 2012, one of the main impacts on revenues was the previously mentioned acquisition of Lincare, contributing €630m to Linde’s gases revenue in 2012, which leads to an adjusted (i.e. Lincare excluded) revenue growth of 3.8% within the last period. The engineering division presented itself still profitable but weaker when compared to the (non-adjusted) numbers of the gases division. Growth rates of maximum 6.5% and an operating margin of round about 10% were reported for engineering throughout the considered period. In 2012, engineering sales grew by 1.2%. These historical results give insights into the high importance of Linde’s gases activities and by that define the major focus on that division for the revenue forecast to be made afterwards. Nevertheless, both gases and engineering are Linde’s core operational activities, making it important not only to analyze the revenue development but further consider the origin of the reported revenues in terms of geographies.

**Figure 9: Worldwide Sales Development by Reportable Segments**



Source: The Linde Group, Annual reports, 2008 - 2012

As can be observed for both divisions, the EMEA is the biggest sales market in 2012. Still, main growth markets for Linde are the Americas and Asia with (non-adjusted) growth rates of 13.7% and 34.7% in gases in 2012. In contrast to that, EMEA only grew by 5.7% within that period. On a comparable basis, i.e. adjusted for price changes, exchange rates and acquisitions, global business growth summed up to 4.1%. Within EMEA, Continental- and Northern European business units show a major contribution to revenues, totaling to €3,494m in 2012. As mentioned before, this increase is mainly based on the acquisition of Air Products' Homecare business in 2012 and Linde's business activities in the LNG market, especially in Scandinavia. Rising prices for liquefied gases and cylinder gases drove Linde's African business sales to €1,631m.

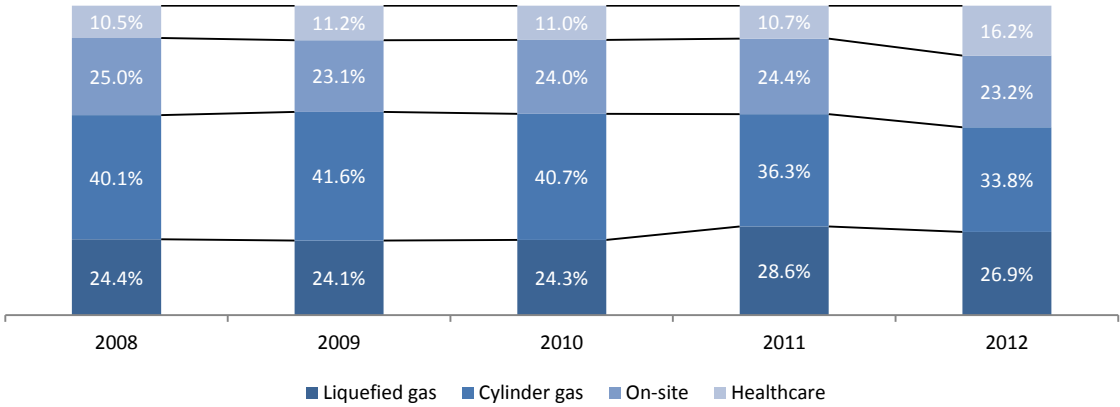
Another project and region to be named is the investment of \$380m to exclusively supply Sadara Petrochemical with on-site gases, representing Linde's largest on-site petrochemical project in the Middle East. Besides those positive events, the globally difficult economic climate impacted revenues negatively, not only in EMEA region but also in the Asian market, especially in the second half of 2012, making positive currency exchange effects the main growth driver within that region. For the Chinese market, on-site contracts were the main source of total income of €833m, a situation that can be compared to the one in the Middle East. Besides those contracts, rising prices for cylinder gas and liquefied gas further contributed to the overall positive development within that market considering the past period. Although demand for on-site projects declined in Southeast Asia, for the total region those projects and the gases price development among currency effects can be named as main growth drivers within Linde's reportable segment Asia/Pacific.

When analyzing the American market, the aforementioned acquisition of Lincare again has to be considered, leading to a normalized revenue growth of 2.8% compared to 2011, leading to a growth rate below the Asian market of 5% in 2012. Still, the acquisition

enabled a significant sales increase within North America, among with price increases for cylinder gas and liquefied gas. For South America, high demand for healthcare compensated for decreased revenues due to a negatively affected economic climate (The Linde Group, Annual report, 2012).

A final product based approach will complete Linde’s historical revenue analysis, giving further implication about the company’s main products and future expectations to be made based on the results obtained.

**Figure 10: Gases Division Sales by Products**



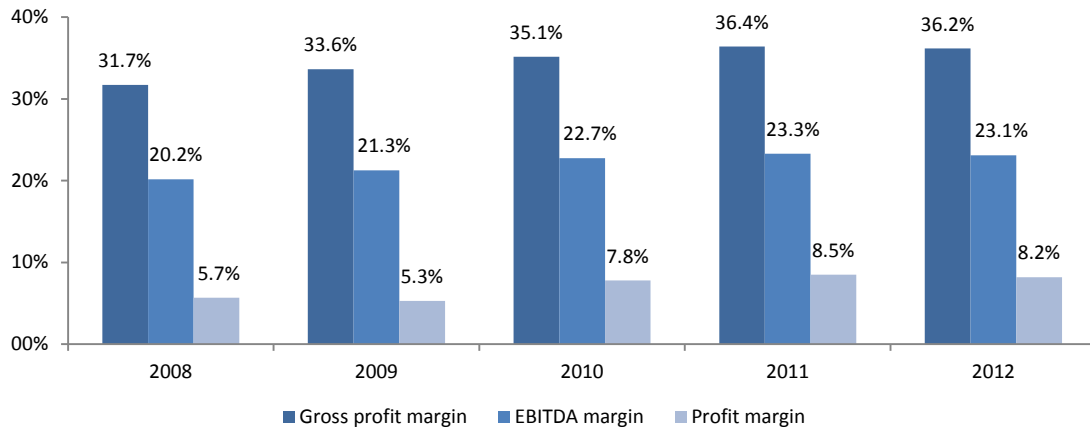
Source: The Linde Group, Annual reports, 2008 - 2012

The chart gives clear indications about the major growth market healthcare, which includes hospital care and homecare, within the company. Among the aforementioned acquisition of Lincare, the market leader in the Americas’ homecare market being the largest market worldwide, in combination with the previous take-over of Air Products Homecare, Linde almost doubled its 2012 healthcare sales to €2,035m, making the company the only worldwide gases provider in this sector (The Linde Group, Full year results 2012: Determination, 2013). Still, the company’s core sources of revenue are industrial gases in terms of cylinder gases and liquefied gases. On-site business is also

dependent on the global industrial markets, making it reasonable to focus on the development for the industrial gases industry in the upcoming valuation.

As mentioned before, besides growth, efficiency can be described as Linde's second large strategic focus. The following chart presents selected profitability margins to illustrate Linde's efficiency increases that occurred within the last periods:

**Figure 11: Profitability Margins (2008-2012)**



Source: The Linde Group, Annual reports, 2008 - 2012

Taking a glance at the figure, Linde's overall profitability improvement can be obtained. Although all margin improved within the last years, the main improvement were made in terms of gross profit margin. This can be attributed to the HPO program, which mainly affected COGS. Consequently, COGS development will be considered for the valuations in terms of further improvements to be expected. Nevertheless, the company also presents strong improvements for EBITDA- and gross profit margin which both increased by round about 3% since 2008.

### **4.1.3 Historical Performance Summary**

The analysis of Linde's historical performance can be summed into two main topics with the first being the long-term and sustainable growth focus and the second area the company's cost optimization procedures. In terms of growth the company presented stable numbers, mainly supported by Linde's exposure to emerging markets in combination with its strong positioning in mature markets. Besides its general market share increase, the company further follows an acquisitive strategy, both historically and in present, as can be observed by the acquisition of Lincare and Air Products Homecare in 2012. In terms of efficiency, the implementation of the HPO program in 2009 enabled the company to significantly reduce overall costs being evident by cost reductions occurred in the past and to be expected for future periods.

Besides those positive values, working capital can be described as a rather problematic area for Linde. This is mainly due to its high dependency on short-term financing, being reflected in the negative NWC of the company. Nevertheless, this potential risk issue is already addressed by Linde and showed improvements in the last years. It is expected that this trend will continue in future periods.

Still, according to the reported numbers Linde presents itself as an established global player in the industrial gases market with high future growth potential to be expected. However, the aforementioned positive and critical aspects will be considered in the upcoming valuation as various positions i.e. revenues, COGS, CapEx and working capital, represent critical items for the value of the company.

### **4.2 Discounted Cash Flow Valuation**

This section can be described as the main chapter of this thesis as it will process all data collected and all assumptions made to finally calculate the price per share for the Linde

stock. To determine the final result, a step by step guidance will be made, starting with the main income statement items to be forecasted and continuing with selected balance sheet items. Afterwards, all the components of the DCF Valuation and the rationale behind their selection will be explained, leading to the enterprise value of Linde. Finally, the transition from enterprise value to equity value and the main items to be considered for this process will be presented.

#### **4.2.1 Income Statement Forecast**

Although the income statement comprises several positions to be estimated, the main focus will be on the forecast of Linde's revenues, with a special emphasis on the gases division. This approach has to be explained in detail as Linde is a globally active company, making it important to clearly describe the assumptions made and the rationale behind them. First, gases division forecast will be explained, followed by the engineering and others division sales to finally determine total sales forecast from 2014 – 2018 (2013 financials will be expected values and as mentioned those will not be part of the valuation). A forecast for more than 5 years didn't seem to be appropriate due to an increase of uncertainty and the general problems arising with the long-term predictability of market developments which are expected to impact the valuation results negatively.

#### **Revenue**

In the company overview, one could obtain that Linde's business activities are divided into reportable segments and business areas/business units. For the revenue forecast, it is generally crucial to implement drivers for both, Linde's business regions and its products. However, individual forecasts may be limited because of restricted access to relevant company information, which might influence the overall level of predictability. Looking at Linde's reported numbers, it can be obtained that a revenue split by products is given for

the company's global sales, but for the individual regions this does not hold. As a general revenue forecast on a global scale may not reflect the growth drivers and market impacts occurring in the different geographies, the forecast will be made on a consolidated level, meaning that revenues for cylinder gases, liquefied gases, on-site and healthcare will not be made individually, but on an aggregated level for each reportable segment (i.e. the Americas, EMEA and Asia/Pacific).

A forecast following this approach requires further assumptions to be made in terms of growth drivers for those markets and additionally the definition of other drivers that may influence revenues in the long-term. Although Linde's product portfolio in the gases division comprises four product areas as aforementioned, an individual forecast for each product is also estimated not to be required due to the comparable basis of all products (i.e. all products are based on natural gases). Looking at Linde's customer base, one can obtain that Linde's sales are generally highly dependent on the industrial production, making it reasonable to implement industrial growth as one variable to forecast future sales for the gases division. As data for expected industrial growth were not available, a proxy was necessary to enable a forecast for the required regions. Due to Linde's dependency on the general economic environment, GDP with constant prices was used to predict industrial growth (International Monetary Fund, 2013).

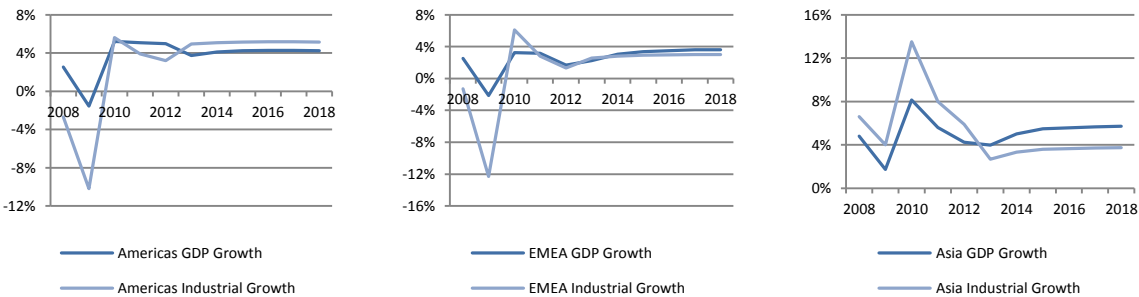
As growth may vary depending on the business region, GDP growth for all Linde locations was applied (The Linde Group, Linde global locations, 2014). For each of the three reportable segments, the average GDP was calculated and a forecast until 2018 was made. Having those data, a linear regression was applied, using the historical and expected regional GDP growth and the historical industrial growth rates (The Linde Group, Annual report, 2012). Again, this was done for each reportable segment and showed practicable results with R-squared values of more than 90% for all regions (Bhatia, 2009).

