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Abstract (ENG)

In financial media as well as in academic circles renewable energy companies are oftentimes associated with overvaluation. For example, certain empirical studies indicate an existence of a speculative “green” bubble in the German stock market. In order to test this presumption, an intrinsic value of Nel Hydrogen – a Norwegian company operating in the green hydrogen industry – is derived in a form of a case study research method by applying both DCF and relative valuation methods. The outcome indicates that at the moment of valuation, the company has an upside potential of 7.87%, which indicates that the company may be considered undervalued. It is based on the primary value drivers of the renewable energy industry (technology efficiency, energy costs, governmental support), as well as on the leading position of Nel Hydrogen to utilize the high growth prospects of the industry.

Abstract (DE)

Sowohl in den Finanzmedien als auch in akademischen Kreisen werden Unternehmen aus dem Bereich der erneuerbaren Energien häufig mit einer Überbewertung in Verbindung gebracht. So deuten einige empirische Studien auf die Existenz einer spekulativen "grünen" Blase am deutschen Aktienmarkt hin. Um diese Vermutung zu überprüfen, wird ein innerer Wert von Nel Hydrogen - einem norwegischen Unternehmen, das in der grünen Wasserstoffindustrie tätig ist - in Form einer Fallstudienforschungsmethode abgeleitet, indem sowohl DCF- als auch relative Bewertungsmethoden angewendet werden. Das Ergebnis zeigt, dass das Unternehmen zum Zeitpunkt der Bewertung ein Wertsteigerungspotenzial von 7.87% hat, was darauf hindeutet, dass das Unternehmen als unterbewertet angesehen werden kann. Es basiert auf den primären Werttreibern der Branche der erneuerbaren Energien (technologische Effizienz, Energiekosten, staatliche Unterstützung) sowie auf der führenden Position von Nel Hydrogen, die dem Unternehmen erlaubt die hohen Wachstumsaussichten der Branche zu nutzen.

Contents

List of Figures

List of Tables

Nomenclature

CAGR – compounded average growth rate

CAPEX – capital expenditures

CF – cash flow

COGS – cost of goods sold

DCF – discounted cash flow

EBIT – earnings before interest and tax

EV – electric vehicle / enterprise value

FCF – free cash flow

HFCV – hydrogen fuel cell vehicle

IRR – internal rate of return

LCOE – levelized cost of energy

LTM – last twelve months

NOK – Norwegian krone

NPV – net present value

NTW – next twelve months

NWC – net working capital

P/B – price/book

P/E – price/earnings

P/TB – price/tangible book

PV – Present Value

R&D – research & development

ROA – real option analysis

SG&A – selling, general & administrative (expenses)

TV – terminal value

WACC – weighted average cost of capital

1 Introduction

When discussing renewable energy companies, financial media often mention overvaluation, as the investors are actively "pouring cash into anything that looks green" (Nauman, 2021). In the academic circle, Damodaran (2020) finds it difficult to find any evidence that ESG leads to high operating performance, or if it can generate positive excess returns. Additionally, empirical research of German renewable energy stocks has concluded that the upbeat sentiment has caused a speculative bubble (Bohl et al, 2013).

As a result, the motivation of this thesis is to test these statements by finding an intrinsic value of a company that operates in the renewable energy industry. For this purpose, a Norwegian company that operates in the green hydrogen sector was chosen that is called Nel Hydrogen (also referred to as Nel ASA). It can be described as an ideal candidate for this thesis as it not only operates in the relatively new sector of the renewables industry, but also it is very vocal about the topics of sustainability, reducing carbon emissions, etc. in its press releases. The goal of this thesis is to derive the intrinsic value of Nel Hydrogen by using the discounted cash flows (DCF) method together with the relative valuation and to determine how this value compares with its current share price as of September 30, 2022.

The thesis starts with a methodology outline where the research design, research questions, and limitations are presented. Afterwards, it is followed by a literature review which consists of two parts: a brief introduction of valuation methods, and a comprehensive analysis of the renewables industry with a particular focus on the hydrogen segment. It is done in order to define the growth prospects and the value drivers that will be consecutively used in the valuation process. Prior to the valuation, the company is analysed in great detail with the focus on its business activity and historical financial performance. When the assumptions that would steer the valuation together with a peer group are defined, the DCF and multiples methods are used. In the DCF method, the line items that comprise the free cash flows (FCFs) are projected and backed up by certain assumptions based on the company's historical growth rate and press releases. It is followed by the valuation summary, where all of the derived values are presented on the "football field" chart that allows to have a concise overview of the potential values a share price of a company may take. Finally, the key findings of the thesis are summarized in the Conclusion chapter.

2 Methodology

The case study research method is selected for this thesis, because it is suitable for detailed and multi-faceted studies in a real-life environment (Crowe et al, 2011). According to Yin (1984), there are three types of case study research that include exploratory, descriptive, and explanatory. This thesis can be categorized predominantly as an exploratory one combined with the aspects of descriptive and explanatory. As an exploratory type, it explores the phenomenon of renewable energy stocks valuation, and is meant to set a foundation for further examination. As a descriptive type, it involves a discussion of a real-world situation connected with academic theories and concepts. Finally, as an explanatory type, it aims to explain the reasons for a given valuation of the company.

For the theoretical parts, the research is based on peer-reviewed articles and finance textbooks on valuation. For conducting the case study, the data is derived from the press releases, annual and quarterly reports of the company, and is supported by the financial data from S&P Capital IQ.

As the ultimate goal of this thesis is to derive an intrinsic value of the green energy company Nel Hydrogen, the following main and sub-research questions are developed.

Main research question:
What is the intrinsic value of Nel Hydrogen?

Sub-research questions:
What are the value drivers and the growth prospects of the renewables industry?
What are the peculiarities of valuing a renewable energy company?
What is the business model of Nel Hydrogen?
How the financial state of Nel Hydrogen can be described based on its historical performance?

This thesis has certain limitations that need to be mentioned. Firstly, the whole concept of valuation is based on subjective assumptions that steer the valuation process, thus the final share price derived cannot be considered as completely objective. Additionally, it greatly varies when certain assumptions are changed by a small magnitude, as it will be discussed in the sensitivity analysis part. Secondly, the assumptions and the respective data are retrieved from public sources, particularly from the company's reports and press releases, which cannot be considered completely objective.

3 Literature Review

3.1 Valuation

Every kind of asset has value. In order to make a sound financial decision, it is not only important to determine what the value of an asset is, but also to understand the drivers that constitute this value. This chapter provides a concise summary of the nature of valuation together with a discussion of two valuation models: discounted cash flows (DCF) and the multiples method.

3.1.1 The Concept of Valuation

According to Damodaran (2012), valuation can be defined as a process of finding a value of a company in a subjective manner. Even though general models used in valuation are quantitative, the inputs for these models can be described as subjective. Therefore, there is no single right way to conduct a company valuation, because of the impact of uncertainty regarding future outcomes.

As the value is affected by company-specific information or by general market trends, it can only be determined at a certain point in time. When the new information is available with time, the value estimations are also likely to change.

The process of valuation is model-driven, where different assumptions can be incorporated. The majority of the models can be grouped into three main approaches:

- Discounted cash flow (DCF): expected future cash flows are discounted to the present value (PV) to derive the value.
- Relative valuation: the value of an asset is based on the pricing of similar ones.
- Real option analysis (ROA): this approach is used for the valuation of strategic projects and decisions that can have multiple potential future outcomes.

As the first two approaches are common to value equity of the company, they would be suitable for this case study, where an intrinsic value of Nel Hydrogen is to be derived. They will be discussed in greater detail in the following chapters.

3.1.2 Discounted Cash Flow Method

According to the DCF method, the value of an asset is the present value of the expected future cash flows that it generates (Damodaran, 2012):

$$V = \sum_{t=1}^{t=n} \frac{CF_t}{(1+r)^t}$$

where

n = life of an asset

CF_t = cash flow at period t

r = discount rate reflecting the riskiness of the estimated cashflows

In the discussion of the DCF model, Hitchner (2003) classifies the set of discounted periods into an explicit period and a terminal period. The former one refers to cashflows during a predetermined amount of years when the business is expected to grow steadily, while the latter one refers to cash flows beyond the forecasted period. The formula for the terminal value is generally based on the Gordon Growth model, which is presented below:

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

where

FCF_n = free cash flow of the n-th period

g = long-term sustainable (terminal) growth rate

WACC = weighted average cost of capital

Additionally, oftentimes the companies do not grow steadily, and it is possible to estimate different growth stages. In order to model such occurrences, a multistage growth model can be used, where several explicit periods are defined with varying growth rates (Hitchner, 2003).

3.1.3 Relative Valuation Method

The general idea of the relative valuation method is that the value of an asset can be determined from the price of comparable assets (Damodaran, 2012). The process begins with the establishment of a peer group of comparable companies based on certain criteria. The aspects that are to be considered to form a peer group include (Hitchner, 2003):

- Industry: it is assumed that the companies operating in the same industry are affected by similar economic and business drivers that are incorporated in their prices.
- Size: the companies that have comparable sales, total assets, or market capitalization. Depending on the size, companies may be, for example, exposed to certain levels of financial risk.

- Growth: this factor is expected to be incorporated in the price of the stock, though it is not trivial to accurately estimate a long-term growth of a company.

It is done by using specific financial ratios, often called multiples. The most commonly used includes Price/Earnings (P/E) ratio, Price-to-Book (P/B) value ratio, Enterprise Value (EV) to EBITDA, etc.

According to Damodaran (2012), in comparison to the DFC method, the relative valuation approach focuses more on the market value of the firm than on its intrinsic value. Therefore, the main assumption for the relative valuation is that the market may price individual stocks incorrectly, but on average (e.g., among the peer group) their stock prices are accurate.

3.2 Renewable Energy Industry

The growing world population and the advances in civilization have resulted in the demand for energy rising exponentially. Even though fossil fuels are not environmentally sustainable, they still remain the primary source of energy, where renewable energy sources accounted for only 12.6% of total energy consumed in 2020 (REN21, 2022). Moreover, due to rapid industrial growth, the usage of fossil fuels is projected to increase in the future (Olabi and Abdelkareem, 2022). Although in percentage terms the share of fossil fuel sources used is expected to gradually decrease in the coming years, in absolute terms this will increase because of overall demand growth. However, due to the ongoing energy crisis in 2022 that was triggered by Russia's invasion of Ukraine, the transition to renewable energy sources is expected to accelerate (IEA, 2022a). The following chapters will introduce the renewables industry and its growth potential, the place of hydrogen in it, and the literature on the valuation of renewable energy companies.

3.2.1 Industry Overview and Growth Prospects

The renewables industry includes companies that are working on generating energy by using natural resources such as wind, sunlight, water, biomass, and geothermal heat. These energy sources have a very low amount of or no air pollutants and greenhouse emissions (Cristobal, 2012). The graph on the following page demonstrates the development of the energy supply (in EJ = exajoule) by the primary renewable energy sources for the last 10 years, together with the values for the year 2030 if the Net Zero scenario is to be achieved.