Those results were now implemented, using the following formula:

$$Industrial\ growth_{t+1} = Regression\ beta * GDP_{t+1} + regression\ alpha$$

The following charts present the results obtained by applying this formula:

**Figure 12: GDP and Industrial Growth Forecast by Reportable Segments**



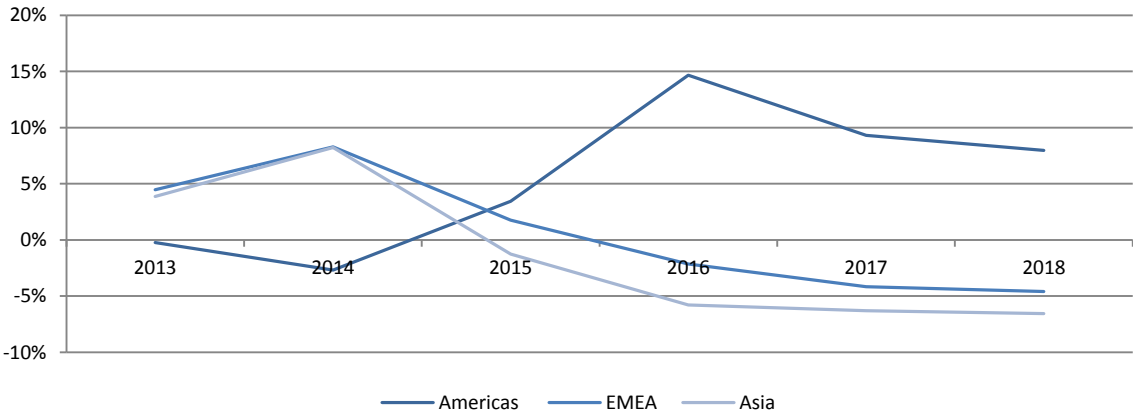
Sources: Regression analysis; International Monetary Fund, 2013; The Linde Group, Annual report, 2012

As indicated by the graphs above, GDP growth and industrial growth show a high correlation for all regions, making it reasonable to use the forecasted industrial growth as a proxy for Linde’s sales in the corresponding region. Still, constant prices GDP was used, as the impact of price changes for Linde should be calculated using different inputs.

One important factor to be considered for Linde’s business activities is the expected inflation rate. This issue is addressed as follows: For all previously mentioned regions GDP Deflator is applied, measuring the price change from the previous to the actual period (International Monetary Fund, 2013). The forecasted results will be applied for 73.1% of Linde’s actual sales (Linde percentage gases division sales in 2012, excluding liquefied gases), as an additional factor is expected to affect the company’s valuation in the future – the LNG market development. For this market, high growth rates are expected for most regions and due to Linde’s strong capabilities in this market, LNG market prices have to be

considered (Avaldsnes, 2013) (The Linde Group, Full year results 2012: Determination, 2013). Natural gas prices show a strong regional discrepancy, making it again necessary to use estimations for separate markets to guarantee an adequate reflection in Linde’s actual expected sales. According to the overall growth forecast, gas prices for three regions, namely the Americas, EMEA and Asia/Pacific were used and changes in gas prices were applied as a proxy for the impact on 26.9% of Linde’s sales. This percentage represents the liquefied gases sales in percentage of total gas sales dated 2012. Note that average prices of four years were used, as Linde’s customer contracts are mainly on a long-term basis and additionally a certain amount of uncertainty is expected for the forecasted prices. The results obtained are presented in the following figure:

**Figure 13: LNG Price Changes Forecast by Reportable Segments**



Source: Economist Intelligence Unit, 2013

The forecasted price changes show some significant differences, depending on the region considered. For EMEA and Asia, prices are expected to decline constantly from 2015 until to 2018. In contrast to that, prices for the Americas are expected to increase at 5%+ until 2016, after a drop in prices in 2013 and 2014. Afterwards, price growth is expected to slow down from 2015 – 2018 but to remain on a comparably high value. Still it has to be stated that those are expected average price changes, including a certain amount of

uncertainty. Finally, another factor has to be considered when forecasting Linde's sales – the acquisition of Lincare in 2012, being the largest acquisition of Linde within the last five years as can be obtained from the acquisitions taken place in the past as presented in the company overview section. The previously calculated growth rates will only be applied for Linde sales, excluding the revenue generated through this acquisition. Main reasoning behind that is the high impact on 2012 sales, making it necessary to normalise the revenue to get a better indication of Linde's actual growth. Additionally, Lincare's business only affects Linde's healthcare sector, meaning that the application of the industrial growth rate may not reflect the actual potential of the company. Consequently, Lincare revenues are forecasted based on the estimations of Credit Suisse (Counihan, O'Connor, & Waugh, 2013). With all those inputs applied and assumptions made, Linde's gases division sales are expected to develop as follows for the upcoming periods:

**Table 6: Gases Division Sales Forecast by Reportable Segments**

in € million	2011	2012	2013E	2014F	2015F	2016F	2017F	2018F
<b>Gases division</b>								
Americas (total)	2,384	3,200	4,299	4,526	4,870	5,346	5,777	6,239
Growth	4.6%	34.2%	34.3%	5.3%	7.6%	9.8%	8.1%	8.0%
Americas (excl. Lincare)	2,384	2,570	2,776	2,974	3,236	3,628	4,012	4,421
Growth	4.6%	7.8%	8.0%	7.2%	8.8%	12.1%	10.6%	10.2%
Lincare only		630	1,523	1,552	1,634	1,718	1,765	1,817
Growth			141.8%	1.9%	5.3%	5.1%	2.7%	3.0%
EMEA	5,672	5,998	6,437	6,990	7,443	7,846	8,245	8,650
Growth	6.4%	5.7%	7.3%	8.6%	6.5%	5.4%	5.1%	4.9%
Asia/Pacific	3,076	3,498	3,764	4,129	4,428	4,656	4,886	5,119
Growth	14.3%	13.7%	7.6%	9.7%	7.2%	5.2%	4.9%	4.8%
Consolidation	-71	-105	-120	-129	-138	-148	-156	-165
<b>Total</b>	<b>11,061</b>	<b>12,591</b>	<b>14,379</b>	<b>15,515</b>	<b>16,602</b>	<b>17,701</b>	<b>18,751</b>	<b>19,842</b>
<b>Growth</b>	<b>8.1%</b>	<b>13.8%</b>	<b>14.2%</b>	<b>8.3%</b>	<b>7.5%</b>	<b>7.2%</b>	<b>6.5%</b>	<b>6.4%</b>

Source: The Linde Group, Annual reports, 2008 – 2012; own estimations

According to the data presented, significant market growth is expected for all regions. The Americas sales are mainly driven by the development in LNG prices and the general outlook for industrial growth. Still, the acquisition of Lincare will affect future sales, with the biggest impact expected in the long-term.

EMEA growth is also expected to recover in the long-term. Growth in 2012 was lower than in the previous period but with an expected economic upturn in combination with Linde's investments in the gases division, business is expected to grow by 7.0% in 2013. Additionally to the market potential in liquefied gases and on-site, the acquisition of Air Products homecare business is expected to boost healthcare sales.

Expectations in Asia/Pacific are also high in terms of revenue increase. Still, gas prices decline may slow down growth, similar to EMEA area. Nevertheless, growth based on Linde's investments, especially in emerging markets is expected to increase Linde's sales position in Asia/Pacific.

It can be concluded, that Americas is expected to have the highest growth potential within the next years for Linde. This can be explained by the high expectations for industrial growth and the relatively stable growth rates for LNG prices. Additionally, the company's activities in the healthcare market are expected to drive sales within that region, which is also expected to influence the EMEA market positively. Although Asia/Pacific presents the strongest growth rates until 2014, the market is expected to slow-down growth due to the developments in the industrial markets and the drops in LNG prices. This development is assumed to be in line with general market expectations (Shao & Standing , 2014). EMEA is expected to remain Linde's core market, positively influenced by an improvement of the general economic conditions.

Although the gases division represents Linde's main business sector, the engineering division is also expected to increase its positioning and to show stable growth rates in future periods. In contrast to the revenues of the gases division, the engineering division sales are not forecasted using external indicators. Instead, sales are linked as percentage to Linde's gases division sales (excluding Lincare sales, as healthcare business will not affect the engineering division significantly). This approach is considered to be appropriate, as those sales are dependent on the general sales development for gases, meaning that an increase in gases sales will also drive demand for industrial plants built by Linde's engineering division. The 2012 percentage of 20.3% is estimated to be appropriate for future periods, as previous developments support this ratio. This estimation of the sales also includes the potential in the area of natural gas processing plants and LNG plants, which are expected to show a higher impact after 2014, making expected growth rates from that period on slightly higher than for the gases division.

Finally, sales in the other division are forecasted through a link to total sales generated by gases and engineering divisions, leading to a share in total sales of 3.9% for the forecasted years. Consequently, the growth rate of the other divisions sales equals Linde's total sales growth, which, with the exception of 2012 due to the acquisitions mentioned, reflects the historical development adequately.

Linde's total sales by division are summarized in the following table:

**Table 7: Linde Group Sales Forecast by Divisions**

in € million	2011	2012	2013E	2014F	2015F	2016F	2017F	2018F
<b>Gases division</b>								
Sales	11,061	12,591	14,379	15,515	16,602	17,701	18,751	19,842
Share of total	80.2%	82.4%	83.8%	83.7%	83.7%	83.7%	83.6%	83.6%
Growth	8.1%	13.8%	14.2%	7.9%	7.0%	6.6%	5.9%	5.8%
<b>Engineering division</b>								
Sales	2,531	2,561	2,615	2,840	3,045	3,251	3,455	3,666
Share of total	18.4%	16.8%	15.2%	15.3%	15.3%	15.4%	15.4%	15.4%
Growth	2.8%	1.2%	2.1%	8.6%	7.2%	6.8%	6.3%	6.1%
<b>Others</b>								
Sales	584	596	668	722	773	824	873	925
Share of total	4.2%	3.9%	3.9%	3.9%	3.9%	3.9%	3.9%	3.9%
Growth	6.4%	2.1%	12.2%	8.0%	7.0%	6.6%	6.0%	5.9%
<b>Reconciliation</b>								
	<b>-389</b>	<b>-468</b>	<b>-501</b>	<b>-541</b>	<b>-579</b>	<b>-618</b>	<b>-655</b>	<b>-693</b>
<b>Total</b>								
Sales	13,787	15,280	17,162	18,536	19,841	21,158	22,425	23,739
Growth	7.1%	10.8%	12.3%	8.0%	7.0%	6.6%	6.0%	5.9%

Source: The Linde Group, Annual reports, 2008 – 2012; own estimations

## COGS and Other Expenses

As stated previously, revenue was presented on a very detailed level due to its high impact on the company's future business. Still, cost development also plays an important role, especially for Linde due to the company's focus on efficiency improvements. As Linde presents its income statement by functions and not by nature, a detailed insight into each cost position is hardly possible and would require plenty of assumptions to be made which might give wrong indications for the forecasted numbers. Consequently, a general overview of the cost positions is provided, giving some additional insight into selected items.

The first position to be looked at are COGS, representing the cost of goods and services sold and the cost of merchandise according to Linde. Additionally, the position comprises depreciation of production plants, amortisation of certain intangible assets and inventory write downs (The Linde Group, Annual report, 2012). The future development is estimated based on total sales and is consequently directly linked to those. As previous years indicate, a share of 63.5% of total sales is appropriate and adequately reflects the costs occurred through recent acquisitions. Still, this value is expected to decrease to 63%, as the HPO program mainly influences those costs in the long-term (i.e. production and distribution cost). This results in a CAGR of 6.54% from 2013 – 2018.

As they are part of COGS, depreciation and amortization forecasts will also be presented, based on the historical numbers as stated in the annual reports. Depreciation is directly linked to net property plant and equipment of the previous period, while amortization is dependent on goodwill and other intangible assets of the year before. For depreciation, a constant value of 17% starting in 2013 is expected. Amortization is expected to be at 3.3% of the aforementioned positions (i.e. goodwill and other intangible assets). For both values, historical numbers were considered to calculate the actual share of tangibles/intangibles.

Other cost positions to be named are selling, general & administrative expenses (“SG&A”), research & development (“R&D”) expenses and other operating income and expenses. All those positions are directly linked to total revenue, following the indications given by historical data. Additionally, SG&A represent by far the largest position regarding the mentioned costs. As Linde states in its annual report, increases in this position are mainly dependent on the general increase of business activities, which makes the dependency on total revenues reasonable. This leads to a share of 24% of total revenues and a CAGR of 6.7% for the forecasted period, also influenced by the expected increases in efficiency.