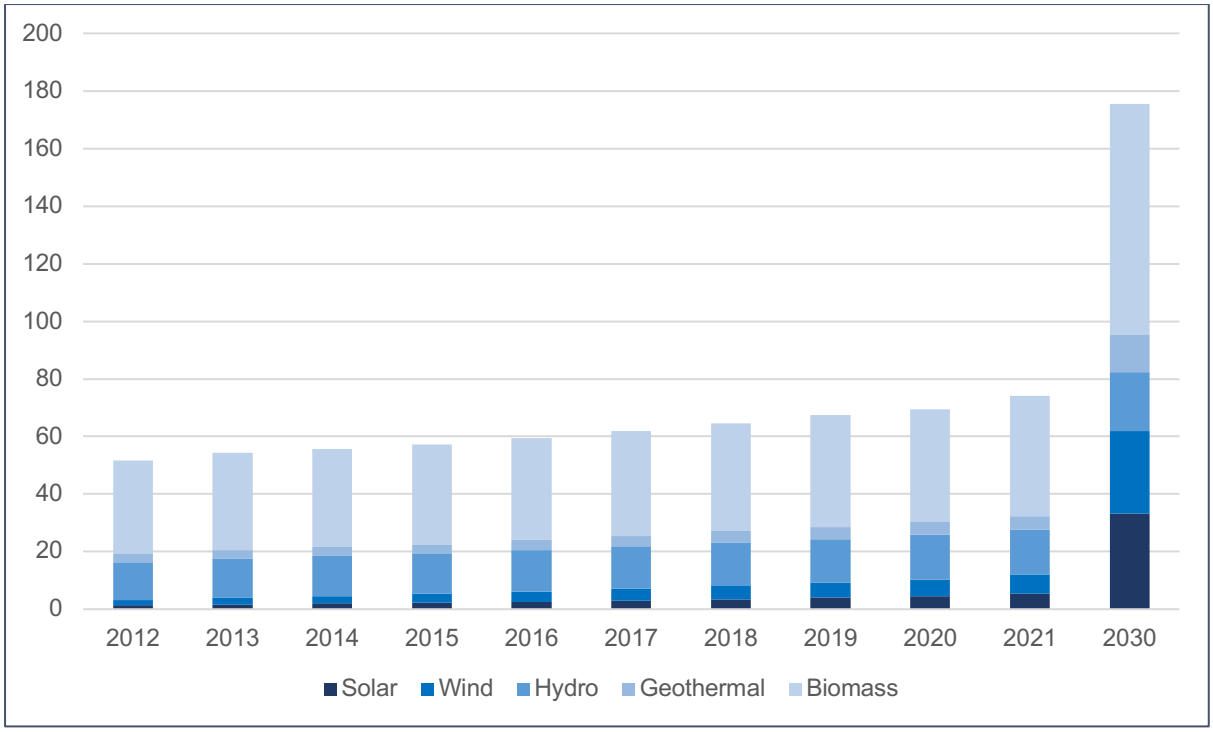

Figure 1: Energy supply of the primary renewable energy sources (IEA, 2022; author)

From this figure, we can see that the growth in 2021 was driven to a larger extent by additions in solar and wind energy supply. However, this constitutes only to one third of the average annual additions if the Net Zero scenario is achieved by 2030. In the case of wind power, the average annual growth has to double each year until 2030.

From the geographical perspective, the following figure 2 summarizes the total energy supply additions editions (in GW = gigawatt) by region during the past 3 years.

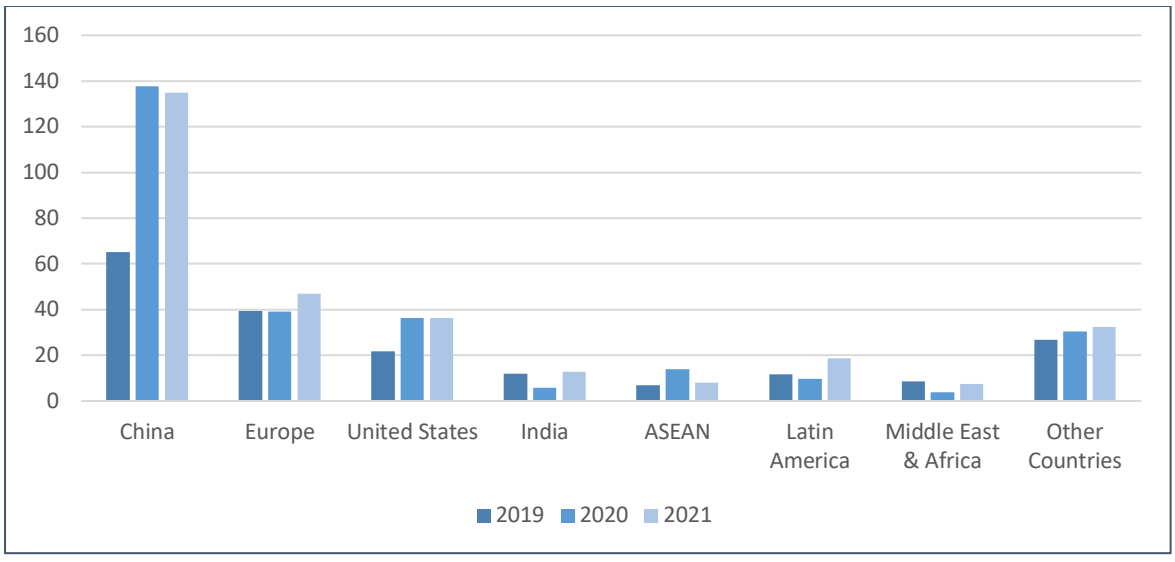

Figure 2: Energy supply additions of the renewable energy by region (IEA, 2022b; author)

It is apparent that China maintains the largest market share in supplying renewable energy accounting for 46% of global capacity additions. However, such a high renewable energy supply can be accounted to its significantly larger population that results in larger energy consumption, and not necessarily to better government policies or technological advancements. Next up is Europe, where due to the support from the European Union and local governments, solar power accounted for almost 65% of the renewable energy additions (IEA, 2022b). Additionally, because of the Russian invasion of Ukraine, the growth rate of renewable energy sources is expected to accelerate significantly due to the fast-tracking of permitting procedures and a large number of new projects announced (European Commission, 2022).

Another important metric is the cost of the production of renewable energy, which is said to be one of the key factors that enables renewable energy adoption. It is generally compared to the cost of using fossil fuels. The benchmark indicator used is levelized costs of electricity generation (LCOE) (Timilsina, 2021). Figure 3 below illustrates the development of LCOE for the three primary renewable energy sources. Additionally, this graph includes the range of a fossil fuel cost, which allows to notice that solar and onshore wind are more affordable than the cheapest fossil fuel-powered energy solutions. The researchers of the International Renewable Energy Agency (2022) claim that in 2022 the expected cost benefits of green energy sources in Europe would be dramatic due to the unprecedented increase in fossil fuel energy prices. As a result, with a rising number of projects and governmental support, the cost of renewable energy sources is expected to decrease even further.

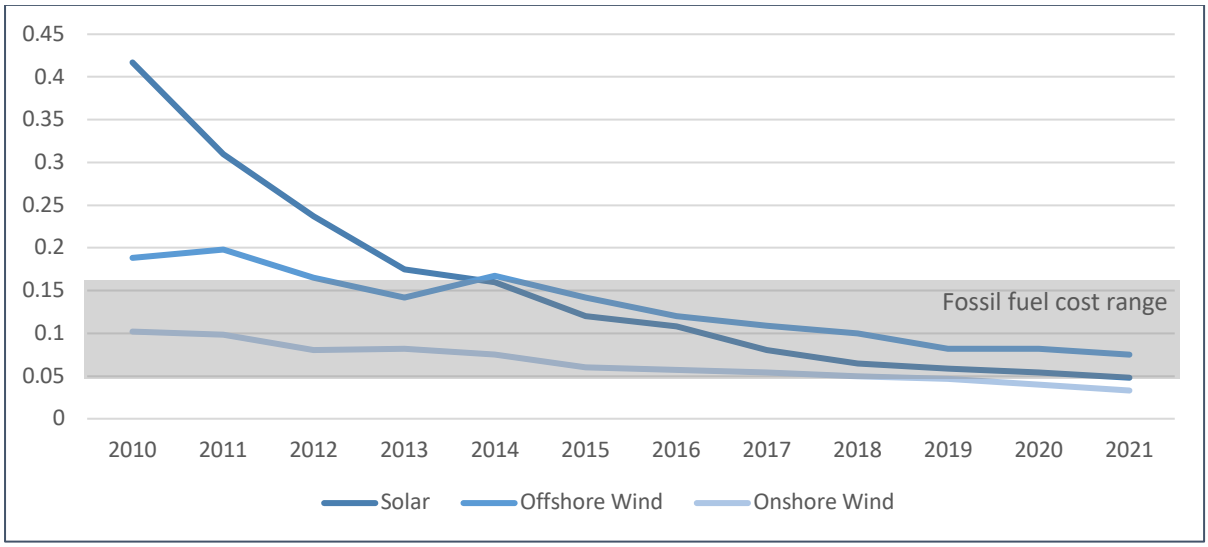

Figure 3: Development of LCOE of renewable energy sources (IRENA, 2022a; author)

3.2.2 Hydrogen Sector

Hydrogen plays a major role in the current transformation toward a green future and is expected to become its key element. The research by Ehteshami and Chan (2014) states that the biggest challenges of the establishment of the renewable energy market are the intermittency of energy supply, storage, and grid connection. This is where hydrogen becomes the most apparent solution because it is the most cost-efficient solution as an energy carrier and storage. Moreover, the technology behind hydrogen fits well in the current energy network. To sum up, hydrogen may serve as the main instrument of storage and transportation of the energy produced by green energy sources.

Hydrogen can be also used to make the transportation sector greener, which includes not only passenger cars but also heavy-duty vehicles, buses, trains, planes, etc. Although over the last decade, the topic of electric vehicles (EVs) has been given major attention, their potential in emissions reduction is different from hydrogen fuel cell vehicles (HFCVs) (Ajanovic & Haas, 2020). If EVs are expected to be the main source of the decarbonization of the automotive sector from the perspective of automobiles, HFCVs are forecasted to lead in the field of heavy-duty and freight vehicles. It stems from the main drawbacks of the current battery technology that make it not feasible to be used in larger vehicles over long distances (Moriarty & Honnery, 2019). Considering that both of the technologies have certain pros and cons, the authors of the research papers mentioned before agree that both technologies will grow in tandem expanding to different areas of the automotive sector.

To continue with the following research, it is important to mention that hydrogen can be produced either from renewable energy sources (green) or from fossil fuels (blue, grey, etc. depending on the type of fuel) (Ajanovic, Sayer & Haas, 2022). This research will now focus specifically on the green hydrogen sector, as it is the one where the analyzed company Nel Hydrogen operates.

The research by IRENA (2022b) summarized various papers that attempt to estimate the future demand (in megatons) for green hydrogen for the year 2050. The outcome of the research is presented in figure 4 on the next page.