**Table 8: Operational Cost Forecast**

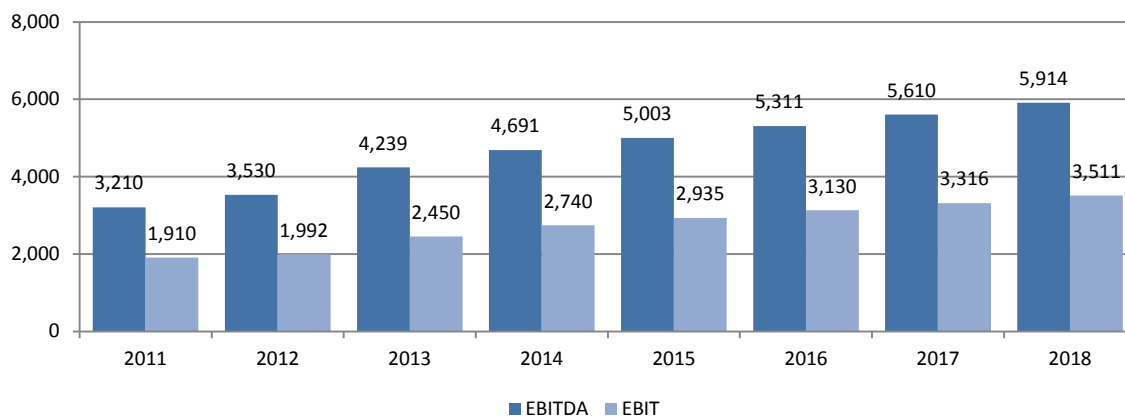
in € million	2011	2012	2013E	2014F	2015F	2016F	2017F	2018F
<b>COGS</b>	<b>8,766</b>	<b>9,755</b>	<b>10,898</b>	<b>11,678</b>	<b>12,500</b>	<b>13,330</b>	<b>14,128</b>	<b>14,956</b>
Growth	93.9%	11.3%	11.7%	7.2%	7.0%	6.6%	6.0%	5.9%
Selling General & Admin Exp.	3,194	3,657	4,119	4,449	4,762	5,078	5,382	5,697
Growth	8.9%	14.5%	12.6%	8.0%	7.0%	6.6%	6.0%	5.9%
R & D Exp.	98	101	113	123	131	140	148	157
Growth	4.3%	3.1%	12.3%	8.0%	7.0%	6.6%	6.0%	5.9%
Other Operating Income	285	288	323	349	374	399	423	447
Growth	-0.3%	1.1%	12.3%	8.0%	7.0%	6.6%	6.0%	5.9%
Other Operating Expenses	180	155	224	242	259	276	293	310
Growth	6.5%	-13.9%	44.6%	8.0%	7.0%	6.6%	6.0%	5.9%

Source: The Linde Group, Annual reports, 2008 – 2012; own estimations

## EBITDA and EBIT

Taking into account the aforementioned costs, EBIT and EBITDA figures can now be presented:

**Figure 14: EBITDA and EBIT Estimations**



Source: The Linde Group, Annual reports, 2008 – 2012; own estimations

Both values are expected to grow at a CAGR of 6.89% for EBITDA and 7.46% for EBIT. Main reasons for the growth in both positions are, as aforementioned, increases in group revenue and efficiency increases especially for COGS. EBITDA presents slightly lower growth rates when compared to EBIT, which is explained by a slight decrease in D&A growth in the long-term as will be further explained in the CapEx forecast. A special focus should be on the EBIT development as it will be a major input for the upcoming DCF Valuation.

### **Interest, Income Tax and Minority Interest**

Following EBIT, further positions have to be considered to finally arrive at the net income of Linde:

Interest income is linked to Linde's short term investments position of the previous period, leading to a slight increase within the forecasted period as the company's short-term investments position is expected to increase due to the company's general business growth. Interest expense is dependent on total debt and due to that is assumed to remain a 4% for the forecasted period, which is in line with the historical development. This value is also in line with the calculation of Cost of Debt based on the average YTM of the company's traded bonds as presented in the Valuation Model Inputs section (pre-tax CoD: 4.02%).

In terms of effective tax rate, the average rate of the past five years is applied for the future periods, leading to a tax rate of 22.7% which is in line with Linde expectations (The Linde Group, Full year results 2012: Determination, 2013).

## Dividend Payout Ratio and Net Income

For the forecasted period an increase of the dividend payout ratio up to 50% in 2018 is expected. Although Linde expects annual increases in dividend payout ratios of 8%, the development of previous periods, showing some periodical decreases in dividend payout ratio, gives indication for a rather careful forecast of an expected dividend growth of 4% per year. Finally, net income is expected to grow up to €2,134m in 2018, representing an CAGR of 8.52%, which appears reasonable due to the aforementioned improvements in terms of growth and efficiency. The historical development of Linde's dividend payout ratio can be obtained in appendix 8.

**Table 9: Income Statement Forecast**

in € million	2011	2012	2013E	2014F	2015F	2016F	2017F	2018F
Revenue	13,787	15,280	17,162	18,536	19,841	21,158	22,425	23,739
<b>Cost Of Goods Sold</b>	<b>8,766</b>	<b>9,755</b>	<b>10,898</b>	<b>11,678</b>	<b>12,500</b>	<b>13,330</b>	<b>14,128</b>	<b>14,956</b>
Gross Profit	5,021	5,525	6,264	6,858	7,341	7,828	8,297	8,784
Selling General & Admin Exp.	3,194	3,657	4,119	4,449	4,762	5,078	5,382	5,697
R&D Exp.	98	101	113	123	131	140	148	157
Other Operating Income	285	288	323	349	374	399	423	447
Other Operating Expenses	180	155	224	242	259	276	293	310
<b>Operating Income</b>	<b>1,834</b>	<b>1,900</b>	<b>2,355</b>	<b>2,637</b>	<b>2,822</b>	<b>3,009</b>	<b>3,190</b>	<b>3,377</b>
Non Operating Income/Expenses	76	92	95	104	112	121	126	134
<b>EBIT</b>	<b>1,910</b>	<b>1,992</b>	<b>2,450</b>	<b>2,740</b>	<b>2,935</b>	<b>3,130</b>	<b>3,316</b>	<b>3,511</b>
Net Interest Inc.	(291)	(305)	(507)	(551)	(549)	(558)	(570)	(586)
Income tax expense	375	363	441	497	542	584	624	664
Minority interest	70	74	84	95	103	111	119	126
<b>Net Income</b>	<b>1,174</b>	<b>1,250</b>	<b>1,418</b>	<b>1,597</b>	<b>1,740</b>	<b>1,877</b>	<b>2,004</b>	<b>2,134</b>
Dividends	428	500	590	691	783	878	975	1,080

Source: The Linde Group, Annual reports, 2008 – 2012; own estimations

#### **4.2.2 Balance Sheet Estimations**

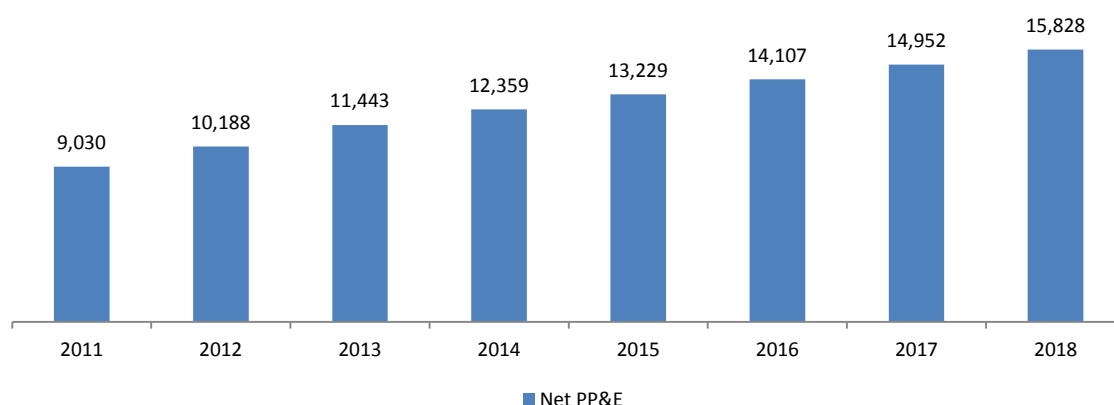
After determining the financials for the income statement, the balance sheet forecast will provide further insights into Linde's asset and liability development. Not only the dependency on several income statement positions, i.e. depreciation and amortization, but also the influence onto the DCF Valuation in terms of CapEx and Working Capital indicate how crucial these data will be for the forecast. Due to that, the main focus will be on the development of PP&E, receivables and payables. Additionally, balancing items will be presented, giving an idea of how assets and liabilities were matched during the forecasted periods.

#### **Property, Plant & Equipment**

Linde's previously mentioned acquisitive strategy and long-term CapEx target of 13% mainly influenced the forecast for this position (The Linde Group, Full year results 2012: Determination, 2013). Consequently, PP&E is linked to total sales, as it is assumed that the company will keep its investment strategy in the long-term. A share of 66.7% of total sales, including revenues generated through Lincare, is expected for future periods, which is supported by the historical development. This results in a total value of €15,828m for net PP&E in 2018.

The following figure illustrates the annual net PP&E development:

**Figure 15: Net PP&E Forecast**



Source: The Linde Group, Annual reports, 2008 – 2012; own estimations

As can be observed, Linde is expected to constantly increase its PP&E, which comes along with the historical development and again meets the strategic focus on growth for future periods.

### **Receivables and Payables**

Another position having an important impact on the final valuation is the development of receivables and payables. For accounts receivable, the forecast is based on total revenue as sales development will directly influence accounts receivable, meaning that higher sales will increase the position and vice versa. This approach is expected to increase accounts receivable to €4,038m in 2018 which is equivalent to a ratio of 17% of total sales. Regarding other receivables, which include receivables from finance leases, income tax receivables and other assets, also revenues are used as base for the forecast. This approach appears reasonable, as all three positions present a stable range within the past four years, making the average percentage of sales a reliable forecast for each individual position. In contrast to the previous positions, trade payables are calculated based on COGS, which can be explained by their dependency on the input price and not on total

sales, as it is stated in relevant literature (Koller, Goedhart, & Wessels, Valuation: Measuring and Managing the Value of Companies, 2010). The position is expected to be at €4,446m in 2018, applying a percentage of sales of 29.7% from 2013 – 2018 which is in line with the historical ratio. Other current liabilities include income tax and finance lease expenses and are forecasted using a constant value of €1,194m. This approach can be explained by the historical development, always ranging between €1,100m and €1,200m, making the 2012 value a reasonable proxy for future developments.

### **Inventory**

Inventory basically follows the approach applied for trade and other payables. The position is linked to COGS as inventory is also dependent on the input price and not on actual sales. Linde's inventory includes raw materials, work in progress goods, finished goods, merchandise and advanced payment to suppliers and is expected to grow at a constant rate of 12% of COGS until 2018.

### **Balancing Items**

The completion of the forecast requires some balancing calculations to ensure that the balance sheet matches assets and liabilities at the end of each period. Following the approach of Koller, Goedhart, & Wessels, (2010), retained earnings are calculated as follows:

$$Retained\ earnings_t = Retained\ earnings_{t-1} + Net\ income_t - Dividends_t$$

Following the retained earnings, common stock is expected to remain constant throughout the forecasted period. The same rationale is applied to total debt, which is in line with Linde's business as mainly changes from short-term to long-term debt occurred

in the past (as explained in the historical financials' analysis), but significant changes in the overall capital structure could not be obtained within the considered timeframe. The final balancing process is done by using excess cash and newly issued debt as balancing positions, meaning that the difference between total assets and total liabilities will determine the balancing account. In the case of Linde, total liabilities plus equity are larger than total assets, leading to an increase of the cash position throughout the forecasted period. This increase is reasonable, considering Linde's overall financial performance from 2013 – 2018. Note that cash is not considered to be operational, making the cash position an adequate balancing position as it will not directly influence the valuation.

**Table 10: Balance Sheet Forecast**

in € million	2011	2012	2013E	2014F	2015F	2016F	2017F	2018F
Total Cash & ST Investments	2,073	2,041	2,250	2,429	2,680	2,979	3,327	3,697
Total Receivables	2,735	3,543	3,838	4,145	4,437	4,732	5,015	5,309
Total Current Assets	5,844	6,682	7,383	7,930	8,572	9,256	9,992	10,745
Net Property, Plant & Equipment	9,030	10,188	11,443	12,359	13,229	14,107	14,952	15,828
Total Non-Current Assets	23,071	26,795	28,172	29,227	30,248	31,289	32,307	33,368
<b>Total Assets</b>	<b>28,915</b>	<b>33,477</b>	<b>35,555</b>	<b>37,157</b>	<b>38,819</b>	<b>40,544</b>	<b>42,299</b>	<b>44,113</b>
Total Current Liabilities	6,556	6,811	7,559	7,791	8,035	8,282	8,519	8,766
Total Non - Current Liabilities	10,215	13,008	13,417	13,797	14,192	14,608	15,038	15,492
Total Common Equity	11,604	13,094	13,922	14,828	15,786	16,784	17,813	18,867
Total Equity	12,144	13,658	14,579	15,569	16,592	17,654	18,742	19,856
<b>Total Liabilities And Equity</b>	<b>28,915</b>	<b>33,477</b>	<b>35,555</b>	<b>37,157</b>	<b>38,819</b>	<b>40,544</b>	<b>42,299</b>	<b>44,113</b>

Source: The Linde Group, Annual reports, 2008 – 2012; own estimations

### 4.2.3 Valuation Model Inputs

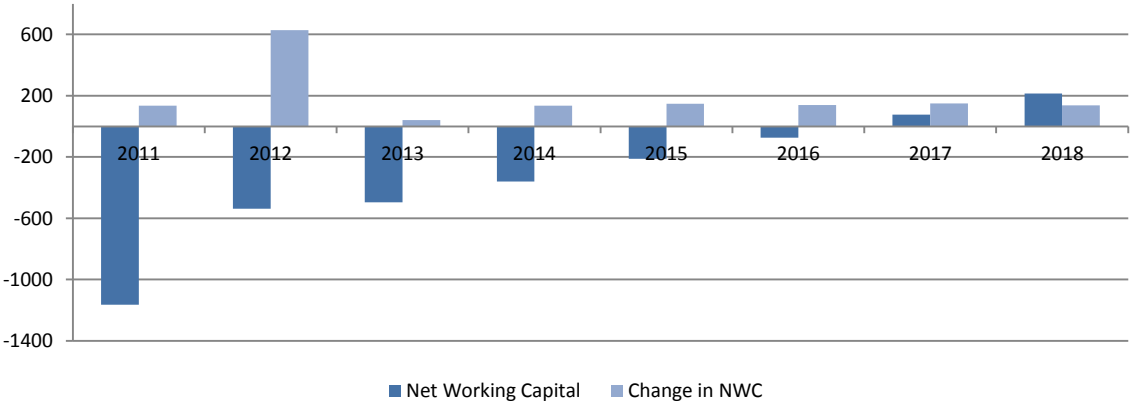
After the forecast for income statement and balance sheet items is completed, the DCF Valuation can now be presented. This chapter will focus on the inputs for the DCF Valuation model and due to that present financials for working capital, CapEx, WACC and terminal growth rate. Additionally, this chapter will give insights into the transition from enterprise value to equity value. Note that forecasts for EBIT, depreciation and

amortization as well as tax expenses will not be covered in this section as they were already discussed in the previous chapters.

**Change in Net Working Capital**

As stated in the historical data analysis, working capital will comprise the following items for the valuation model: Accounts receivable, other receivables, inventories, accounts payable and other payables. Forecasts for all of these positions were presented in the previous section. Consequently the calculation of the change in net working capital and its development throughout the forecasted periods will be covered now. In contrast to the previously presented calculation of net working capital, the valuation model requires change in net working capital as input variable. Due to that, the following chart presents both numbers from 2011 – 2018 and gives insights into Linde’s financing policy:

**Figure 16: NWC and Change in NWC Estimations**



Source: The Linde Group, Annual reports, 2008 – 2012; own estimations

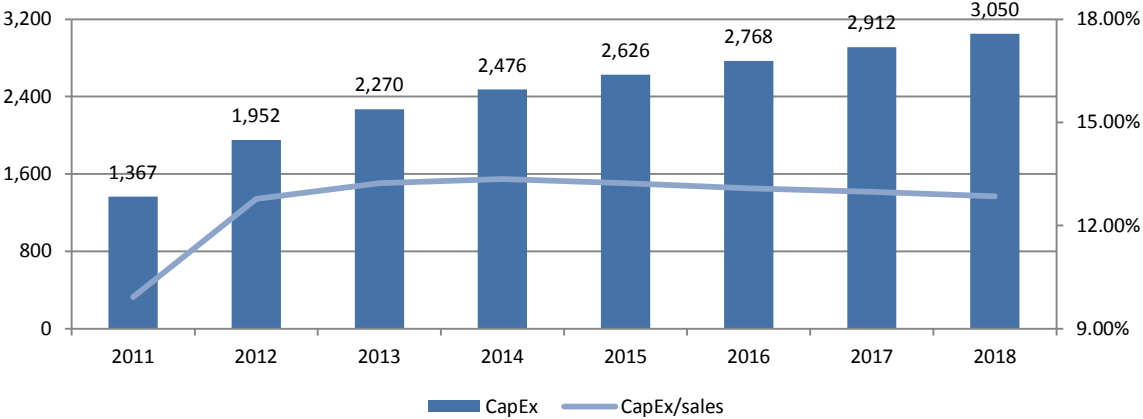
One can obtain from the figure above that Linde is expected to constantly improve its NWC, meaning that the company reduces its dependency on customer financing through increasing its short-term assets. This trend was already visible since 2011 and considering

the big change in NWC in 2012, it is expected that the improvements will continue and lead to a positive NWC in 2017. This can be interpreted as positive, as a negative NWC might not be a big issue as long as economic conditions are expected to be stable. In case of a further economic downturn, a high dependency on customer on short-term liabilities for short-term financing needs might cause serious problems. Due to that, although reducing the company valuation, in terms of sustainability and risk exposure, the NWC forecast can be interpreted positively.

**CapEx**

Similar to NWC, the forecasts for the inputs of CapEx were already discussed previously. Still, the forecasted data for CapEx should be presented and analyzed to give further insights into the assumptions behind and the main driver for the expected growth of this position. With the goal of enabling this deeper understanding, the upcoming chart presents CapEx from 2011 – 2018 and additionally CapEx/Sales ratio for the same period:

**Figure 17: CapEx and CapEx/Sales Forecast**



Source: The Linde Group, Annual reports, 2008 – 2012; own estimations

Generally it is expected that Linde will keep its CapEx on a relatively high level until 2014, which is reasonable considering Linde's target CapEx/Sales ratio of 13% as goal for 2013 (The Linde Group, Full year results 2012: Determination, 2013). It is expected that this value will peak at 13.36% in 2014 and afterwards constantly decline and stabilize at slightly below 13% in 2018. This development gives an indication about Linde's future growth potential in terms of both investments into new facilities in emerging markets and its general strategy of acquisitions to enable a sustainable growth in the long-term.

### **Weighted Average Cost of Capital Calculation**

Besides the never questioned relevance and importance of the financials forecast, the accurate determination of the CoC is also a crucial element for the valuation, as assumptions made within this area have a significant impact on the final enterprise value. Due to that, the determination of the CoC will be presented in detail, starting with CoE, over CoD and finally the WACC, including capital structure expectations.

### **Cost of Equity**

The calculation of Cost of Equity comprises three main components: The risk-free rate, the equity risk premium and the company's beta. Before presenting the results, it is urgent to state that Linde is a multinational company, with exposure to emerging markets, which implies chances but also risks for the company. These risks have to be reflected in the cost of equity composition to ensure that the risks arising with the company's business activities are not underestimated.

For the risk-free rate, the average 10 year yield to maturity of the German Government Bund from 2008 – 2014 is applied (Bloomberg, German Government Bunds, 2014). Although, usual practice might recommend using the latest risk-free rate and not an

average, the economic environment and the current low interest rate level led to the assumption that using an average might give a better evaluation of the overall risk. This appears even more reasonable as future prospects might indicate an increase in risk-free rate as the actual situation represents a historical low (Financial Times Money, 2013). However, an average might also not correctly reflect future developments, but give a slightly higher risk-free rate when compared to not using an average, leading to the assumption that future developments might be covered more extensive than using just one simple rate.

Following the risk-free rate, the equity risk premium will be covered next. Considering the aforementioned characteristic of Linde being a multinational company, this additional risk will be reflected through this position. Although information about actual sales volumes of each single country is not provided, again the three reportable segments the Americas, EMEA and Asia/Pacific will be used as a proxy for Linde's total equity risk premium. Still, Linde's business activities in certain markets should be covered in the derivation of the equity risk premium. Due to that, the final value is determined by using weighted average premiums based on the actual 2012 sales of the gases and engineering division for each region.

This approach enables a consideration of Linde's higher risk exposure and at the same time includes the lower risk that occurs in developed markets. The method was applied according to recent literature, stating that using average equity risk premiums is an appropriate way to evaluate multi-national companies (Damodaran, *The Octopus: Valuing Multi-business, Multi-national companies*, 2009). The calculation resulted in a value of 9.59%, which seems reasonable, again considering Linde's exposure to various markets in different stages (Damodaran, *Country Default Spreads and Risk Premiums*). Note that the input for the current risk premium for a mature equity market (i.e.

Germany) was set to 5.9% (Credit Suisse, 2013). A detailed overview about the risk premiums for the various Linde locations is provided in appendix 12.

Finally, to compute the cost of equity, a beta derivation is necessary. In contrast to the equity risk premium, beta is not calculated for each business segments but through the application of a linear regression of the change in Linde's stock price against the change in price of the DAX 30 from 2007 – 2013 (Bloomberg, Deutsche Börse AG German Stock Index DAX, 2014) (Bloomberg, Linde AG, 2014). This decision was made, as the equity risk premium is expected to cover all additional risks in an appropriate way, making region specific betas redundant. Further, a broader range of betas might also overestimate Linde's overall business risk. The obtained raw beta of 0.8050 was adjusted, applying the Bloomberg approach as stated in the literature review, and led to an adjusted beta of 0.8699.

### **Cost of Debt**

Besides the Cost of Equity, Cost of Debt have to be determined to finally compute total Cost of Capital. As already stated in the literature review, for investment grade companies with marketable bonds outstanding, the YTM of those can be used to precisely estimate the company's Cost of Debt. According to Linde's annual report (2012), the company is rated A3 (Moody's) and A (Standard & Poor's) with outlook from both companies set to stable. In combination with the availability of traded bonds (see appendix 5), it is reasonable to calculate pre-tax Cost of Debt using these bonds.

Considering the overall bond structure, of the total of 15 traded bonds of Linde, 9 were used for the Cost of Debt calculation. Bonds excluded include subordinated bonds and bonds with variable coupons. Additionally, bonds with maturity date in 2013 were also not considered for the calculations. Looking at the structure of the selected bonds, YTMs from

1.75% up to 6.75% can be obtained, depending on the date of issue and maturity. This broad range of values will be considered on purpose, as, following the approach of the calculation of the risk-free rate, average coupons are supposed to anticipate possible future increases in interest rates and due to that give a better estimation of Linde's overall business risk.

Note that not latest prices but issue prices were considered for the calculation of the YTM, as those are supposed to reflect the expected returns more realistic, considering the financial environment during the time of their issuance. Based on those bonds, the calculated average YTM resulted in pre-tax Cost of Debt for Linde of 4.02%. Additionally, the tax shield has to be considered to calculate after-tax Cost of Debt. As stated in the income statement forecast, the average income tax rate of 22.71% from 2008 – 2012 was applied, providing after-tax Cost of Debt of 3.11%.

### **Cost of Capital**

As all input factors are determined, the final computation of WACC can now be presented. However, Linde's capital structure has to be stated first, as WACC will also be influenced by the way the structure is expected to develop. As previously stated, Linde presented some structural changes, in terms of converting short-term liabilities into short-term debt. Still, apart from these changes, which will not influence Linde's debt/EV structure, which is crucial for the WACC computation, no significant changes of the target capital structure are expected. Linde's debt/EV ratio remained within a small range from 57.7% up to 59.2%, making it reasonable to apply an average debt/EV ratio of 58.32% for the WACC calculation.

The final WACC of Linde is presented in the following table:

**Table 11: Detailed WACC Calculation**

Risk-Free Rate	2.59%
Country Risk Premium	0.00%
Subtotal	2.59%
Equity Risk Premium	9.59%
Beta	0.87
<b>Cost of Equity</b>	<b>10.93%</b>
<b>Cost of Debt</b>	<b>4.02%</b>
Tax	22.71%
After Tax Cost of Debt	3.11%
D/V	58.32%
E/V	41.68%
<b>WACC</b>	<b>6.37%</b>

Source: Own estimations

## Terminal Value

With the data described, FCFF can now be calculated and discounted to finally arrive at enterprise value. However, one input factor of high importance has to be determined, as it will influence the valuation result significantly – the terminal value. For this purpose, Linde’s global business activity is considered again. In contrast to the derivation of the equity risk premium, only OECD countries are considered for the terminal value calculation. Although Linde has a certain exposure to emerging markets, one cannot expect that those markets will keep growing at the current rates until infinity. Due to that, it is assumed that the average global GDP growth for OECD countries in the Americas, EMEA and Asia/Pacific will provide an adequate proxy of the terminal growth rate for those regions (U.S. Energy Information Administration, 2013). Again weighted averages based on 2012 sales are applied, to reflect the amount of business activity Linde has in each of the regions. This results in a terminal growth rate of 1.83% and a terminal value weight of 85.6% of the total enterprise value of Linde.

## Enterprise Value

Including all the forecasted data and discounting the FCFF will result in the enterprise value. The whole valuation is presented in the following table:

**Table 12: DCF Valuation Results**

in € m	2014F	2015F	2016F	2017F	2018F
EBIT	2,740	2,935	3,130	3,316	3,511
Taxes	497	542	584	624	664
+Deprec. and amortization	1,951	2,069	2,181	2,294	2,403
<b>CF from Operations</b>	<b>4,194</b>	<b>4,462</b>	<b>4,727</b>	<b>4,986</b>	<b>5,250</b>
-Change in NWC	136	147	138	151	137
-CapEx	2,476	2,626	2,768	2,912	3,050
<b>FCFF</b>	<b>1,582</b>	<b>1,689</b>	<b>1,820</b>	<b>1,924</b>	<b>2,063</b>
Present Value	1,487	1,492	1,513	1,503	
Terminal Value				35,550	
<b>Enterprise Value</b>	<b>41,546</b>				

Source: The Linde Group, Annual report, 2012; own estimations

The table above shows that the DCF Valuation results in an enterprise value of €41,546m for Linde. However, enterprise value represents the value of the company belonging to both equity holders and debtholders. As the final value to derive should be the price per share, which only concerns equity holders, this enterprise value has to be adjusted to calculate equity value which requires additional calculations.

### Enterprise Value to Equity Value Transition

The first step to calculate equity value is the addition of excess cash and short term investments to enterprise value. Both positions were assumed to be non-operational and due to that they were not considered in the valuation so far. Still, both items can be converted into cash quickly and due to that are added to the calculated enterprise value.