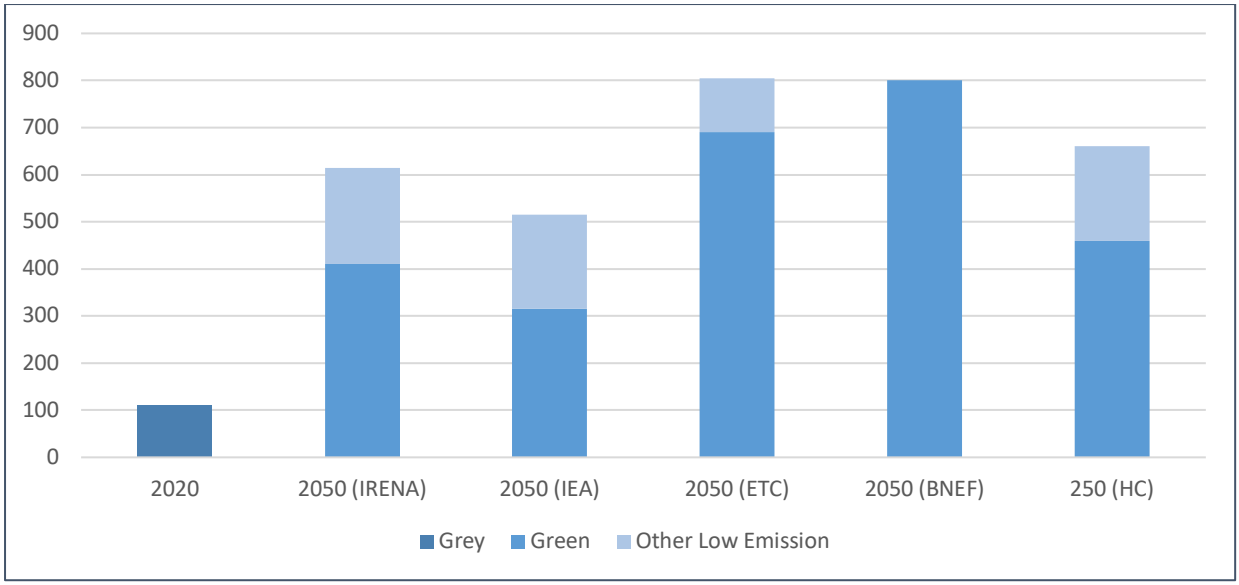

Figure 4: Hydrogen demand estimation from 2020 to 2050 (IRENA, 2022b; author)

Notably, in 2020 approximately 1% of the hydrogen supplied was considered to be green. At the same time, all of the research papers agree that the production of grey hydrogen will be completely offset by green or low-emission types by 2050. The average estimated value for the green hydrogen demand based on the given report is 535 Mt. As a result, when approximately 1.1 Mt of green hydrogen was produced in 2020, we can estimate a compound annual growth rate (CAGR) at 22.9% for the period from 2020 to 2050. It is calculated using the following formula:

$$CAGR = \left(\frac{V_{t(n)}}{V_{t(0)}}\right)^{\frac{1}{n}} - 1$$

where

$V_{t(n)}$ = value at the last period t

$V_{t(0)}$ = value at the beginning

n = number of periods

Lastly, it is important to mention two main value drivers of the hydrogen economy: production cost and government policies. As green hydrogen is generally produced via electrolysis from renewable energy sources, its cost is directly dependent on the cost of these energy sources. Another major cost component of hydrogen production is the efficiency of electrolyser – equipment used for electrolysis, while other costs like labor, water, and land are considered to be minor determinants (Longden et al., 2020). Based on the data from figure 3 on page 15, as well as based on the previously mentioned research, it can be

concluded that the prices for hydrogen production have been rapidly decreasing during the past decade. Nevertheless, at its current state green hydrogen is by far more expensive than other types of hydrogen and fossil fuels. According to Patonia and Poudineh (2022), further reduction in production costs of green hydrogen would be led by the combination of technological advancements and governmental policies. The latter ones include fiscal incentives in the form of grants and loans, as well as production capacity support. These government policies are not very common yet but are expected to become much more frequent globally if the pledged net zero goals are to be achieved.

3.3 Valuation of the Renewable Energy Companies

Before deriving the value of Nel Hydrogen, it is important to determine if there are any peculiarities in assessing the companies operating in the renewables energy industry, as well as if there is a framework that investors in renewable energy should follow. The research by Aslani and Mohaghar (2013) has defined three main decision-making factors of investment in the green energy industry that corresponds with the value drivers of the hydrogen industry defined in the previous chapter. They are:

- Engineering: efficiency, annual exploitability, regional energy potential.
- Government and business policy: supportive policies of the governments, consumption market.
- Environment: energy payback ratio (amount of electrical energy produced divided by the total energy required).

As for the valuation of renewable energy businesses, academic literature generally focuses on separate projects rather than on companies operating in the industry. For example, a research paper by Santos et al. (2014) states that the real options analysis (ROA) is a better instrument to measure investment performance than traditional measures like net present value (NPV) or internal rate of return (IRR) because the first one allows to determine the optimal time to invest or to estimate the value of the uncertainties. However, such an approach cannot be applied to the valuation of a company.

4 Valuation

The chapter starts with the analysis of Nel Hydrogen, which aims to become one of the basis points to develop a holistic view of the company. In detail, it begins with a brief history and corporate ownership, followed by an overview of its current business model. The second subchapter is the valuation of Nel Hydrogen. It begins with the presentation of assumptions that would be steering the valuation process. Afterwards the valuation is performed by first using the discounted cash flow DCF method with the sensitivity analysis, followed by the selection of a peer group that would be used in a consecutive relative valuation method.

4.1 Company Information

4.1.1 Brief History

Nel Hydrogen was founded in 1927, when a small electrolyser installation at Notodden, Norway was built, which was used for the production of pure hydrogen for fertilizers. Throughout its history, the company was established as an innovator in the field of hydrogen electrolysis. For example, in 1940 it built the world's largest installation of water electrolysers, and in 2003 it opened the first public hydrogen fuelling station in the world. In 2014 Nel Hydrogen became publicly listed on Oslo Stock Exchange, as well as the first public company that completely focuses on hydrogen technology. In the next three years after going public, the company acquires the world leading hydrogen fuelling technology company H2 Logic, as well as the electrolysis technology company Proton OnSite, which made Nel Hydrogel the world's largest electrolyser company. (Nel Hydrogen, no date)

4.1.2 Corporate Ownership

As of 30 September 2022, Nel Hydrogen constituted 1561 million common shares outstanding. The 26 largest holders of the company's outstanding shares are traditional investment managers, whose total ownership of the company results in 17.94% of the total ownership. The detailed breakdown of the top 10 shareholders of the company is presented in table 1 on the following page:

Rank	Holder	Percentage of Common Shares Outstanding
1	Vanguard Group Inc.	2.81%
2	DNB Asset Management AS	1.56%
3	KLP Kapitalforvaltning AS	1.56%
4	Handelsbanken Funds	1.40%
5	The Goldman Sachs Group Inc.	1.17%
6	Folketrygdfondet	1.02%
7	Storebrand Asset Management AS	1.00%
8	Amundi Asset Management SAS	0.62%
9	L&G Investment Management Ltd.	0.59%
10	Argenta Asset Management SA	0.58%
	Total	**12.31%**

Table 1: 10 largest shareholders of Nel Hydrogen
(S&P Capital IQ, no date (a); author)

Almost 100% of the total shares of Nel Hydrogen are in a free float, while 0.36% are distributed between the insiders (top executives) and the strategic investors (S&P Capital IQ, no date (a)). Notably, 95% of the recorded institutional investors in Nel Hydrogen are classified as growth-related based on their calculated investment styles according to the S&P Capital IQ database (no date (a)).

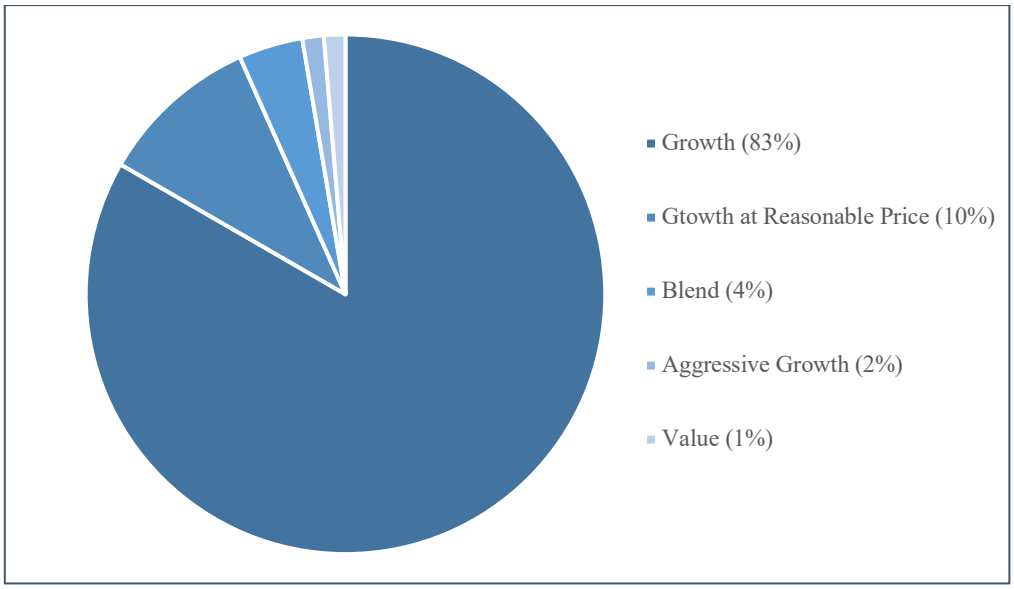

Figure 5: Types of institutional investors by calculated investment styles
(S&P Capital IQ, no date (a); author)

4.1.3 Business Model

The company consists of two divisions: Electrolyser and Fuelling. The former focuses on business solutions that allow hydrogen production from renewable energy sources, while the

latter focuses on fuelling solutions for trucks, buses and cars. The following figure 6 illustrates the business structure of Nel hydrogen:

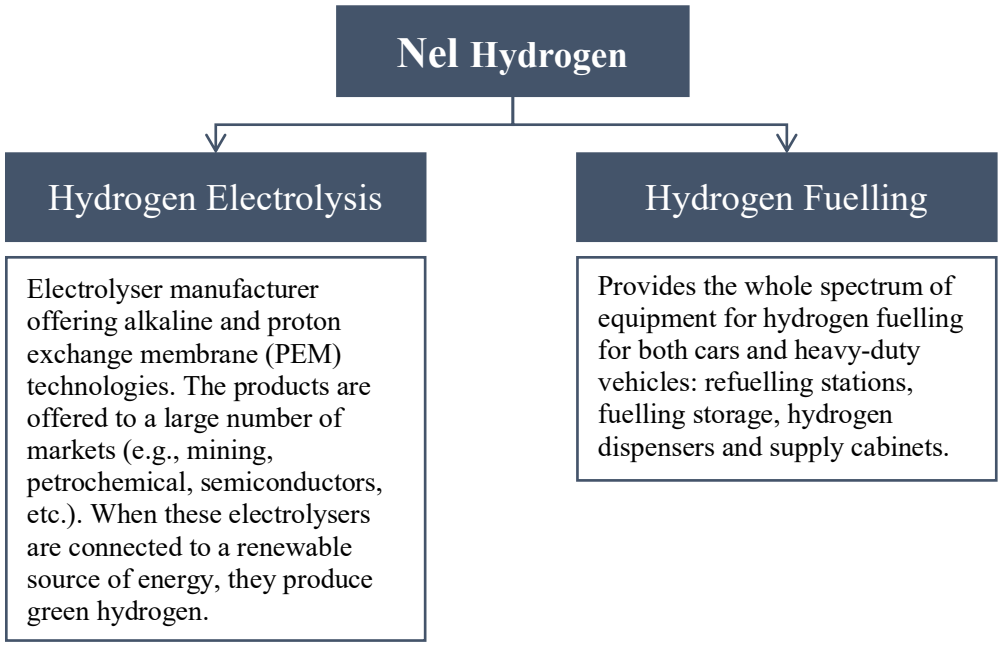

Figure 6: Nel Hydrogen business structure
(Nel Hydrogen, no date; author)

Overall, the company is established as the largest electrolyser manufacturer as well as the leader in hydrogen fuelling stations, which allows it to secure large-scale projects. Particularly, in the 2022 Q3 report it was mentioned that over 200 MW of alkaline electrolyser equipment was ordered, while the company has announced an expansion to its existing 500 MW alkaline production line with another 500 MW facility in order to meet the growing global demand for green hydrogen.