Both positions will be considered at their 2013 book values, following the approach of latest literature, not recommending to value these positions separately to get a market value (Koller, Goedhart, & Wessels, *Valuation: Measuring and Managing the Value of Companies*, 2010). In 2013 the book value for cash is €1,422m and for short-term investments Linde reports €828m.

Another item that has to be added to the enterprise value are long-term investments. For Linde, this position includes investment into associates and joint ventures, meaning that Linde has influence onto those companies' business but does not obtain control. As earnings of those companies are not considered in the income statement, those positions have to be added to enterprise value as they represent non-operational assets, adding value to the company. Again, the expected book value of 2013 is applied, leading to an increase of the calculated enterprise value of €816m.

Besides the performed additions, the calculation of equity value also requires certain deductions from the enterprise value. As mentioned previously, enterprise value represents the total value of the company, whereas equity value only represents the company's part that belongs to shareholders. Consequently, debt has to be subtracted from the enterprise value. Although Linde is partially financed through outstanding bonds, the company is also receives financing through bank loans, making it more difficult to obtain actual market prices for the debt position.

However, recent literature presents an approach to approximate the market value of debt in case several input items are given, i.e. interest expense, average maturity of debt, cost of debt and book value of debt (Damodaran, *Debt and Value: Beyond Miller-Modigliani*). Linde provides all those information, although for the average maturity assumptions were made, as Linde only presents its debt maturities in intervals from <1 years, 1 – 5 years and > 5 years, making an exact maturity calculation hardly possible (The Linde Group, Full year

results 2012: Determination, 2013). A debt maturity profile can be found in appendix 13. Due to that, an average maturity of 4.84 years is assumed to calculate market value of debt. This value was obtained, using weighted average maturities based on the amount of debt outstanding for each maturity (the following assumptions were made: maturities <1 year = 0.5 years average maturity, maturities 1 – 5 years = 3 years average maturity and maturities >5 years = 7.5 years average maturity). The formula applied can be obtained in appendix 6 and resulted in a market value of debt for Linde of €11,214m, using the 2013 estimated book value. Note that a maturity overview based on historical data for 2013 was not available yet, as the annual report of Linde will be published after the submission of this thesis as stated previously. In the forecast it is assumed that short- and long-term debt positions remain unchanged which led to the assumption that the average maturities of 2012 can also be applied for the 2013 values.

Other items to be subtracted are provisions and contingent liabilities. The latter includes guarantees and warranties, totaling €63m in 2013. These liabilities are reported on the balance sheet but have to be considered for the derivation of the equity value as those might be cost that could occur and due to that reduce the equity value. For provisions, Linde reports provisions for pensions and similar obligations and other provisions. The first can be clearly identified as debt equivalents according to Koller, Goedhart, & Wessels, (2010), which have to be deducted from enterprise value. For the latter, warranty obligations are excluded as they are already accounted for free cash-flows. Besides that, other provisions are considered as relevant for the calculation of equity value, leading to a total amount of provisions of €3,404m.

As Linde does not report any preferred equity or employee stock options, the last position to be considered to calculate equity value is minority interest. Again, the estimated value for 2013 is used to perform that operation, as no further information is provided by Linde regarding this position.

The following table presents a step by step derivation of price per share, including all the items discussed previously.

**Table 13: Price Per Share Derivation**

<b>Enterprise Value</b>	<b>41,546</b>
<b>Additions</b>	
Cash & Short Term Investments	2,250
Contingent Liabilities	816
<b>Subtractions</b>	
Market Value of Debt	11,214
Provisions	3,404
Contingent Liabilities	63
Preferred Equity	0
Total Minority Interest	657
Equity Value	29,338
Shares Issued	186
<b>Price per Share</b>	<b>158.07 €</b>

Source: The Linde Group, Annual report, 2012; own estimations

### 4.3 Multiple Valuation

In addition to the DCF Valuation, a Multiple Valuation based on selected peer companies is performed to enhance the previous valuation and to additionally give insights into potential different valuation results, depending on the method used. Note, that only three companies are used to determine the peer group multiples. Although this might be estimated as a rather small amount of companies, the rationale behind is that those companies present huge similarities in terms of business activity and size, meaning that for instance adding more chemical companies to the peer group wouldn't have increased the accuracy. Due to that Linde's main competitors in the industrial gases sector, Air Liquide, Air Products and Praxair are used as peer group. More detailed information about the selected peer companies was already provided in the industry analysis.

Regarding the valuation, EV/EBITDA and P/E multiples were applied, with the goal of having valuations for both enterprise value and equity value. As already stated in the literature review, those multiples are expected to be the most common ones used by practitioners.

For both multiples, forward values are applied, as future and not historical cash flows of the company should be evaluated. The final multiples are derived through weighted averages based on each company's market capitalization, as the peer groups' market values should be incorporated which led to the following results:

**Table 14: Weighted Average Valuation Multiples obtained by Peer Group**

	EV/EBITDA	Price/Earnings	Market Cap.	W. EV/EBITDA	W. P/E
Air Liquide	10.3	18.1	42,248	4.1	7.3
Praxair	13.1	19.7	37,699	4.7	7.1
Air Products	11.3	18.6	25,035	2.7	4.4
Total			104,982	11.54	18.79

Source: Bloomberg

Multiplying the calculated EV/EBITDA multiple with Linde's estimated EBITDA for 2014 and also multiplying the computed P/E multiple with Linde's expected net income for 2014 will result in enterprise value and equity value.

Dividing equity value through Linde's shares outstanding will result in price per share, as presented in the table:

**Table 15: DCF Valuation and Multiple Approach Results Comparison in €m**

Method	Linde valuation comparison		
	Enterprise value	Equity value	Price per share (€)
Multiple Valuation	54,149	30,021	161.75
DCF Valuation	41,546	29,338	158.07
Delta	-12,603	-683	-3.68

Source: Bloomberg; own estimations

As can be clearly obtained, the results from the Multiple Valuation imply a slightly higher value for Linde than the results of the DCF Valuation may indicate. However, looking at price per share one can obtain that the prices are indeed different but within a rather small range of €3.68. The DCF Valuation model used gives a rather careful forecast for Linde's future developments, as variables like the prices for LNG or the future possibility of a slight slow-down of growth in emerging markets bare uncertainties which are reflected in the model. Also, the calculation of the terminal growth rate, only considering OECD countries is estimated relatively conservatively. Still, the Multiple Valuation states that the DCF Valuation can be assumed to be correct and the assumptions behind to be in consensus with markets estimates. To provide further insight into the high impact of some key drivers behind the DCF Valuation, the following sensitivity analysis was performed.

#### 4.4 Sensitivity Analysis

With the comparison of the DCF Valuation and the Multiple Approach, one could obtain slight differences between the calculated enterprise and equity value for both models. Although it was explained in the previous section why these differences may occur, changing some parameters and assumptions will give further intuition about the main drivers behind the valuation and how big their impact on the finally calculated value is.

The sensitivity analysis will cover three topics, namely changes in WACC, changes in terminal growth rate, changes in the revenue forecast and finally changes in COGS.

Rationale behind is that the first two positions represent direct valuation parameters, whereas the last two items are related with general assumptions made about Linde which are again linked to the two topics discussed throughout the whole thesis: Growth and efficiency increase.

**WACC**

The calculated WACC of 6.37% represents an important factor in terms of the derived enterprise and equity value. As discussed, the final CoC are based on several input parameters, requiring some assumptions to be made. The following figure gives an intuition about the impact on the price per share of Linde, when only WACC are changed, while all other inputs remain the same. Note that the horizontal axis represents the applied value for the WACC:

**Figure 18: WACC - Sensitivity Analysis**



Source: Own estimations

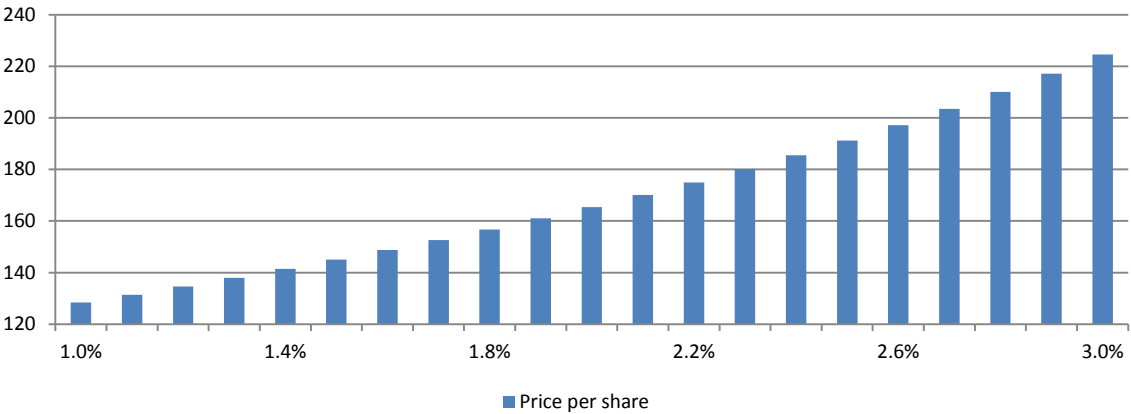
Looking at the chart, it can be implied that higher CoC will decrease the price per share whereas lower CoC will increase the calculated equity value. Although these results may be considered intuitive, the huge influence of these WACC changes has to be mentioned.

Changing the CoC within a range of 2% leads to prices per share ranging from €112.50 up to €211.78. This outcome clearly underlines the importance of the CoC, making the rationale behind the assumptions in this area one of the most crucial parts of the whole valuation.

**Terminal Value**

Besides WACC, terminal value also has a high impact on the company evaluation, as it will impact the long-term expected growth potential of the company. Additionally, terminal value represents 85.6% of the calculated enterprise value. Consequently, changes on terminal value are expected to have a significant impact on the price per share. The following figure presents the prices per share, with terminal value ranging from 1.0% up to 3.0%. The horizontal axis represents the applied terminal growth rates, all other input variables remain unchanged.

**Figure 19: Terminal Growth Rate - Sensitivity Analysis**



Source: Own estimations

Following the findings from the WACC sensitivity analysis, changes in terminal value also impact price per share significantly. In contrast to CoC, higher growth will increase price

per share and vice versa. Prices show again a broad range, starting from €128.36 and peaking in a price per share of €224.56.

### **Industrial Growth Rate**

After determining WACC and terminal growth rate as crucial input parameters for the DCF Valuation, changes in expected revenue growth are analyzed next. As explained in the previous section, revenues are generated in three divisions (i.e. gases, engineering and others). For the gases division, the forecast is calculated using industrial growth rates, GDP-Deflators and changes in LNG prices as inputs.

The conducted sensitivity analysis will give intuition about the impact on Linde's price per share, assuming changes in the expected industrial growth rates for the Americas, EMEA and Asia/Pacific. As engineering sales are linked to gases division sales, and others revenues are linked to revenues in the gases and engineering divisions, this analysis will have an impact on Linde's total sales forecast. The calculated and applied data for the actual valuation are presented in the middle of the following table (price per share: €158.07).

For the analysis, changes in industrial growth rates from -2% up to +2% for each region are assumed:

**Table 16: Industrial Growth Rate by Reportable Segments - Sensitivity Analysis**

Industrial Growth							
Region	2013	2014	2015	2016	2017	2018	Price per share
Americas	2.93%	3.09%	3.15%	3.17%	3.17%	3.15%	<b>141.33</b>
EMEA	0.58%	0.82%	0.91%	0.95%	0.99%	0.99%	
Asia	0.68%	1.32%	1.61%	1.65%	1.71%	1.74%	
Americas	3.43%	3.59%	3.65%	3.67%	3.67%	3.65%	<b>145.40</b>
EMEA	1.08%	1.32%	1.41%	1.45%	1.49%	1.49%	
Asia	1.18%	1.82%	2.11%	2.15%	2.21%	2.24%	
Americas	3.93%	4.09%	4.15%	4.17%	4.17%	4.15%	<b>149.54</b>
EMEA	1.58%	1.82%	1.91%	1.95%	1.99%	1.99%	
Asia	1.68%	2.32%	2.61%	2.65%	2.71%	2.74%	
Americas	4.43%	4.59%	4.65%	4.67%	4.67%	4.65%	<b>153.77</b>
EMEA	2.08%	2.32%	2.41%	2.45%	2.49%	2.49%	
Asia	2.18%	2.82%	3.11%	3.15%	3.21%	3.24%	
Americas	4.93%	5.09%	5.15%	5.17%	5.17%	5.15%	<b>158.07</b>
EMEA	2.58%	2.82%	2.91%	2.95%	2.99%	2.99%	
Asia	2.68%	3.32%	3.61%	3.65%	3.71%	3.74%	
Americas	5.43%	5.59%	5.65%	5.67%	5.67%	5.65%	<b>162.45</b>
EMEA	3.08%	3.32%	3.41%	3.45%	3.49%	3.49%	
Asia	3.18%	3.82%	4.11%	4.15%	4.21%	4.24%	
Americas	5.93%	6.09%	6.15%	6.17%	6.17%	6.15%	<b>166.92</b>
EMEA	3.58%	3.82%	3.91%	3.95%	3.99%	3.99%	
Asia	3.68%	4.32%	4.61%	4.65%	4.71%	4.74%	
Americas	6.43%	6.59%	6.65%	6.67%	6.67%	6.65%	<b>171.46</b>
EMEA	4.08%	4.32%	4.41%	4.45%	4.49%	4.49%	
Asia	4.18%	4.82%	5.11%	5.15%	5.21%	5.24%	
Americas	6.93%	7.09%	7.15%	7.17%	7.17%	7.15%	<b>176.09</b>
EMEA	4.58%	4.82%	4.91%	4.95%	4.99%	4.99%	
Asia	4.68%	5.32%	5.61%	5.65%	5.71%	5.74%	

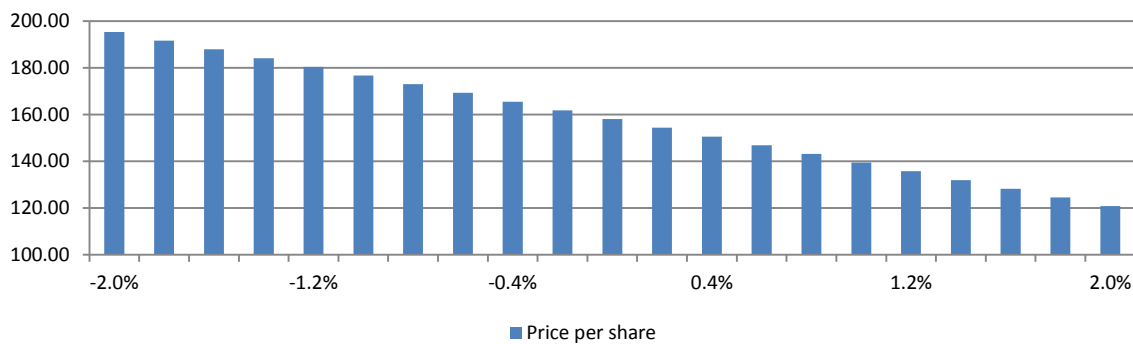
Source: Own estimations

In contrast to the WACC and terminal growth analysis, the impact of revenue increases or decreases can be described as smaller. Still the obtained prices per share range from €141.33 up to €176.09.

## COGS

Finally, the last sensitivity analysis to be conducted will cover changes in Linde's efficiency, measured through changes in COGS. As COGS are forecasted as percentage of sales, these percentages have been changed from -2.0% up to 2.0% to determine the impact on the price per share. Again, the horizontal axis presents the applied percentage change in COGS linked to total sales.

Figure 20: COGS - Sensitivity Analysis



Source: Own estimations

The results can again be described as intuitive, as a decrease in efficiency will lower the obtained price per share, while decreases in COGS will lead to higher equity values. As for the other analyses, the price range has to be considered, showing a significant impact as prices range from €120.81 up to €195.33. This shows the high importance of efficiency improvements and gives an indication of the relevance of the HPO program for Linde's future profitability.

## 5. Valuation Analysis' Results in Comparison to Morgan Stanley's Estimations

As all valuations are performed, the calculated value for Linde will now be compared to the estimates of Morgan Stanley's broker report dated June 5<sup>th</sup> 2013.

Morgan Stanley applies four different valuation models to derive the price per share of Linde. The final equity value is calculated through an average of all valuation models. Still, the focus of this comparison will be on the bank's results obtained using the DCF and the Multiple Valuation as those models were also used in this thesis. However, the residual income and dividend discount model valuation conducted by Morgan Stanley led to results almost equal to their DCF Valuation.

For the DCF Valuation, Morgan Stanley calculated a price per share of €153 for Linde, resulting in a final price target of €155 (as stated above: Average price per share of DCF Valuation, residual income, dividend discount and Multiple models) in the base case. As the valuation performed in this thesis is also based on a base case scenario, this will be the price the valuation will be compared with. Still, appendix 7 provides further information about Morgan Stanley's results obtained through the individual models and cases. The bank values the Linde stock €5.07 lower than the result obtained in this thesis. This difference might be caused by several input parameters, still two main assumptions and calculations are different from the valuation performed in this thesis. In terms of WACC (8.4%) and terminal growth rate (2.5%) Morgan Stanley estimates both values higher than this report. Looking at the calculation formula for terminal value as explained in the literature review, a larger "gap" between WACC and terminal growth will decrease terminal value. This is true for the estimations of MS in comparison to this thesis' estimations, which becomes evident when comparing the enterprise values. While Morgan Stanley reports an EV of €38,694m, the value of €41,546 obtained in this thesis is slightly higher. In contrast to that, the general expectations of Linde's overall business

are rather comparable, meaning that differences should not be based on the general business forecast.

It can be concluded that the calculated enterprise value (€38,694m) of Morgan Stanley, which is lower than the value calculated in this thesis (€41,546), is mainly due to the assumptions of WACC and terminal growth rate. However, the final difference in price per share is based on the transformation from enterprise value to equity value. As the bank does not provide further details about their calculation rationale, the value obtained in this report is expected to be correct as it follows the approach of recent literature. Based on this calculation, Morgan Stanley reports an equity value of €28,320m, which is €274m below the estimations in this report.

Taking into account those data, it is assumed that the central expectations of the bank are matching with the forecasts made in this thesis, but differences in WACC and terminal value as well as in the transition from enterprise value to equity value, lead to a slightly lower price per share based on Morgan Stanley's estimates when compared to this thesis.

In terms of Multiple Valuation, Morgan Stanley also uses the forward P/E multiple to determine an equity value for Linde. The bank states, that Linde's P/E multiple has risen from <14x to close to 17x, making it almost equal with Air Liquide's multiple (Mackey, Walsh, & Stiefel, 2013). Still, Linde's calculated price per share based on that multiple is €159, which is again comparable with the value calculated in this thesis' Multiple Valuation (€161.65).

Finally, although certain differences may occur due to the aforementioned reasons, the valuation of Morgan Stanley is in line with the calculations in this thesis.

## 6. Conclusion

During this thesis, Linde was analyzed from a historical perspective, a financials forecast was made based on several assumptions and estimations and finally the valuation was compared to the broker report of an investment bank. One has to be aware that these inputs and the results obtained are always limited due to the availability of adequate information and the unpredictability of financial markets. Still, based on the public information available, inputs were selected carefully, growth potentials and risks were considered and two valuation models were applied to ensure a certain amount of plausibility and reliability.

One can conclude that the valuation results are in line with market estimations, which was proven by the comparison of the price per share using the DCF Valuation and the Multiple Approach. Additionally, although MS expects Linde's value to be slightly below the estimations made in this thesis, the results are within a small range, giving even more confidence that the assumptions behind the valuation model are generally matching market estimations.

Further, Linde's future business potential was analyzed carefully. Although an industrial gases company, Linde invested into its positioning in the growing healthcare market. Two acquisitions occurred in this segment in 2012, driving especially the company's business in the Americas. Additionally, these acquisitions were in line with Linde's general strategy of sustainable business growth. CapEx is expected to remain high, with a special focus on emerging markets. Apart from these areas of growth, Linde is also expected to continue to increase its efficiency through the HPO program, which will reduce operational costs in the long-term. Still, the company is highly dependent on the development of the industrial market. An economic downturn will affect Linde sales significantly as was proven in the conducted sensitivity analysis. Although the liquefied gases market only accounts for

around 20% of the gases division's sales, decreasing prices may also affect Linde's business negatively, in both the gases and the engineering division. Taking into account all these information, it can be concluded that Linde is a healthy and established company, with areas of high potential but also areas of certain risks to be monitored carefully. These risks are also reflected in the valuation, which is slightly above the expectations of the investment bank but with target price not being significantly above the current market price. Consequently the valuation supports the explained upwards potential of Linde, but also covers the limits that may be reached due to external factors.

Nevertheless, this thesis gives also evidence of the high level of sensibility every valuation model is based on. This was even more proven by the conducted sensitivity analysis, which showed that WACC and terminal growth rate may have the biggest impact on the valuation results, but also other inputs like revenues or COGS can change the estimated enterprise or equity value significantly. Due to that, this valuation is not supposed to give any investment advice but should present an individual valuation of Linde.

## Appendices

### Appendix 1: The Fama French Three Factor Model

#### Formula

$$r = r_f + \beta_3 * (k_m - r_f) + b_s * SMB + b_v * HML + \alpha$$

#### Explanation

$r$  = return of stock or portfolio;  $r_f$  = risk-free return;  $k_m$  = market return;  $\beta$  = stock or portfolio development in comparison to the market; SML = “small minus big”; HML = “high minus low”;  $b_s$  and  $b_v$  are calculated through a linear regression and  $\alpha$  represents the error variable

SML: Return of small stocks in comparison with big stocks (where size = market capitalization)

HML: Return of value stocks in comparison with growth stocks, where value stock = high book to market ratios and growth stock = low book to market ratios

Source: French

## Appendix 2: The Arbitrage Pricing Theory

### Formula

$$E(\tilde{r}_i) = \lambda_0 + \lambda_1 b_{i,1} + \dots + \lambda_K b_{i,K}$$

### Explanation

$E(\tilde{r}_i)$  = Expected portfolio return

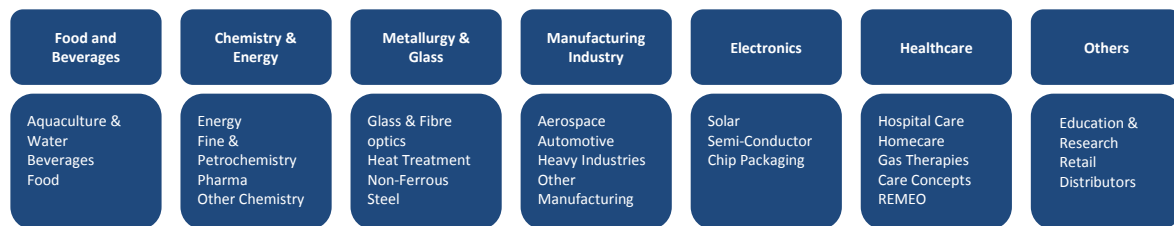
$\lambda$  = Factor risk premium, additional return for extra risk in portfolio

$b$  = Factor loading (risk)

If  $b = 0$ , then  $\lambda_0 = r_f$  as the return of risk-free portfolios must equal the risk-free rate

Source: Kellogg School of Management

## Appendix 3: Linde Customer Overview



Source: The Linde Group, Annual report, 2012

## Appendix 4: Net Cash Position

in € million	2008	2009	2010	2011	2012
Cash and Cash Equivalents	1,002	831	1,159	1,000	1,218
Short-Term Financial Debt	1,290	381	459	1,277	1,262
Net Cash	-288	450	700	-277	-44

Source: The Linde Group, Annual reports, 2008 - 2012

## Appendix 5: Traded Bonds Overview

ISIN	Issued	Maturity	Calc. Date	Maturity	Iss. Price	Kupon	Par	YTM
XS0297699588	04.2007	04.2017	02.2014	3.16	0.9875	4.75%	1	5.2%
XS0297700006	04.2007	04.2023	02.2014	9.07	0.9872	5.88%	1	6.1%
XS0403540189	12.2008	12.2015	02.2014	1.80	0.9953	6.75%	1	7.0%
XS0465484938	11.2009	11.2014	02.2014	0.74	0.9974	3.63%	1	4.0%
XS0632659933	06.2011	06.2021	02.2014	7.20	0.9916	3.88%	1	4.0%
XS0718526790	12.2011	12.2018	02.2014	4.77	0.9915	3.13%	1	3.3%
XS0790015548	06.2012	06.2019	02.2014	5.26	0.9964	1.75%	1	1.8%
XS0828235225	09.2012	09.2020	02.2014	6.51	0.9928	1.75%	1	1.9%
XS0835302513	09.2012	09.2017	02.2014	3.58	0.9962	2.75%	1	2.9%
<b>Average</b>								<b>4.02%</b>

Source: Bloomberg, own calculations

## Appendix 6: Market Value of Debt Calculation Formula

$$MV \text{ of Debt} = \text{Interest expense} * \left( \frac{1 - \left( \frac{1}{(1 + CoD)^T} \right)}{CoD} \right) + \frac{BV \text{ of Debt}}{(1 + CoD)^T}$$

With interest expense = interest expense according to income statement; CoD = Cost of Debt as calculated for WACC and T = average maturity of debt

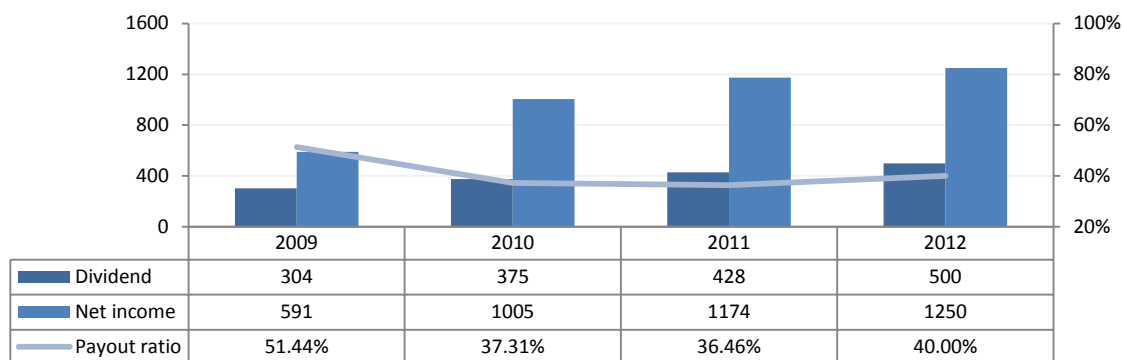
Source: Damodaran, Debt and Value: Beyond Miller-Modigliani