From a financial perspective, the Electrolysis business generates significantly larger revenues than the Fuelling one. One of the reasons is that the hydrogen fuelling technology is much newer and complex, while the market for it is still not mature. That implies that Nel Hydrogen would face high costs in the near future when developing its fuelling solutions. The difference in the performance of these two divisions is particularly noticeable from the order intake KPI: during the 2022 Q3 this value has increased by 608% for the Electrolysis division, and only by 120% for Fuelling. Figure 7 on the next page summarizes the comparison in performance of these divisions (the values are in NOK millions):

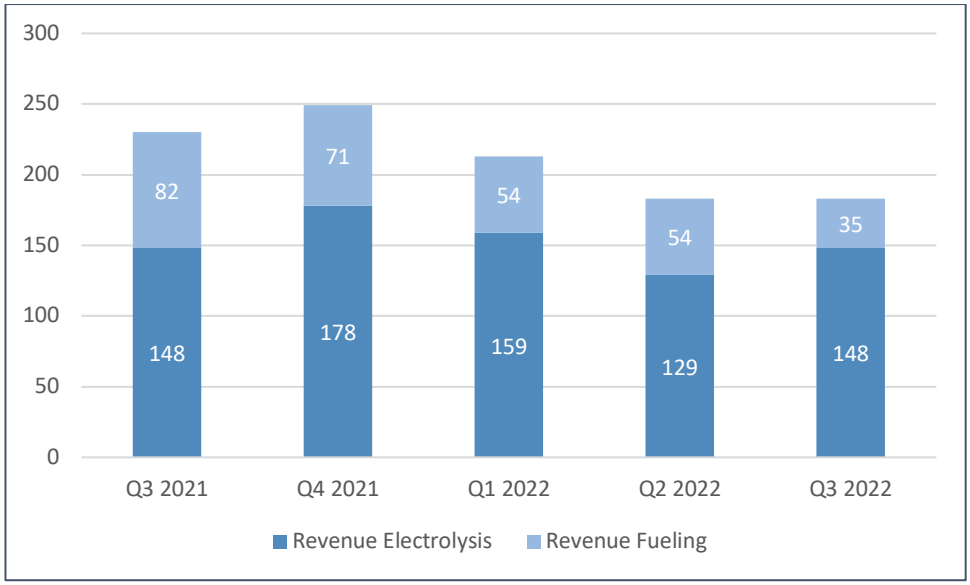

Figure 7: Nel Hydrogen revenue breakdown
(Nel Hydrogen, 2022a; author)

A detailed overview of the company's financial statements is presented in the following chapter *4.1.4 Historical Financial Performance*.

4.1.4 Historical Financial Performance

The last step before the DCF valuation is to analyze the company's financial performance over the last five years in order to determine its general state. One of the challenges is that for the year 2022 there is only data available until Q3, and the literature does not provide one standard way how to account for the values in the missing quarter. Two approaches are suggested (Patnaik, Satpathy & Das, 2014):

- Restatement of the financial year, which means the potential year could start from $Q4_{t-1}$ and would end at $Q3_t$.
- Assuming that the last quarter of the year yields the same result as the average value of the past three quarters.

According to the academic literature, none of the two options is considered to be preferable, and because the DCF valuation is generally conducted for full years, the second approach is used in the thesis while considering the cyclicality of revenues. When analyzing the revenues of the company per quarter over the last five years, on average the value in Q4 is ~43% larger than the average one of the Q1-Q3 period. As a result, the missing revenue for Q4 in 2022 is estimated at NOK 259.9 million.

Because revenue growth is considered to be one of the key drivers of the DCF model, the CAGR value is to be derived from the income statements from the past five years combined

with the current one. Figure 8 below illustrates the revenue development over the specified period (in thousands):

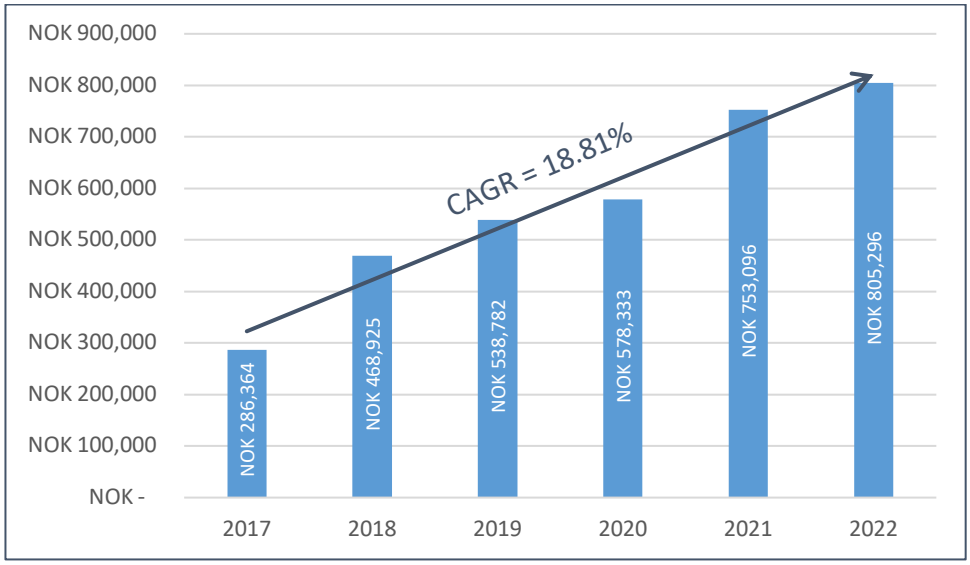

Figure 8: Nel Hydrogen revenue development 2017-2022
(S&P Capital IQ, no date (b); author)

From this figure, we can derive the CAGR of 18.81% over the period of 6 years, which is only slightly lower than the forecasted CAGR of the hydrogen sector of 22.9%. While strong and consistent revenue growth is a positive side of the company's performance, having a closer look at other indicators like EBIT may reveal one of its primary current weaknesses. Figure 9 below shows the development of the company's EBIT over the specified period:

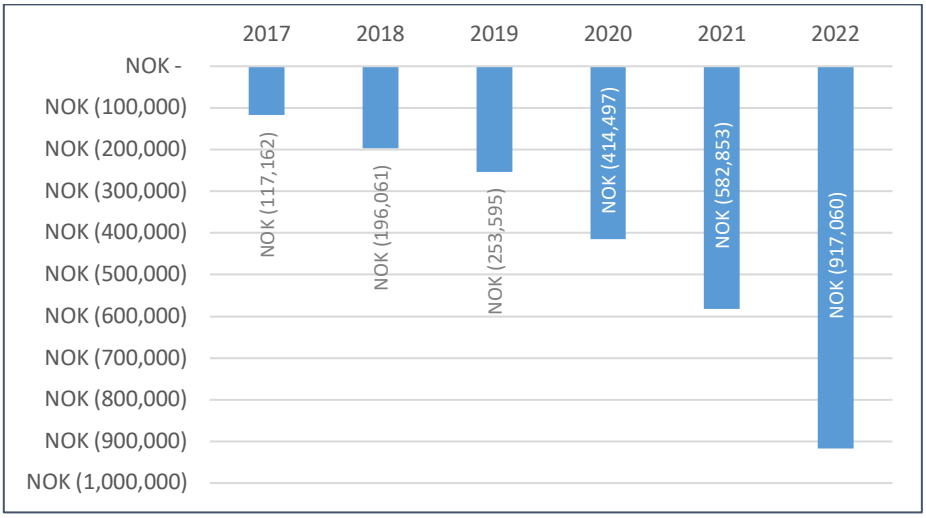

Figure 9: Nel Hydrogen EBIT development 2017-2022
(S&P Capital IQ, no date (b); author)

From this figure, we can see that the company has not delivered a non-negative EBIT over the past 6 years. According to the company's 2021 annual report (2022), the low marginality of the business was driven by the delays of closing orders due to COVID-19 and the supply

chain issue. For example, the expenses for raw costs have increased by 40% between the years 2020 and 2021. Additionally, during this period the company has significantly increased the number of full-time employees from 393 to 507, as well as increased the R&D expenses by over 40%.

According to Damodaran (2022), this occurs when the company is in the rapid expansion stage of its life cycle. It is common to have high revenue growth while having a negative operating income. The main source of value for such companies is future growth.

One of the things that can provide Nel Hydrogen with such growth that would allow it to achieve positive EBIT in the nearest future is the rapidly increasing order intake that consecutively affects the order backlog. Being the industry leader, the company is able to secure the largest projects in the hydrogen sector, however, due to the nature of business, the time span of these projects can be multiple years. For example, in Q3 2022 Nel Hydrogen signed a contract to deliver a large-scale project to be delivered in mid-2024 for the value of EUR 45 million (~NOK 475 million) which corresponds to over half of the company's projected revenue in 2022. Additionally, in the same quarter, Nel Hydrogen received a contract worth NOK 600 million that is planned to be signed in Q4 2022. Overall, in Q3 2022 the order intake has increased by 456% year-over-year, which has brought the company's backlog to new heights. The following figure 10 summarizes the development of order backlog over the past 2 years on a quarterly basis (in millions):

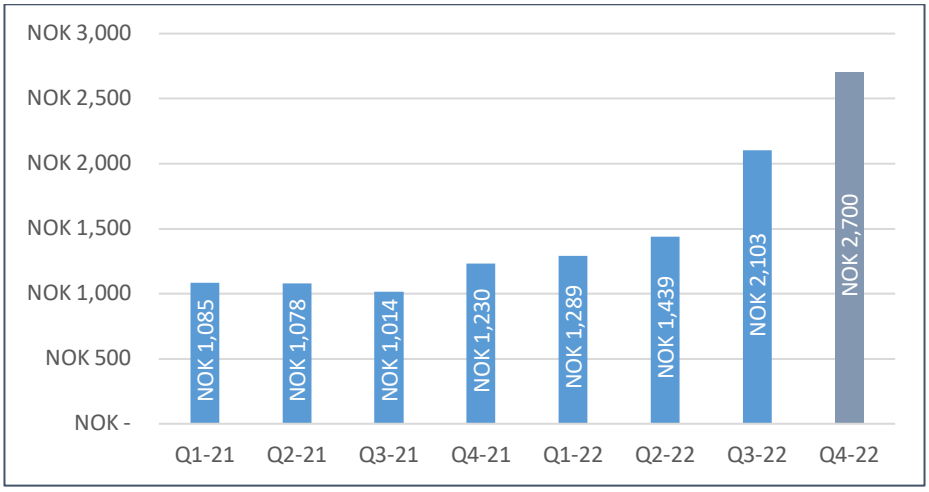

Figure 10: Nel Hydrogen order backlog development, the value for Q4-22 is projected by the company (Nel Hydrogen, 2022a; author)

According to the company's alternative performance measures definition, order backlog can be defined as purchase orders with a predefined price, timing, terms, and conditions, where the revenue is not yet recognized. Additionally, according to Barber & Hollie (2021), order backlog is one of the primary indicators of future earnings, mainly due to the high level of

correlation with sales growth. As a result, this feature can be used for short- to medium-term projections of revenue. However, considering the volatility of the data due to the high-growth stage of the business and highly varying timings of the projects, it is challenging to calculate a specific revenue growth rate that has an economic sense. What could be assumed is that based on the development of the order backlog in 2022 and on the assumptions of the management of the company (Nel Hydrogen, 2022a), the future revenue growth is likely to grow at a faster pace than during the past five years due to the increasing order intake quantity and the size of these orders.

As it was discussed before in this chapter, one of the reasons for a negative EBIT is the low marginality of the business. It is driven by the three main aspects based on the company's reports (Nel Hydrogen, 2022a):

- Increasing costs triggered by COVID-19 and followed by the supply chain crisis that delayed the delivery of the previously agreed projects.
- The rapid expansion of the company by the means of hiring new employees (almost a 30% increase in the employee count during the period of 2020 to 2021, and already a 14% increase during the period of Q1 2022 to Q3 2022).
- Active investment in research and development (R&D) to maintain the status of the leader in the industry (during 2021 the company has invested over 20% of its revenue into R&D).

The development of the company's Gross Profit margin is shown in figure 11 below:

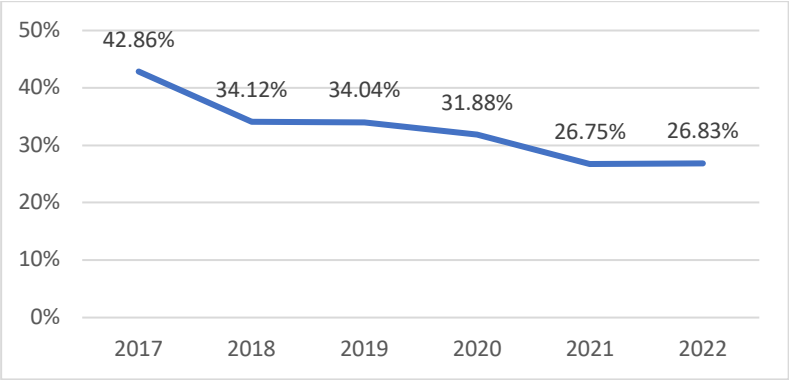

Figure 11: Nel Hydrogen Gross Profit margin development, the value for 2022 is derived from S&P Capital IQ (S&P Capital IQ, no date (b); author)

It can be noticed that the Gross Profit margin was constantly shrinking until 2021 with a slight expected recovery in 2022.

Lastly, considering that the company is losing money for the past five years, it is important to know if the company has sufficient cash reserves and a cash flow from investing and

financing activities to cover for cash outflow from operating activities. The following table 3 summarizes the Consolidated Statements of Cash Flows over the past five years:

Summary of the Statements of Cash Flows					
in NOK millions	**2017**	**2018**	**2019**	**2020**	**2021**
Net cash flow from operating activities	(113.02)	(142.82)	(199.71)	(215.89)	(449.46)
Net cash flow from investing activities	(219.27)	(143.46)	(134.12)	(294.43)	(373.62)
Net cash flow from financing activities	401.82	340.77	509.98	2313.71	1215.93
Net change in cash and cash equivalents	**69.53**	**54.75**	**176.23**	**1806.87**	**389.92**
Cash balance as of 31.12	**295.00**	**349.75**	**525.98**	**2332.85**	**2722.77**

Table 2: Summary of the statements of cash flows of Nel Hydrogen 2017-2021 (S&P Capital IQ, no date (c); Nel Hydrogen, 2022; author)

From this table, we can see that Nel Hydrogen is able to consistently increase its cash balance due to cash inflows from financing activities that stem to a large extent from the issuance of common stock. It can be also noticed that the company has a very considerable amount of cash that would allow it to sustain the rapid growth stage of development. Next to that, Nel Hydrogen faces no issues with regard to liquidity. The following liquidity ratios by end of 2021 only confirm this point (S&P Capital IQ, no date (c)):

- Current Ratio: 5.88
- Quick Ratio: 4.42
- Cash Ratio: 3.86

To summarize, the overall financial health of the company based on the past 5 years is strong and shows promise for the future. Being in a rapid growth stage, Nel Hydrogen is able to maintain consistent revenue growth that is expected to increase even further in the short-term due to a rising order backlog. As the company is growing in a new industry, it suffers from a negative EBIT due to active investments in new technologies and hiring a new workforce. Additionally, COVID-19 and the supply chain crisis also affected financial performance. Nevertheless, Nel Hydrogen has large cash reserves and high liquidity ratios that allow the company to cover all of its short-term obligations. Finally, based on the estimations of the company's management and analysts' consensus, due to the investments in operational efficiency the company would significantly improve its marginality in the near future.

4.2 Valuation Preliminaries

Before starting with the DCF and Multiples valuations, the assumptions that would steer the valuation process as well as a peer group of Nel Hydrogen have to be defined. It also needs to be mentioned that the valuation is conducted as of 30th of September 2022, as it is the end of the third quartal.

4.2.1 Valuation Assumptions

The first step of the valuation process is to summarize the assumptions that would be used for this process. They are based on the research from the Literature Review chapter of this thesis: from the industry growth perspectives to the trends in the company's past financial performance. Additionally, the press releases of Nel Hydrogen are analyzed to understand the future outlook of the management. The following points are the general assumptions that would steer the valuation process of Nel Hydrogen, while further assumptions for other aspects would be presented throughout the following chapters.

- **Revenue.** The hydrogen industry is expected to grow at a rate of 22.9% until 2050. At the same time, the company's revenue CAGR over the past 5 years is 18.81%. Because the company's order intake has significantly increased during the first three quarters of 2022, and considering the management's outlook, the revenue growth in the short-term perspective would be well above the 18.81% level. For example, according to the data derived from S&P Capital IQ (no date (b)), the CAGR for the company's revenue over the period from 2021 to 2024 is 32.66%. As a result, in the DCF model, it is assumed that the revenue growth rate for the first three years would occur at a rate of 30% and would gradually decline afterwards over the next seven years to the industry average value of 22.9%.
- **Cost of Goods Sold (COGS).** According to the annual and quarterly reports, a large portion of R&D investments is dedicated to improving operational efficiency. Next to that, the technology used at the core of the business will become more mature, and as a result, easier to produce. Finally, as the company grows, it will benefit from the economies of scale. Therefore, the percentage of Cost of Goods Sold in relation to the revenue will decline over the whole period of valuation. In the first three years, it is assumed that the decline will be more prominent at 5% every year as the investments in operational efficiency are realized, followed by a gradual decline toward a 1%

decrease rate over the next seven years because of the technology maturity and the economies of scale.

- **Selling, General & Administrative expenses (SG&A).** These expenses include all of the main operating expenses that are not part of COGS like salaries, marketing, rent, utilities, etc. It was noted before that the company is actively hiring new employees. When being a relatively small company in the active growth stage and increasing the number of employees by 30% every year, the salary expenses become a very significant part of SG&A expenses. With the predicted high overall growth of the company, it can be assumed that in the future the hiring rate would decrease, and the current SG&A expenses would become a lesser part in relation to the revenue of the company. Therefore, it is assumed that over the next five years, when the company would significantly grow in size, the SG&A expenses would be gradually decreasing up to 20% per year. During the next five years, SG&A expenses would be gradually achieving the average value of the companies in its peer group that is defined in chapter *4.2.2 Peer Group* on this page below. The assumed value during for last year of the forecast is approximately 17.13% of Revenue. Refer to Appendix A on page 47 for the derivation of this value.
- **Other Operating Expenses.** There is very little amount of information available about the projections of Other Operating Expenses in the press releases and reports of Nel Hydrogen. As a result, a similar approach is used for SG&A costs projections. Based on the average value of the peer companies, Other Operating Expenses are assumed to decrease toward approximately 5.93% of Revenue. Refer to Appendix A on page 47 for the derivation of this value.

4.2.2 Peer Group

In order to use the relative valuation method, it is first necessary to establish a peer group of companies that are similar to Nel Hydrogen in industry, size, and growth rate. After analysing the peer group defined in S&P Capital IQ (no date (d)), the following list of companies is selected as presented in table 3 on the next page. Almost all of them are similar in terms of market capitalization and operate in the renewable energy industry: four hydrogen companies, four solar and/or wind energy, and one that produces equipment for renewable electricity companies. Moreover, it can be assumed that they face similar growth prospects.

From the geographic perspective, the majority of the selected companies are based in Europe, followed by two companies from North America, and one from China.

in EUR mil.	Industry	Country	Market Cap	Revenue
Plug Power	Green Hydrogen	USA	6,772.2	424.29
Ballard Power	Green Hydrogen	Canada	1,341.7	88.41
PowerCell	Green Hydrogen	Sweden	541.8	15.75
Hexagon Purus	Green Hydrogen	Norway	554.5	49.80
Energiekontor	Renewable (Solar&Wind)	Germany	1,076.6	156.52
Alfen NV	Renewable (Electricity)	Netherlands	1,828.9	249.68
PNE AG	Renewable (Wind)	Germany	1,629.8	117.73
EIDF	Renewable (Solar)	Spain	1,614.3	423.31
Jinlei	Renewable (Wind)	China	1,188.6	215.13
Nel Hydrogen	Green Hydrogen	Norway	2,173.0	52.71

Table 3: Peer Group Companies
(S&P Capital IQ, no date (d); author)

4.3 DCF Valuation

4.3.1 FCF Projection

The first step of the DCF valuation is to determine the Free Cash Flows (FCFs) that the company would achieve during the projected period. In this thesis, cash flows would be projected over the next ten years, because the company remains in the high growth stage and it would be essential to capture its cashflows until a certain level of stable growth is reached. According to Berg & DeMarzo (2020), the formula of FCF is defined as:

$$FCF = EBIT \times (1 - Tax\ Rate) + Depreciation - CAPEX \pm \Delta NWC$$

Based on the assumptions from chapter *4.2.1 Valuation Assumptions*, Earnings Before Interest and Taxes (EBIT) are derived for the analyzed period. It is done by separately projecting each of the values on the Income Statement that constitute EBIT. The outcome is presented in the following table 4 below:

EBIT Projection																
	Historical						*Projected*									
in NOK mil.	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Revenue	**286.37**	**453.19**	**519.05**	**578.33**	**753.10**	**805.30**	**1,046.89**	**1,360.95**	**1,769.24**	**2,273.47**	**2,887.30**	**3,623.57**	**4,493.22**	**5,522.17**	**6,786.75**	**8,340.91**
% Growth	*190.89%*	*58.26%*	*14.53%*	*11.42%*	*30.22%*	*6.93%*	*30.00%*	*30.00%*	*30.00%*	*28.50%*	*27.00%*	*25.50%*	*24.00%*	*22.90%*	*22.90%*	*22.90%*
COGS	(163.64)	(298.55)	(342.37)	(393.98)	(551.66)	(589.24)	(713.66)	(859.71)	(1,029.16)	(1,220.17)	(1,434.12)	(1,673.00)	(1,939.72)	(2,245.87)	(2,624.44)	(3,142.02)
% of Revenue	*57.14%*	*65.88%*	*65.96%*	*68.12%*	*73.25%*	*73.17%*	*68.17%*	*63.17%*	*58.17%*	*53.67%*	*49.67%*	*46.17%*	*43.17%*	*40.67%*	*38.67%*	*37.67%*
Gross Profit	**122.73**	**154.64**	**176.68**	**184.35**	**201.44**	**216.06**	**333.22**	**501.24**	**740.07**	**1,053.30**	**1,453.18**	**1,950.57**	**2,553.50**	**3,276.30**	**4,162.31**	**5,198.89**
% Margin	*42.86%*	*34.12%*	*34.04%*	*31.88%*	*26.75%*	*26.83%*	*31.83%*	*36.83%*	*41.83%*	*46.33%*	*50.33%*	*53.83%*	*56.83%*	*59.33%*	*61.33%*	*62.33%*
SG&A	(123.27)	(170.48)	(218.19)	(302.97)	(434.47)	(628.72)	(735.60)	(812.84)	(845.35)	(869.02)	(882.93)	(941.86)	(1051.12)	(1162.64)	(1286.00)	(1422.45)
% of Revenue	*43.05%*	*37.62%*	*42.04%*	*52.39%*	*57.69%*	*78.07%*	*70.27%*	*59.73%*	*47.78%*	*38.22%*	*30.58%*	*25.99%*	*23.39%*	*21.05%*	*18.95%*	*17.05%*
Depreciation	(39.76)	(64.47)	(75.50)	(91.29)	(103.12)	(168.26)	(214.64)	(269.68)	(341.60)	(423.57)	(542.93)	(597.37)	(656.06)	(721.13)	(792.15)	(873.23)
% PPE	*13.88%*	*14.23%*	*14.55%*	*15.79%*	*13.69%*	*20.89%*	*14.43%*	*14.43%*	*14.43%*	*14.43%*	*14.43%*	*14.43%*	*14.43%*	*14.43%*	*14.43%*	*14.43%*
Other Operating Expenses	(65.49)	(115.75)	(136.58)	(147.59)	(244.43)	(291.53)	(303.19)	(315.32)	(336.13)	(362.82)	(387.06)	(412.90)	(435.19)	(454.62)	(474.92)	(496.13)
% of Revenue	*22.87%*	*25.54%*	*26.31%*	*25.52%*	*32.46%*	*36.20%*	*28.96%*	*23.17%*	*19.00%*	*15.96%*	*13.41%*	*11.39%*	*9.69%*	*8.23%*	*7.00%*	*5.95%*
EBIT	**(105.80)**	**(196.06)**	**(253.59)**	**(357.50)**	**(580.58)**	**(872.46)**	**(920.21)**	**(896.60)**	**(783.02)**	**(602.12)**	**(359.74)**	**(1.56)**	**411.13**	**937.91**	**1,609.24**	**2,407.09**

Table 4: Nel Hydrogen EBIT Projection 2023-2032
(S&P Capital IQ, no date (b); author)

For Depreciation, it is assumed that the value is a percentage from an average of the past five years of Depreciation in relation to Property, Plant, and Equipment (PPE). The values from PPE are assumed to grow with the same rate as revenues. Such growth can be explained by the nature of the Electrolysis business of the company, where investing in new manufacturing facilities directly results into the growth of this business unit.

From table 4 we can see that by 2029 the company would be able to generate a positive EBIT due to rapid Revenue growth and cost efficiency.

The next step in calculating the FCFs is to account for taxes. In this valuation, the average tax rate based on the past five years is used and is equal to 13.46%. This average tax rate is derived by using the company's Effective Tax Rate, which is the most widely used method according to Damodaran (2012). It is derived by dividing the tax expense by taxable income.

The calculation continues by adding back the depreciation because it is not a cash expense. Then it is followed by subtracting the Capital Expenditures (CAPEX), which are funds that are used to acquire, maintain, and upgrade the company's physical assets. CAPEX is forecasted as a percentage of revenue for the same reasons used for the PPE forecast, and due to the lack of information in the reports. The percentage value of CAPEX/Revenue is derived as an average for the five past years and is equal to 15.76%.

Finally, the increase in Net Working Capital (NWC) is subtracted. The change in NWC is defined as Current Assets minus Current Liabilities. The following table 5 summarizes the projection of the items that constitute these two values:

NWC Projection																
in NOK thousands	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
Current Assets	**584,282**	**636,655**	**1,034,241**	**4,593,753**	**4,144,139**	**4,519,699**	**4,749,487**	**5,033,343**	**5,384,264**	**5,818,428**	**6,355,990**	**7,022,075**	**7,848,021**	**8,872,940**	**10,145,678**	**11,727,270**
Inventories	138,723	134,804	205,234	237,129	328,465	390,263	463,687	550,926	654,578	777,732	924,055	1,097,908	1,304,470	1,549,895	1,841,494	2,187,955
Accounts Receivable	130,411	120,416	227,922	242,531	398,077	497,620	622,054	777,605	972,052	1,215,122	1,518,975	1,898,808	2,373,623	2,967,169	3,709,136	4,636,640
Cash & ST Investments	295,000	349,747	569,883	4,067,085	3,330,869	3,520,265	3,520,265	3,520,265	3,520,265	3,520,265	3,520,265	3,520,265	3,520,265	3,520,265	3,520,265	3,520,265
Other Current Assets	20,148	31,688	31,202	47,008	86,728	111,552	143,480	184,547	237,369	305,309	392,696	505,094	649,663	835,612	1,074,782	1,382,410
Current Liabilities	**213,874**	**199,193**	**336,659**	**431,085**	**705,051**	**912,462**	**1,105,550**	**1,346,639**	**1,648,372**	**2,026,830**	**2,502,480**	**3,101,394**	**3,856,795**	**4,811,050**	**6,018,211**	**7,547,263**
Accounts Payable	64,857	69,473	92,197	81,570	132,962	147,420	169,040	193,831	222,257	254,853	292,229	335,086	384,228	440,578	505,191	579,281
Accrued Expenses	24,129	32,168	36,687	54,626	59,044	59,044	59,044	59,044	59,044	59,044	59,044	59,044	59,044	59,044	59,044	59,044
Unearned Revenue	40,079	68,640	147,481	193,082	360,821	534,882	685,113	877,538	1,124,009	1,439,705	1,844,071	2,362,008	3,025,418	3,875,157	4,963,559	6,357,657
Other Current Liabilities	84,809	28,912	60,294	101,807	152,224	171,116	192,353	216,226	243,061	273,227	307,137	345,256	388,105	436,272	490,417	551,282
NWC	370,408	437,462	697,582	4,162,668	3,439,088	3,607,237	3,643,937	3,686,705	3,735,892	3,791,598	3,853,510	3,920,681	3,991,226	4,061,890	4,127,467	4,180,007
Change in NWC		**67,054**	**260,120**	**3,465,086**	**-723,580**	**168,149**	**36,700**	**42,768**	**49,188**	**55,706**	**61,912**	**67,172**	**70,545**	**70,664**	**65,577**	**52,540**

Table 5: Nel Hydrogen NWC Projection 2023-2032
(S&P Capital IQ, no date (e); author)

As for Current Assets, all of the related items are projected at a historical growth rate with the exception of Cash & Short-Term Investments, which remain stable at their historical level. The sharp increase in this Balance Sheet line item stems from issuing new common stock, and no other indications of similar activity in the future were mentioned in press releases and reports of Nel Hydrogen. As for Current Liabilities, all of the line items but Accrued Expenses are projected based on historical average growth rates.

By applying the formula from the beginning of this chapter, the values for FCFs are forecasted for the next ten years. It is summarized in the following table 6 below:

FCF Projection											
in NOK mil.	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
EBIT	**(872.46)**	**(920.21)**	**(896.60)**	**(783.02)**	**(602.12)**	**(359.74)**	**(1.56)**	**411.13**	**937.91**	**1,609.24**	**2,407.09**
(-) Taxes	(117.41)	(123.84)	(120.66)	(105.37)	(81.03)	(48.41)	(0.21)	55.33	126.22	216.56	323.93
% Effective Tax Rate	*13.46%*	*13.46%*	*13.46%*	*13.46%*	*13.46%*	*13.46%*	*13.46%*	*13.46%*	*13.46%*	*13.46%*	*13.46%*
(+) Depreciation	168.26	214.64	269.68	341.60	423.57	542.93	597.37	656.06	721.13	792.15	873.23
(-) CAPEX	(116.99)	(152.09)	(197.72)	(257.04)	(330.29)	(419.47)	(526.44)	(652.78)	(802.27)	(985.99)	(1,211.78)
% of Revenue	*14.53%*	*15.76%*	*15.76%*	*15.76%*	*15.76%*	*15.76%*	*15.76%*	*15.76%*	*15.76%*	*15.76%*	*15.76%*
(+/-) Change in NWC	168.15	36.70	42.77	49.19	55.71	61.91	67.17	70.54	70.66	65.58	52.54
FCF	**(1,106.74)**	**(770.53)**	**(746.76)**	**(642.27)**	**(483.52)**	**(249.78)**	**2.41**	**288.53**	**659.89**	**1,133.26**	**1,692.07**

Table 6: Nel Hydrogen FCF Projection 2023-2032
(Author)

According to this forecast, in 2028 Nel Hydrogen is expected to deliver a positive FCF due to its high levels of growth and costs optimization.

4.3.2 WACC Determination & Discounting of FCFs

The next step in the DCF valuation is to discount the previously derived FCF values. To do so, a weighted average cost of capital (WACC) has to be determined. The formula of WACC is shown below:

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

where

r_E = Cost of Equity

r_D = Cost of Debt

E = Total Equity

D = Total Debt

T = Tax rate

The first part of the equation is the cost of equity. A common method to calculate this value is to use the Capital Asset Pricing Model (CAPM), which is defined as follows (Damodaran, 2012):

$$r_E = r_f + \beta * (r_m - r_f)$$

where

r_f = Risk-free rate

β = A measure of risk that an investment adds to a market portfolio

r_m = Market risk

As there is no truly risk-free rate, a general approach is to use the long-term government bond yield. In this case, a 30-year US government bond is used with a rate of 3.79% as of September 30 (U.S. Department of The Treasury, no date).

To determine a beta (β), stock returns of Nel Hydrogen are regressed against a STOXX Europe 600 index that replicates almost 90% of investable market of developed European economies (Qontigo, no date). As for the time frame selection, past five years of monthly returns are used, which is a common practice in determining the stock's beta. The table with data points and the consecutive derivation of the beta are summarized in *Appendix B: Stock Beta Derivation* on page 48. The outcome is a beta of approximately 0.988. Lastly, it is important to discuss the reliability of such an estimate. Though the value of R-squared is rather low at 0.075, the p-value = 0.0239 < 0.05 that indicates that at a 5% significance level

it can be suggested that there is a relationship between stock and index returns. Summary of the regression statistics can also be found in the *Appendix B* as mentioned before.
Nel Hydrogen also uses debt for its financing, so it is necessary to transform the unlevered beta value of 0.988 to a levered one by using the following formula:

$$\beta_{LEV} = \beta_{UNLEV} \times (1 + (1 - T) \times \frac{D}{E})$$

As a result, the value of a levered beta coefficient that is used in the cost of equity formula, when considering a corporate income tax of 28%, equals to 1.125. The value for market risk is taken from the website of Damodaran (no date) that is defined for green and renewable energy companies in Europe and is equal to 4.24%. Finally, the cost of equity equals to approximately 8.53%.
The second part of the WACC calculation is to define the cost of debt. The value is taken by using the same approach from the website of Damodaran (no date), and the cost of debt for companies in the green and renewable energy industry in Europe has a value of 6.57%.
As Nel Hydrogen is currently at its high growth stage and uses cash raised from the issuance of common stock, it has a high amount of equity (84.15%) in comparison to its amount of debt (15.85%). This ratio is likely to change over time as the company matures, thus a target ratio that is likely to be achieved in the future is used. In the financial reports, a specific desired ratio is not mentioned. As a result, an average value of the renewable energy companies operating in Europe (Damodaran, no date) for a capital structure will be used: 37.02% for Debt/(Equity + Debt) and 62.98% for Equity/(Equity + Debt).
Finally, by putting all the values together, WACC is calculated:

$$WACC = 8.53\% \times 62.98\% + 6.57\% \times 37.02\% \times (1 - 28\%)$$
$$WACC = 7.1233\%$$

To see how the change of capital structure from the target one to the existing one would affect WACC and consecutively the share price, WACC is also calculated by using the capital structure. The alternative value for WACC by using the current capital structure equals to approximately 7.93%. Its effect on share price will be discussed in chapter *4.3.5 Sensitivity Analysis* on page 35.
It is now possible to discount the FCFs that were calculated in the previous chapter. The result is presented in the following table 7 on the next page.