## Appendix 7: Morgan Stanley Valuation Overview

Model	Pricing	Range	Stock
Discounted Cashflow	€153 Growth: 2.5% WACC: 7.3%	€200 Bull case €190 Base case <b>€155</b> 04 June Share price €145.35 Bear case €118 €100	HOLD
Residual Income	€153 Growth: 2.5% WACC: 7.3%		
Dividend Discount	€154 CoE: 8.4%		
Multiples	€159		

Source: Mackey, Walsh, & Stiefel, 2013

## Appendix 8: Linde Dividend Payout Ratio 2008 – 2012



Source: The Linde Group, Annual reports, 2008 - 2012

## Appendix 9: GDP by Countries and Reportable Segments (2010 – 2018)

Americas	2010	2011	2012	2013	2014	2015	2016	2017	2018
Argentina	422	460	468	485	498	512	526	540	555
Brazil	1,112	1,142	1,152	1,181	1,211	1,249	1,291	1,336	1,382
Canada	1,593	1,634	1,662	1,688	1,725	1,767	1,810	1,854	1,894
Chile	98,171	103,837	109,670	114,499	119,648	125,032	130,658	136,538	142,682
Ecuador	56	61	64	66	69	72	75	78	81
Iceland	848	873	887	904	923	943	964	985	1,008
Mexico	12,274	12,764	13,223	13,384	13,786	14,268	14,801	15,356	15,933
Peru	210	224	239	251	266	281	298	315	333
United States	14,779	15,052	15,471	15,712	16,119	16,659	17,238	17,818	18,364
Uruguay	563	600	623	645	666	687	710	736	765
Venezuela	56	58	61	62	63	64	66	68	69
<b>Total</b>	<b>130,084</b>	<b>136,704</b>	<b>143,520</b>	<b>148,879</b>	<b>154,973</b>	<b>161,534</b>	<b>168,436</b>	<b>175,623</b>	<b>183,066</b>
<b>Growth</b>	<b>5.2%</b>	<b>5.1%</b>	<b>5.0%</b>	<b>3.7%</b>	<b>4.1%</b>	<b>4.2%</b>	<b>4.3%</b>	<b>4.3%</b>	<b>4.2%</b>

Source: International Monetary Fund, 2013

EMEA	2010	2011	2012	2013	2014	2015	2016	2017	2018
Algeria	5,973	6,127	6,329	6,523	6,762	7,015	7,270	7,543	7,829
Angola	1,339	1,392	1,464	1,546	1,643	1,748	1,861	1,928	2,057
Austria	262	269	272	273	277	282	287	291	295
Belgium	356	363	362	362	366	371	376	382	388
Bosnia and Herz.	20	20	20	20	21	21	22	23	24
Botswana	67	71	74	76	80	83	86	90	94
Bulgaria	52	53	53	54	54	56	57	59	61
Republic of Congo	1,382	1,429	1,484	1,570	1,646	1,773	1,903	2,094	2,193
Croatia	273	273	267	266	270	275	282	289	296
Cyprus	15	15	15	14	13	13	13	14	14
Czech Republic	3,557	3,622	3,577	3,564	3,616	3,692	3,773	3,864	3,957
Denmark	1,543	1,560	1,554	1,555	1,575	1,599	1,623	1,648	1,673
Estonia	11	12	13	13	13	14	14	15	15
Finland	157	161	160	159	161	163	166	169	173
France	1,773	1,809	1,809	1,812	1,830	1,857	1,889	1,923	1,960
Germany	2,371	2,451	2,473	2,485	2,520	2,555	2,589	2,621	2,653
Greece	194	180	168	161	162	167	173	179	185
Hungary	21,825	22,185	21,801	21,837	22,112	22,453	22,829	23,199	23,572
Ireland	159	163	163	164	167	171	175	180	184
Italy	1,418	1,424	1,390	1,365	1,375	1,390	1,409	1,429	1,446
Kazakhstan	968	1,041	1,094	1,149	1,209	1,282	1,357	1,430	1,508
Kenya	1,451	1,514	1,583	1,676	1,781	1,893	2,019	2,137	2,266
Latvia	7	7	7	8	8	8	9	9	10
Lesotho	10	11	12	12	13	13	14	15	15
Lithuania	76	81	84	87	89	93	96	99	103
Malawi	642	670	683	717	761	810	863	919	979
Mozambique	142	153	164	175	190	206	223	241	260
Namibia	42	45	47	49	51	53	55	58	60
Netherlands	549	554	548	541	542	551	561	573	585
Nigeria	11,057	11,871	12,652	13,441	14,431	15,422	16,477	17,612	18,768
Norway	2,543	2,576	2,654	2,696	2,757	2,820	2,882	2,946	3,012
Pakistan	8,801	9,124	9,522	9,863	10,113	10,467	10,855	11,345	11,913
Poland	1,238	1,294	1,318	1,336	1,367	1,403	1,446	1,495	1,546
Portugal	163	161	156	153	154	156	159	162	165
Romania	329	336	338	345	352	361	372	384	398
Saudi Arabia	1,067	1,159	1,218	1,261	1,317	1,373	1,431	1,493	1,556
Serbia	1,859	1,888	1,855	1,892	1,929	1,972	2,021	2,076	2,139
Seychelles	6	7	7	7	7	8	8	8	9
Slovak Republic	62	64	65	66	67	69	72	74	77
Slovenia	24	24	24	23	23	23	23	24	25
South Africa	1,842	1,906	1,954	1,993	2,052	2,119	2,191	2,268	2,347
Spain	1,044	1,045	1,027	1,014	1,016	1,021	1,028	1,038	1,050
Sweden	3,415	3,515	3,549	3,579	3,662	3,746	3,832	3,922	4,015
Switzerland	532	542	548	557	567	578	589	600	612
Tunisia	52	51	53	55	57	59	62	65	68
Turkey	106	115	118	122	126	132	138	144	150
Ukraine	653	687	688	691	701	712	723	737	751
United Arab Emirates	946	983	1,026	1,067	1,109	1,151	1,191	1,232	1,275
United Kingdom	1,486	1,502	1,505	1,526	1,555	1,586	1,617	1,650	1,689
<b>Total</b>	<b>83,862</b>	<b>86,503</b>	<b>87,944</b>	<b>89,919</b>	<b>92,667</b>	<b>95,783</b>	<b>99,115</b>	<b>102,696</b>	<b>106,418</b>
<b>Growth</b>	<b>3.3%</b>	<b>3.1%</b>	<b>1.7%</b>	<b>2.2%</b>	<b>3.1%</b>	<b>3.4%</b>	<b>3.5%</b>	<b>3.6%</b>	<b>3.6%</b>

Source: International Monetary Fund, 2013

Asia/Pacific	2010	2011	2012	2013	2014	2015	2016	2017	2018
Australia	1,390	1,423	1,475	1,512	1,554	1,600	1,647	1,697	1,747
Bangladesh	5,317	5,660	6,007	6,353	6,735	7,173	7,658	8,194	8,767
China	14,141	15,456	16,647	17,912	19,211	20,562	22,004	23,538	25,176
Hong Kong SAR	1,847	1,936	1,965	2,024	2,112	2,205	2,304	2,408	2,517
India	52,961	56,314	58,137	60,343	63,449	67,430	71,789	76,565	81,710
Malaysia	677	711	751	787	825	868	913	961	1,011
Mauritius	180	187	193	200	209	218	228	239	249
New Zealand	140	142	146	150	154	158	162	166	170
Papua New Guinea	12	13	14	15	15	19	19	20	21
Philippines	5,702	5,909	6,312	6,741	7,148	7,541	7,956	8,393	8,855
Russia	39,770	41,480	42,890	43,525	44,832	46,401	48,025	49,706	51,446
Singapore	286	301	305	316	327	339	351	365	379
Solomon Islands	4	4	4	5	5	5	5	5	5
Sri Lanka	2,646	2,864	3,046	3,237	3,455	3,680	3,919	4,174	4,445
Swaziland	13	13	13	13	13	13	13	13	13
Taiwan Province of China	14,215	14,793	14,989	15,317	15,894	16,519	17,206	17,960	18,801
Tanzania	16,829	17,914	19,156	20,492	21,966	23,514	25,132	26,822	28,599
Thailand	4,596	4,600	4,898	5,050	5,316	5,582	5,828	6,101	6,386
Zambia	17	19	20	21	23	24	25	27	28
Zimbabwe	7	7	8	8	8	9	9	9	10
Total	160,748	169,747	176,977	184,020	193,251	203,858	215,195	227,361	240,337
Growth	8.1%	5.6%	4.3%	4.0%	5.0%	5.5%	5.6%	5.7%	5.7%

Source: International Monetary Fund, 2013

## Appendix 10: Industrial Production Forecast Regression Analysis by Regions

Statistics	2010	2011	2012	2013	2014	2015	2016	2017	2018	
<b>Americas</b>	GDP	5.2%	5.1%	5.0%	3.7%	4.1%	4.2%	4.3%	4.3%	4.2%
	IP	5.6%	3.9%	3.2%	4.930%	5.090%	5.152%	5.169%	5.166%	5.154%
RSQ	0.9793									
Alpha	0.0328									
Beta	0.4432									

Sources: International Monetary Fund, 2013; The Linde Group, Annual reports, 2008 - 2012

Statistics	2010	2011	2012	2013	2014	2015	2016	2017	2018	
<b>EMEA</b>	GDP	3.3%	3.1%	1.7%	2.2%	3.1%	3.4%	3.5%	3.6%	3.6%
	IP	6.1%	2.8%	1.3%	2.575%	2.820%	2.912%	2.947%	2.988%	2.991%
RSQ	0.9041									
Alpha	0.0190									
Beta	0.3017									

Sources: International Monetary Fund, 2013; The Linde Group, Annual reports, 2008 – 2012

Statistics		2010	2011	2012	2013	2014	2015	2016	2017	2018
Asia/Pacific	GDP	8.1%	5.6%	4.3%	4.0%	5.0%	5.5%	5.6%	5.7%	5.7%
	IP	13.5%	8.0%	5.9%	2.678%	3.316%	3.607%	3.652%	3.709%	3.742%
RSQ	0.9217									
Alpha	0.0023									
Beta	0.6158									

Sources: International Monetary Fund, 2013; The Linde Group, Annual reports, 2008 - 2012

## Appendix 11: Long-Term Global GDP Forecast

in € million	2015	2020	2025	2030	2035	2040	Delta (%)
<b>OECD</b>							
<b>OECD Americas</b>	<b>17,353</b>	<b>19,963</b>	<b>22,555</b>	<b>25,441</b>	<b>28,803</b>	<b>32,722</b>	<b>2.6</b>
United States <sup>a</sup>	14,679	16,859	18,985	21,355	24,095	27,277	2.5
Canada	1,351	1,521	1,686	1,853	2,057	2,289	2.2
Mexico/Chile	1,322	1,583	1,884	2,233	2,651	3,156	3.7
<b>OECD Europe</b>	<b>16,655</b>	<b>18,441</b>	<b>20,319</b>	<b>22,073</b>	<b>23,992</b>	<b>26,147</b>	<b>1.7</b>
<b>OECD Asia</b>	<b>7,286</b>	<b>7,927</b>	<b>8,537</b>	<b>9,039</b>	<b>9,565</b>	<b>10,072</b>	<b>1.4</b>
Japan	4,960	5,206	5,422	5,515	5,579	5,549	0.6
South Korea	1,231	1,503	1,768	2,035	2,330	2,671	3.3
Australia	1,095	1,219	1,347	1,489	1,656	1,852	2.2
<b>Total OECD</b>	<b>41,294</b>	<b>46,332</b>	<b>51,411</b>	<b>56,553</b>	<b>62,360</b>	<b>68,941</b>	<b>2.0</b>
<b>Non-OECD</b>							
<b>EU/Euras.</b>	<b>1,866</b>	<b>2,305</b>	<b>2,732</b>	<b>3,139</b>	<b>3,558</b>	<b>3,919</b>	<b>3.1</b>
Russia	1,092	1,331	1,560	1,756	1,948	2,074	2.8
Other	773	973	1,172	1,383	1,610	1,846	3.5
<b>Asia</b>	<b>10,178</b>	<b>13,744</b>	<b>18,011</b>	<b>23,192</b>	<b>29,045</b>	<b>35,116</b>	<b>5.4</b>
China	5,746	7,921	10,559	13,753	17,167	20,279	5.7
India	1,696	2,415	3,283	4,355	5,657	7,212	6.1
Other	2,736	3,409	4,169	5,083	6,222	7,625	4.3
<b>Middle East</b>	<b>1,589</b>	<b>1,954</b>	<b>2,360</b>	<b>2,802</b>	<b>3,269</b>	<b>3,742</b>	<b>3.7</b>
<b>Africa</b>	<b>2,108</b>	<b>2,652</b>	<b>3,298</b>	<b>4,119</b>	<b>5,147</b>	<b>6,431</b>	<b>4.5</b>
<b>Central and South America</b>							
<b>America</b>	<b>2,776</b>	<b>3,337</b>	<b>3,877</b>	<b>4,463</b>	<b>5,136</b>	<b>5,918</b>	<b>3.2</b>
Brazil	1,315	1,590	1,846	2,146	2,515	2,963	3.4
Other	1,461	1,746	2,031	2,317	2,621	2,955	3.0
<b>Total</b>	<b>18,517</b>	<b>23,992</b>	<b>30,277</b>	<b>37,714</b>	<b>46,156</b>	<b>55,126</b>	<b>4.7</b>
<b>Total World</b>	<b>59,810</b>	<b>70,323</b>	<b>81,688</b>	<b>94,268</b>	<b>108,515</b>	<b>124,066</b>	<b>3.0</b>