PV of FCFs										
in NOK mil.	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**
FCF	(770.53)	(746.76)	(642.27)	(483.52)	(249.78)	2.41	288.53	659.89	1,133.26	1,692.07
PV of FCF	**(719.29)**	**(650.74)**	**(522.48)**	**(367.18)**	**(177.07)**	**1.59**	**178.24**	**380.54**	**610.07**	**850.32**

Table 7: Nel Hydrogen PV of FCFs 2023-2032
(Author)

4.3.3 Terminal Value Calculation

Terminal Value (TV) is the closing part of the DCF valuation. It is based on the assumption that as the business grows, it becomes more difficult to sustain higher levels of growth, therefore, it will grow at a rate that is either equal or less than the economy in which it operates. The value of the long-term sustainable growth rate has to be estimated. As the majority of revenue is generated in the US (48.5%), and all of the major projects are expected to be delivered there as well, the average historical growth rate of GDP is used that is based on the past 10 years excluding 2020 that was heavily affected by COVID-19 (Nel Hydrogen, 2022b). This rate equals to 2.67%, therefore a long-term growth rate is assumed to be 2.6%. As a result, TV is equal to NOK 19,287.45 million.

4.3.4 Share Price According to DCF

Now it is possible to derive the share price of Nel Hydrogen based on this DCF valuation. The first step is to calculate the Enterprise Value, which is the sum of all FCFs at their present value (PV) plus TV. Afterwards, in order to derive an Equity Value, Total Debt has to be subtracted and Cash & Cash Equivalents have to be added to the Enterprise value. Finally, to determine a share price, Equity Value has to be divided by the number of shares outstanding. The summary of these calculations is presented in the following table 8 below:

Share Price Calculation		
Enterprise Value	NOK	18,871,436,915
(-) Total Debt	NOK	(1,168,960,000)
(+) Cash & Cash Equivalents	NOK	3,520,270,000
Equity Value	NOK	21,222,746,915
Shares Outstanding		1,562,907,271
Share Price	NOK	13.58

Table 8: Nel Hydrogen Share Price Calculation According DCF
(S&P Capital IQ, no date (e); author)

As a result, the share price according to the DCF method of Nel Hydrogen equals to NOK 13.58. In chapter *4.5 Valuation Summary* on page 39, it will be discussed how this estimate

compares to the share price calculated by using the multiples method, and how it compares to the analysts' estimates.

4.3.5 Sensitivity Analysis

The sensitivity analysis is used in order to see how the share price of Nel Hydrogen would look based on changes in certain values of the valuation. In this case, as the company is in its high growth stage and a ten-year forecasting period was used with six years of FCF outflows, the terminal value contributes to over 100% of the Enterprise value. Therefore, it is important to test how the share price would change if the terminal growth rate and WACC are different by 0.5%. The result is presented in table 9 below:

WACC \ Terminal Growth Rate	1.6%	2.1%	2.6%	3.1%	3.6%
6.1%	13.46	15.05	17.08	19.79	23.58
6.6%	12.24	13.52	15.11	17.16	19.88
7.1%	11.25	12.30	13.58	15.18	17.24
7.6%	10.42	11.30	12.35	13.64	15.25
8.1%	9.71	10.46	11.34	12.40	13.70

Table 9: Share Price Sensitivity analysis (Author)

From this table, we can see that even a relatively small change in one of the assumptions can lead to a significant change in the share price of the company. In this case, a 0.5% increase in WACC results in almost 10% change in share price, while a 0.5% decrease in WACC increases the share price by over 11%. As for the terminal growth rate, a 0.5% increase of this value increases the share price by almost 12%, and a 0.5% decrease results in a share price that is approximately 10% lower.

Additionally, as it was mentioned before, it is important to see how the share price would like if the existing capital structure would remain constant and would not converge to the average industry value over time. In this scenario, the share price would equal to NOK 10.90, which is 24.5% lower than NOK 13.58 under the assumption of a changing capital structure.

4.4 Relative Valuation

As it was mentioned in the Literature Review chapter of this thesis, the goal of relative valuation is to estimate the value of an asset based on the prices of similar ones. Damodaran (2012) categorizes multiples into four main categories: earnings, book value, revenue, and sector-specific. The earnings multiples are not suitable for this thesis, as not only Nel Hydrogen but also the majority of its peers are not generating any positive EBIT or Net Income, because they are in the high growth stage. The sector-specific multiples are the least common ones due to the following pitfalls: it is hard to relate these multiples to fundamentals and they can result in high under- or overvaluation. Therefore, they will not be used in this thesis.

From book value multiples, the following will be used:

- Price-to-book ratio. There are two variations of this multiple: one with share price and one with a market value of equity. In this thesis, the latter one is used with the Market Value of Equity divided by its Book Value.
- Price-to-tangible book ratio. Similar to the previous multiple with the only difference in the denominator, where the Goodwill and other non-tangible assets are subtracted.

From revenue multiples, the following will be used:

- Enterprise Value (EV) / Revenue LTM (last twelve months): Enterprise value of the company divided by the revenue of the company from the last twelve months.
- Enterprise Value (EV) / Revenue NTM (next twelve months): Enterprise value of the company divided by the revenue of the company from the next twelve months based on the analysts' estimate.

The values for multiples are derived from S&P Capital IQ (2022), and are summarized in the following table 10:

	EV/Revenue LTM	EV/Revenue NTM	Price/Book	Price/Tangible Book
Plug Power	6.76	4.34	1.81	2.01
Ballard Power	5.97	5.22	1.26	1.35
PowerCell	22.93	20.94	19.05	19.57
Hexagon Purus	6.09	3.86	3.18	5.75
Energiekontor	5.43	3.63	12.53	12.59
Alfen NV	4.05	3.30	14.82	17.87
PNE AG	17.26	13.57	6.95	9.61
EIDF	7.33	5.78	24.00	37.01
Jinlei	5.45	3.93	3.12	3.33
Nel Hydrogen	25.19	16.26	4.19	4.77

Table 10: Multiples Summary
(S&P Capital IQ, no date (d); author)

The next step is to derive the new market capitalization based on these multiples by using different scales: mean, median, minimal, and maximal values. It would allow to better understand what potential values the market capitalization and consecutively a share price may take based on these ranges. To derive a market capitalization for revenue multiples, the following calculation needs to be conducted, analogously to the DCF method: Equity value = Enterprise value – Total Debt + Cash & Cash Equivalents. As for book value multiples, they are simply multiplied by a Book Value of the company and by a Tangible Book Value. It is summarized in the following table 11 below:

Market Capitalization				
in NOK millions	**EV/Revenue**	**EV/Revenue**	**P/B**	**P/TB**
min	5612.76	5008.79	6348.77	5257.66
25th percentile	6736.15	5413.45	14070.58	11683.68
mean	10924.49	8860.52	45806.86	44343.46
median	7525.34	6200.63	28065.58	29910.22
75th percentile	17392.23	13820.74	80002.02	71250.98
max	22636.72	19214.21	120928.90	144137.67

Table 11: Market Capitalizations of Nel Hydrogen Based on Different Multiples (S&P Capital IQ, no date (d); author)

Finally, possible share prices can be calculated by dividing the values from table 11 by the number of shares outstanding. The results can be seen in the following table 12 below:

Share Price				
in NOK	**EV/Revenue LTM**	**EV/Revenue NTM**	**P/B**	**P/TB**
min	3.59	3.20	4.06	3.36
25th percentile	4.31	3.46	9.00	7.48
mean	6.99	5.67	29.31	28.37
median	4.81	3.97	17.96	19.14
75th percentile	11.13	8.84	51.19	45.59
max	14.48	12.29	77.37	92.22

Table 12: Market Capitalizations of Nel Hydrogen Based on Different Multiples (S&P Capital IQ, no date (d); author)

It can be noticed that the range of potential share prices is quite broad. If an average share price value is to be derived based on all multiples, it would equal to NOK 17.59 when using the average of mean values. However, in order to reduce the effect of the outliers, the average value of median values is a preferred option. It results in a share price of NOK 11.47. It can be noticed that the revenue multiples yield significantly lower share prices than book value ones. The main reason for low revenue multiples is that Nel Hydrogen generates significantly less revenue than other companies while having a much larger enterprise value. Finally, the feasibility of the share prices coming from the book value multiples is to be assessed via a

reality check. In order to achieve a share price based on median values of P/B and P/TB multiples (NOK 17.96 and NOK 19.14), the revenue growth rate in the DCF model has to be approximately 30% for all projected 10 years, in comparison to the existing revenue growth structure where only the first 3 years have a growth rate of 30% with consecutive conversion to the industry average of 22.9%. At the same time, to achieve a share price based on the mean values of P/B and P/TB (NOK 29.31 and NOK 28.37), the revenue growth rate has to equal to approximately 37% for 10 consecutive years. The latter scenario of having a revenue growth rate that is almost 62% higher than the industry growth rate for a 10-year period may be considered not feasible because none of the sources analysed have mentioned such a high growth rate. To conclude, due to the previously mentioned feasibility check and in order to deal with outliers, the share price of Nel Hydrogen based on the relative valuation method is NOK 11.47 using the average of median values of all multiples.

4.5 Valuation Summary

Having derived two potential share prices by using the DCF and multiples methods, it is possible to calculate a share price by combining these two methods. Considering that the peer companies are not completely comparable with Nel Hydrogen, the weight of a share price based on the relative valuation is assumed to have a weight of 0.25, while the weight of a share price based on the DCF method is 0.75. The share price is, therefore, is assumed to equal to NOK 13.05:

$$13.58 * 0.75 + 11.47 * 0.25 = 13.05$$

It can be also noted that according to the estimates of 21 analysts (S&P Capital IQ, no date (f)), the mean share price value of Nel Hydrogen is NOK 14.22 and the median share price is NOK 13.00, which falls in the same range as the values derived in DCF and in the combination of DCF and relative valuation methods. To visualize all of the valuation results, the following figure 12 is used, which is often referred to as a "football field" chart. For multiples, the values of 25% and 75% percentiles are used to have a more consistent and narrow illustration. For DCF, the values from the sensitivity analysis are used to show the range of potential values. Additionally, the trading price range over the last twelve months is presented together with the valuation estimates of the analysts derived from S&P Capital IQ (no date (f)).