Source: U.S. Energy Information Administration, 2013

## Appendix 12: Equity Risk Premium by Countries

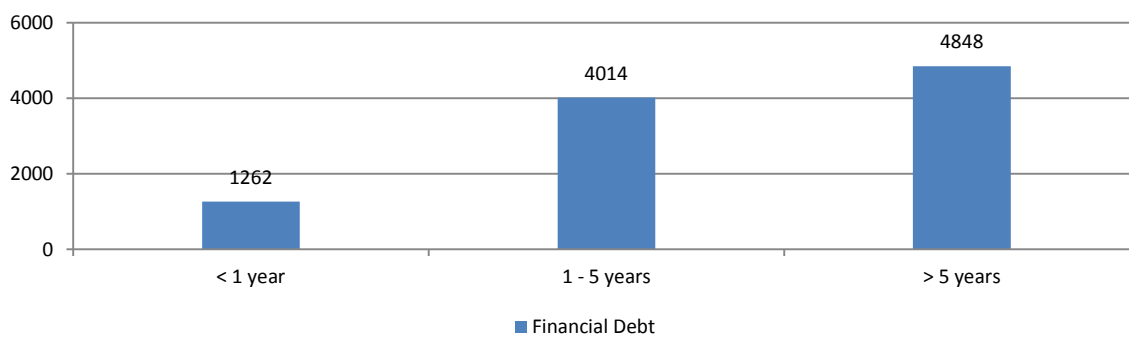
Americas	ERP	EMEA	ERP	Asia/Pacific	ERP
Argentina	15.7%	Angola	11.3%	Australia	5.9%
Brazil	8.8%	Austria	5.9%	Bangladesh	11.3%
Canada	5.9%	Belarus	15.7%	China	6.8%
Chile	6.8%	Belgium	6.8%	Hong Kong	6.5%
Colombia	9.2%	Bosnia and Herzegovina	15.7%	India	9.2%
Ecuador	17.2%	Botswana	7.2%	Indonesia	9.2%
Iceland	9.2%	Bulgaria	8.8%	Malaysia	7.7%
Mexico	8.3%	Republic of the Congo	11.3%	Mauritius	8.3%
Peru	8.8%	Croatia	9.7%	New Zealand	5.9%
United States of America	5.9%	Cyprus	20.9%	Papua New Guinea	12.7%
Uruguay	9.2%	Czech Republic	7.0%	Philippines	9.2%
Venezuela	17.2%	Denmark	5.9%	Russia	8.3%
<b>Average</b>	<b>10.2%</b>	Estonia	7.0%	Singapore	5.9%
		Finland	5.9%	Sri Lanka	12.7%
		France	6.5%	Taiwan	6.8%
		Germany	5.9%	Thailand	8.3%
		Greece	20.9%	Vietnam	14.2%
		Hungary	9.7%	Zambia	12.7%
		Ireland	9.7%	<b>Average</b>	<b>9.0%</b>
		Italy	8.8%		
		Kazakhstan	8.8%		
		Kenya	12.7%		
		Latvia	8.8%		
		Lithuania	8.3%		
		Mozambique	12.7%		
		Namibia	9.2%		
		Netherlands	5.9%		
		Nigeria	11.3%		
		Norway	5.9%		
		Pakistan	17.2%		
		Poland	7.2%		
		Portugal	11.3%		
		Romania	9.2%		
		Saudi Arabia	6.8%		
		Serbia	12.7%		
		Slovakia	7.2%		
		Slovenia	9.7%		
		South Africa	8.3%		
		Spain	9.2%		
		Sweden	5.9%		
		Switzerland	5.9%		
		Tunisia	11.3%		
		Turkey	9.2%		
		Ukraine	17.2%		
		United Arab Emirates	6.7%		
		United Kingdom	6.5%		
		<b>Average</b>	<b>9.7%</b>		

Source: Damodaran, Country Default Spreads and Risk Premiums

Region	Sales 2012	Weight	Equity risk premium
Americas	3,669	24.05%	2.44%
EMEA	7,226	47.36%	4.58%
Asia/Pacific	4,362	28.59%	2.56%
<b>Total</b>	<b>15,257</b>	<b>100%</b>	<b>9.59%</b>

Source: Own calculations

### Appendix 13: Financial Debt Maturity Profile



Source: The Linde Group, Annual report, 2012

## Appendix 14: Non-Abbreviated Income Statement

in € millions	2013E	2014F	2015F	2016F	2017F	2018F
Revenue	17,161.8	18,536.3	19,840.5	21,158.0	22,425.3	23,739.2
Gases	14,379.4	15,515.3	16,602.5	17,700.8	18,751.5	19,841.6
Thereof Lincare	1,523.0	1,551.5	1,634.1	1,718.1	1,764.8	1,817.4
Engineering	2,615.0	2,840.2	3,044.6	3,250.9	3,455.1	3,666.1
Other	668.5	722.0	772.8	824.1	873.5	924.7
Reconsiliation	(501.1)	(541.2)	(579.3)	(617.8)	(654.8)	(693.1)
Cost Of Goods Sold	10,897.7	11,677.8	12,499.5	13,329.5	14,127.9	14,955.7
<b>Gross Profit</b>	<b>6,264.0</b>	<b>6,858.4</b>	<b>7,341.0</b>	<b>7,828.5</b>	<b>8,297.3</b>	<b>8,783.5</b>
Selling General & Admin Exp.	4,118.8	4,448.7	4,761.7	5,077.9	5,382.1	5,697.4
R & D Exp.	113.4	122.5	131.1	139.9	148.2	156.9
Other Operating Income	323.5	349.4	374.0	398.8	422.7	447.4
Other Operating Expenses	224.1	242.0	259.0	276.2	292.8	309.9
<b>Operating Income</b>	<b>2,355.3</b>	<b>2,636.6</b>	<b>2,822.1</b>	<b>3,009.5</b>	<b>3,189.7</b>	<b>3,376.6</b>
Non Operating Inc./Exp.	95.1	103.6	112.4	120.7	126.2	134.1
Depreciation & Amortisation	1,788.7	1,950.5	2,068.8	2,181.0	2,294.3	2,403.3
<i>thereof depreciation</i>	1,314.4	1,476.3	1,594.5	1,706.7	1,820.0	1,929.0
<i>therof amortization</i>	474.3	474.3	474.3	474.3	474.3	474.3
<b>EBITDA</b>	<b>4,239.0</b>	<b>4,690.7</b>	<b>5,003.3</b>	<b>5,311.1</b>	<b>5,610.2</b>	<b>5,914.0</b>
<b>EBIT</b>	<b>2,450.4</b>	<b>2,740.2</b>	<b>2,934.5</b>	<b>3,130.2</b>	<b>3,315.9</b>	<b>3,510.7</b>
Interest and Invest. Income	271.5	273.2	299.0	315.8	329.5	339.3
Interest Expense	778.8	824.2	848.3	873.4	899.4	925.7
<b>Net Interest Inc.</b>	<b>(507.2)</b>	<b>(551.0)</b>	<b>(549.3)</b>	<b>(557.5)</b>	<b>(569.9)</b>	<b>(586.3)</b>
<b>EBT</b>	<b>1,943.1</b>	<b>2,189.1</b>	<b>2,385.2</b>	<b>2,572.6</b>	<b>2,746.0</b>	<b>2,924.4</b>
Income Tax Expense	441.3	497.2	541.8	584.3	623.7	664.2
<b>Net Income to Company</b>	<b>1,501.8</b>	<b>1,691.9</b>	<b>1,843.5</b>	<b>1,988.3</b>	<b>2,122.3</b>	<b>2,260.2</b>
Minority Int. in Earnings	83.9	94.5	103.0	111.1	118.6	126.3
<b>Net Income attrib. to sh</b>	<b>1,417.9</b>	<b>1,597.4</b>	<b>1,740.5</b>	<b>1,877.2</b>	<b>2,003.7</b>	<b>2,133.9</b>
<b>Dividends</b>	<b>589.8</b>	<b>691.1</b>	<b>783.1</b>	<b>878.4</b>	<b>975.1</b>	<b>1,080.0</b>

Source: Own estimations

## Appendix 15: Non-Abbreviated Balance Sheet

in € millions	2013E	2014F	2015F	2016F	2017F	2018F
<b>ASSETS</b>						
Cash and Equivalents	1,422	1,523	1,722	1,980	2,298	2,643
Short Term Investments	828	906	957	999	1,029	1,054
<b>Total Cash &amp; ST Investments</b>	<b>2,250</b>	<b>2,429</b>	<b>2,680</b>	<b>2,979</b>	<b>3,327</b>	<b>3,697</b>
Trade Receivables	2,919	3,153	3,375	3,599	3,814	4,038
Other Receivables	919	993	1,062	1,133	1,201	1,271
Receivables f. Finance Leases	73	79	85	91	96	102
Income Tax Receivables	154	166	177	189	201	212
Other Receiv./Assets	692	747	800	853	904	957
<b>Total Receivables</b>	<b>3,838</b>	<b>4,145</b>	<b>4,437</b>	<b>4,732</b>	<b>5,015</b>	<b>5,309</b>
Inventory	1,294	1,355	1,455	1,545	1,650	1,739
<b>Total Current Assets</b>	<b>7,383</b>	<b>7,930</b>	<b>8,572</b>	<b>9,256</b>	<b>9,992</b>	<b>10,745</b>
Gross PP&E	27,893	30,286	32,750	35,335	38,000	40,805
Accumulated Depreciation	16,450	17,927	19,521	21,228	23,048	24,977
<b>Net PP&amp;E</b>	<b>11,443</b>	<b>12,359</b>	<b>13,229</b>	<b>14,107</b>	<b>14,952</b>	<b>15,828</b>
Long-term Investments	816	816	816	816	816	816
Goodwill	10,620	10,620	10,620	10,620	10,620	10,620
Accumulated Deferred Tax	592	730	881	1,043	1,217	1,402
Other Intangible Assets	3,580	3,580	3,580	3,580	3,580	3,580
Other Long-Term Assets	1,122	1,122	1,122	1,122	1,122	1,122
<b>Total Non-Current Assets</b>	<b>28,172</b>	<b>29,227</b>	<b>30,248</b>	<b>31,289</b>	<b>32,307</b>	<b>33,368</b>
<b>Total Assets</b>	<b>35,555</b>	<b>37,157</b>	<b>38,819</b>	<b>40,544</b>	<b>42,299</b>	<b>44,113</b>
<b>LIABILITIES</b>						
Trade Payables	3,240	3,472	3,716	3,963	4,200	4,446
Short Term Financial Debt	1,262	1,262	1,262	1,262	1,262	1,262
Current Provisions	1,863	1,863	1,863	1,863	1,863	1,863
Other Current Liabilities	1,194	1,194	1,194	1,194	1,194	1,194
<b>Total Current Liabilities</b>	<b>7,559</b>	<b>7,791</b>	<b>8,035</b>	<b>8,282</b>	<b>8,519</b>	<b>8,766</b>
Long Term Financial Debt	8,862	8,862	8,862	8,862	8,862	8,862
Newly Debt Issued						
Non-Current Provisions	1,773	1,915	2,050	2,186	2,317	2,453
Deferred Tax Liabilities	2,398	2,636	2,896	3,176	3,475	3,793
Other Non-Current Liabilities	384	384	384	384	384	384
<b>Total Non - Current Liabilities</b>	<b>13,417</b>	<b>13,797</b>	<b>14,192</b>	<b>14,608</b>	<b>15,038</b>	<b>15,492</b>
<b>Total Liabilities</b>	<b>20,976</b>	<b>21,588</b>	<b>22,227</b>	<b>22,890</b>	<b>23,557</b>	<b>24,258</b>
Common Stock	474	474	474	474	474	474
Retained Earnings	7,248	8,154	9,112	10,110	11,139	12,193

Comprehensive Inc. and Other	6,200	6,200	6,200	6,200	6,200	6,200
<b>Total Common Equity</b>	<b>13,922</b>	<b>14,828</b>	<b>15,786</b>	<b>16,784</b>	<b>17,813</b>	<b>18,867</b>
Minority Interest	657	740	807	870	928	989
<b>Total Equity</b>	<b>14,579</b>	<b>15,569</b>	<b>16,592</b>	<b>17,654</b>	<b>18,742</b>	<b>19,856</b>
<b>Total Liabilities And Equity</b>	<b>35,555</b>	<b>37,157</b>	<b>38,819</b>	<b>40,544</b>	<b>42,299</b>	<b>44,113</b>

Source: Own estimations

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