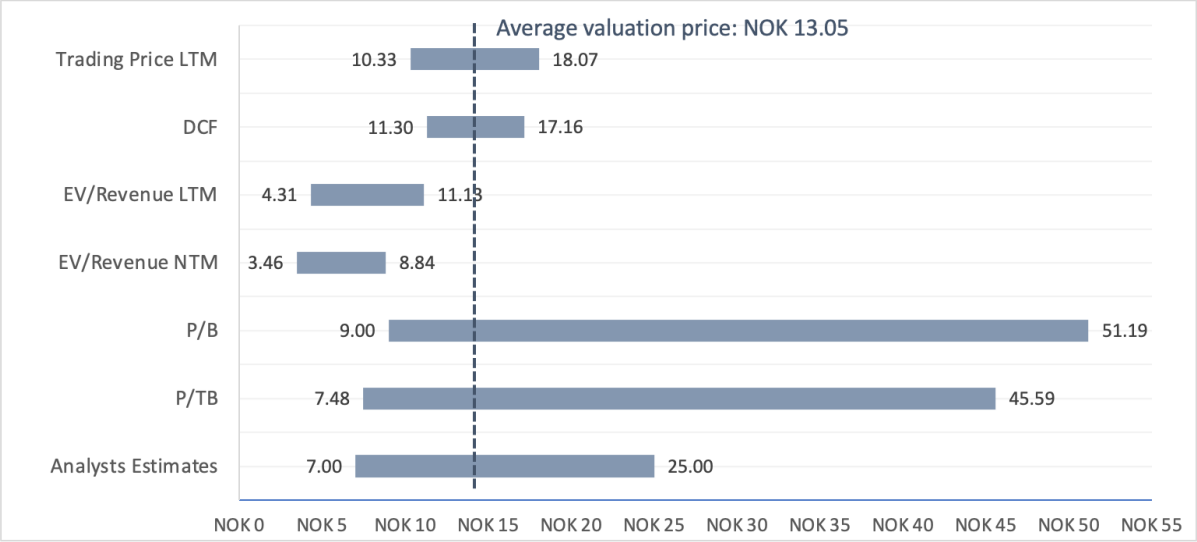

Figure 12: Nel Hydrogen Valuation "Football Field"
(S&P Capital IQ, no date (f); author)

The share price of Nel Hydrogen on the 30th of September 2022 was equal to NOK 12.10. Therefore, according to the valuation results of this thesis, with an estimated share price of NOK 13.05 the company has an upside potential of 7.87%. In other words, it can be

concluded that contrary to the general beliefs described in the Introduction chapter of this thesis (i.e., green energy stocks are claimed to be overvalued), the stock of Nel Hydrogen is undervalued by 7.87%. It comes from the valuation methods used in this thesis that aim to derive an intrinsic value of a company. In this case, the derived intrinsic value is larger than the market price at a given point in time, which indicates undervaluation. Overall, the mean values of all of the methods except the revenue multiples indicate that the share price of Nel Hydrogen is undervalued.

5 Conclusion

As a company operating in the renewable energy industry, Nel Hydrogen is subject to its general value drivers and responds to general growth trends. The main value drivers of the renewables industry that are also applicable to the green hydrogen sector are the cost of energy production, governmental support, and technology efficiency. The first one refers to the fact that energy produced from renewable energy sources was historically more expensive than the one produced from fossil fuels, however, over the last years the situation has improved to a point using green energy as the main power source would be more cost-efficient in certain cases. The second point indicates that the governments are significantly involved in the green energy sector as they are trying to achieve zero emissions goals. As a result, companies operating in this industry often get subsidies and other initiatives. The last point refers to the fact the technology used in the production and distribution of green hydrogen is relatively new and is rapidly developing, thus at this points the margins are very slim due to high R&D costs. From the growth perspective, based on multiple projections, the average growth rate for the green hydrogen business is expected to be 22.9% for the period from 2020 until 2050.

There were no specific approaches determined in the literature that could be used to value a renewable energy company. Real option analysis valuation method is often mentioned, but in the context of valuing investment projects, and not business as a whole. Generally, the value drivers are mentioned in a few papers on the green hydrogen industry, that were discussed in the previous paragraph.

Nel Hydrogen business activities comprise two areas of the green hydrogen segment: electrolysis and fuelling technologies. It is established as the largest electrolyser manufacturer in the world, as well as the leader in hydrogen fuelling technology. From the financial perspective, the company is generating an annual revenue growth of 18.81% over the last 5 years with this value expected to grow significantly in the nearest future. As a company that operates in a relatively young industry, it needs to invest a large percentage of its revenue in R&D and hiring new employees. This results in a narrow gross profit margin that consecutively leads to negative EBIT and Net Income, when other operating costs such as SG&A are included. However, according to the forecast, the company will be able to generate positive EBIT by the year 2029. Additionally, the company raised a large amount of cash through the issuance of common shares to sustainably fund its rapid expansion stage.

Finally, based on the DCF valuation method, the value of one share of Nel Hydrogen equals to NOK 13.58, while based on the relative valuation method it equals to NOK 11.47. When deriving a final share price, a larger weight is assigned to the DCF value, because the selected peer companies cannot be described as perfect substitutes due to the relatively young age of the industry and the companies being in varying maturity stages. As a result, the share price of Nel Hydrogen is assumed to equal to NOK 13.05. Considering that the market share price as of 30th of September 2022 was NOK 12.10, Nel Hydrogen has an upside potential of 7.87%. It indicates an undervaluation of the stock contrary to the beliefs and assumptions mentioned in the Introduction chapter that presume general overvaluation of green energy stocks.

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Appendix A: Peer Group SG&A and Other Operating Expenses

in EUR thousands	SG&A	SG&A / Revenue	OOE	OOE / Revenue
Plug Power	152,147	35.86%	60,899	14.35%
Ballard Power	32,045	36.25%	46	0.05%
PowerCell	6,809	43.24%	2,127	13.51%
Hexagon Purus	20,628	41.42%	24,143	48.48%
Energiekontor	20,053	12.81%	7,223	4.61%
Alfen NV	40,051	16.04%	12,953	5.19%
PNE AG	39,702	33.72%	10,342	8.78%
EIDF	17,063	4.03%	37,063	8.76%
Jinlei	7,987	3.71%	2,157	1.00%
Average		**17.03%**		**5.95%**

* OOE = Other Operating Expenses
** The values of green hydrogen peers are discounted because they incur similar high costs due to high growth in the relatively new industry

Table A: Derivation of Average Peer Group Value for SG&A/Revenue and OOE/Revenue (S&P Capital IQ, no date (d); author)

Appendix B: Stock Beta Derivation

Date	NEL (Adj. Close) EUR	NEL (Return)	STOXX Europe 600 (Adj. Close) EUR	STOXX Europe 600 (Return)
01/01/2017	1.99		360.12	
01/02/2017	2.83	0.4200	370.24	0.0281
01/03/2017	2.08	-0.2641	381.14	0.0294
01/04/2017	2.25	0.0813	387.09	0.0156
01/05/2017	2.12	-0.0575	389.99	0.0075
01/06/2017	2.29	0.0798	379.37	-0.0272
01/07/2017	2.58	0.1261	377.85	-0.0040
01/08/2017	2.39	-0.0734	373.88	-0.0105
01/09/2017	2.68	0.1231	388.16	0.0382
01/10/2017	2.78	0.0372	395.22	0.0182
01/11/2017	3.05	0.0968	386.69	-0.0216
01/12/2017	3.33	0.0915	389.18	0.0064
01/01/2018	3.04	-0.0862	395.46	0.0161
01/02/2018	3.12	0.0256	379.63	-0.0400
01/03/2018	2.98	-0.0460	370.87	-0.0231
01/04/2018	2.77	-0.0697	385.32	0.0390
01/05/2018	3.12	0.1260	383.06	-0.0059
01/06/2018	3.18	0.0198	379.93	-0.0082
01/07/2018	3.23	0.0144	391.61	0.0307
01/08/2018	3.57	0.1065	382.26	-0.0239
01/09/2018	3.87	0.0828	383.18	0.0024
01/10/2018	4.31	0.1163	361.61	-0.0563
01/11/2018	4.63	0.0736	357.49	-0.0114
01/12/2018	4.61	-0.0052	337.65	-0.0555
01/01/2019	5.58	0.2097	358.67	0.0623
01/02/2019	5.31	-0.0475	372.80	0.0394
01/03/2019	5.82	0.0951	379.09	0.0169
01/04/2019	7.24	0.2451	391.35	0.0323
01/05/2019	7.98	0.1015	369.06	-0.0570
01/06/2019	6.92	-0.1323	384.87	0.0428
01/07/2019	6.97	0.0072	385.77	0.0023
01/08/2019	6.77	-0.0287	379.48	-0.0163
01/09/2019	8.33	0.2297	393.15	0.0360
01/10/2019	7.94	-0.0462	396.75	0.0092
01/11/2019	7.93	-0.0019	407.43	0.0269
01/12/2019	8.65	0.0915	415.84	0.0206
01/01/2020	9.18	0.0607	410.71	-0.0123
01/02/2020	9.65	0.0518	375.65	-0.0854
01/03/2020	10.35	0.0725	320.06	-0.1480

01/04/2020	12.63	0.2198	340.03	0.0624
01/05/2020	14.96	0.1850	350.36	0.0304
01/06/2020	18.85	0.2600	360.34	0.0285
01/07/2020	18.67	-0.0098	356.33	-0.0111
01/08/2020	21.30	0.1412	366.51	0.0286
01/09/2020	16.96	-0.2038	361.09	-0.0148
01/10/2020	18.08	0.0660	342.36	-0.0519
01/11/2020	24.41	0.3501	389.36	0.1373
01/12/2020	28.96	0.1864	399.03	0.0248
01/01/2021	30.76	0.0622	395.85	-0.0080
01/02/2021	25.22	-0.1801	404.99	0.0231
01/03/2021	25.19	-0.0012	429.60	0.0608
01/04/2021	24.18	-0.0401	437.39	0.0181
01/05/2021	18.10	-0.2514	446.76	0.0214
01/06/2021	20.08	0.1094	452.84	0.0136
01/07/2021	16.89	-0.1591	461.74	0.0197
01/08/2021	14.29	-0.1540	470.88	0.0198
01/09/2021	13.07	-0.0854	454.81	-0.0341
01/10/2021	17.83	0.3647	475.51	0.0455
01/11/2021	18.97	0.0639	462.96	-0.0264
01/12/2021	15.21	-0.1982	487.80	0.0537
01/01/2022	11.90	-0.2176	468.88	-0.0388
01/02/2022	16.01	0.3458	453.11	-0.0336
01/03/2022	14.95	-0.0665	455.86	0.0061
01/04/2022	13.61	-0.0896	450.39	-0.0120
01/05/2022	14.63	0.0746	443.35	-0.0156
01/06/2022	11.97	-0.1819	407.20	-0.0815
01/07/2022	16.53	0.3815	438.29	0.0764
01/08/2022	14.71	-0.1104	415.12	-0.0529
01/09/2022	12.10	-0.1772	387.85	-0.0657

Table B1: Monthly returns of Nel Hydrogen and STOXX Europe 600
(Yahoo Finance, no date (a); Yahoo Finance, no date (b); author)

NEL		STOXX Europe 600	
Average Monthly Returns:	0.0384	**Average Monthly Returns:**	0.0020
Variance Returns:	0.0244	**Variance Returns:**	0.0019

Table B2: Average returns and their variance of Nel Hydrogen and STOXX Europe 600
(Author)

Covariance:	0.0018
Beta:	0.988224817

Table B3: Covariance and beta estimate
(Author)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.27371625
R Square	0.07492058
Adjusted R Square	0.06090423
Standard Error	0.1512287
Observations	68

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.12224595	0.12224595	5.34522598	0.02390849
Residual	66	1.50942783	0.02287012		
Total	67	1.63167379			

	Coefficients	*tandard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.03640068	0.01835956	1.98265564	0.0515709	-0.0002554	0.07305673	-0.0002554	0.07305673
X Variable 1	0.98822482	0.4274376	2.31197448	0.02390849	0.13481812	1.84163152	0.13481812	1.84163152

Table B4: Regression summary statistics
(Author)