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A valuation of Nel ASA

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A valuation of

ABSTRACT: Capital markets are increasingly paying attention to companies and investment opportunities that address the world's climate challenges. Environment awareness has become a driver for market value.

In Norway, several companies are shifting their business model to new industries. One of these industries is Hydrogen, which promises to store energy without any associated CO_2 emissions.

Nel ASA has been listed for close to a decade on the Oslo Stock Exchange, and during the last few years, it has been one of the fastest moving stocks on the market. This, despite a negative EBITDA and a significant need to raise capital from equity investors.

This paper addresses the fair valuation of Nel ASA. The analysis herein finds that the market value of equity, when taking to account the risks associated with the business, is substantially lower than its current trading price of 18 NOK per share.

TABLE OF CONTENT

1. Introduction

Finance and valuation are interesting fields of study, and a topic I chose in order to gain a deeper understanding of a company's financial structure. Valuation of a hydrogen company caught my interest as the industry is in high growth, popular amongst investors and has an environmental aspect. The latter has become more and more relevant, as public opinion and political demand is driving change in several industries.

With the green agenda as a booming megatrend throughout the world, one is seeing change across industries. Not just communicatively, but actual transformations are being implemented in the value chain in order to reach a more sustainable future. Businesses are experiencing both political and public pressure to implement more environmentally friendly solutions. These entail more than just reducing CO_2, other common areas are air pollution and plastic pollution. The shift towards hydrogen could lead to significant impact, as it represents a carrier of energy that can be related to very low CO_2 output, as well as the combustion of hydrogen not leading to any toxic air pollution.

The increased focus on the environment has also led to several new companies, with their entire business model tapping into this new way of thinking. In combination with several years of strong capital markets, many of these companies are becoming listed companies on stock exchanges, and investors are increasingly paying attention to ESG metrics when evaluating firms. Several of these companies are growing at rapid speed in terms of market value, while the actual ability to deliver positive cash flow is non-existent. Diving deeper into such a business and understanding what the real drivers for market value growth are, is an excellent exercise to further develop one's business acumen.

The skillset from my studies and from my professional experience are applied in this thesis. The outcome is valuable for those seeking to understand NEL and what the important drivers for growth are, but also the risks associated with a so called "growth" case. At the same time, this thesis has been a learning exercise teaching me about both the hydrogen industry and business risk.

A valuation of NEL is time relevant because the company holds a high market value compared to its profitability, and a hypothesis is that the company valuation "lacks" a fair risk assessment. At the same time, the company represents a new industry that is deemed alfa-omega if the world shall reach its climate goals.

A. Problem Statement

This thesis will assess Nel ASA (hereafter NEL) from the perspective of a marginal equity investor, with the aim of estimating the fair value of equity as of 30/04/2021. This will be done through the application of various valuation methods, and a thorough strategic analysis of NEL and the hydrogen industry.

What is the intrinsic equity value for a marginal investor in Nel ASA as of 30/04/2021?

By answering this question, the thesis may add value to both current marginal investors and those who are contemplating an investment. This is done by offering an unbiased opinion, based on high-level competency of business strategy and finance, acquired through a master's degree at NMBU.

In order to answer the above problem statement, a range of sub-questions must be answered. Each section of this thesis is linked to various sub-questions that ultimately leads up to the main problem statement. The findings and answers to each sub-question will be addressed in their relevant section, and combined they will support the answer to the main problem statement of this thesis.

Presentation of Company and Industry

It is critical to assess the overall business in which NEL operates and its industry. The thesis must "understand" and present the value chain of the hydrogen industry, as well as the full business environment in order to assess the fair equity value. The below sub-questions are important first steps in defining the relevant value drivers of NEL and are critical for the following analysis sections. The following sub-questions will be addressed in this section of the thesis:

- What characterizes NEL's current business model and strategy going forward?
- What characterizes the industry in which NEL operates?
- Who are NEL's typical clients?
- What type of firms can be characterized as NEL's competitors?

Strategic analysis

To assess a correct fair value of NEL, the non-financial drivers that impact the company will be evaluated. The thesis will analyse how external factors affect NEL today and what developments can be expected, together with an evaluation of the internal factors and how NEL is positioned today to gain further momentum in the future. Three frameworks will be applied, well grounded in academia, to assess the full external and internal business environment. The following questions will help guide the strategic analysis of NEL:

- How does the supply chain look like today, and what development may take place that affect the value of NEL, as hydrogen becomes more commercialized?
- Which macro factors currently affect the hydrogen industry, and how can these factors impact NEL in the future?
- Does NEL hold a sustainable competitive advantage?

Financial analysis

The financial components of NEL will be broken down in order to assess the historical performance. It is important to emphasize that historical performance is not a precondition for future results, but in the case of NEL it is important to understand what the financial situation is, and what it is compared to peers. This may give some indications as to what can be expected for the future, but it is critical that subsequent forecasting is directly linked to the non-financial drivers as well.

- How has the financial development been for NEL compared to its peers since 2016?
- What have been the financial effects of a strong sales growth?

Forecasting

This section combines the knowledge gained from the strategic and financial analysis, in order to set realistic expectations for NEL's future development. The subsequent valuation will be based on the forecasting of cash flow. Therefore, it is essential that the assessment is highly accurate in implementing its findings into the valuation frameworks. Failing to do so will quickly result in under- or overestimation of NEL's fair value.

- What is the expected market outlook for the hydrogen market and how is NEL expected to perform?
- How will the cost structure of NEL develop up until the company reaches a steady state?
- When will NEL reach a steady state for revenue growth?
- Is future growth contingent on changes to NEL's balance sheet and CAPEX?

Valuation

A plethora of valuation models exist, that could be relevant when assessing a company like NEL. This thesis will mainly apply models with a basis on financial performance and present value estimation. In order to calculate the present value, the thesis must estimate a fair risk adjusted discount rate. The following sub-questions will be answered in this section:

- What is the fair discount rate to apply when evaluating NEL?
- What are the forecasted free cash flows from operations, up until NEL's steady state?
- What is the expected market value of NEL's equity?

Sensitivity analysis

The thesis acknowledges that just as much as a valuation exercise can be extremely precise, it can also easily result in an unfair valuation. Simply put, the level of analytical understanding and ability to convert non-financial factors into a financial forecast is not an exact science. Therefore, it is important to test the sensitivity, not just against single parameters, but also against changes in multiple parameters simultaneously. This section will answer the following sub-question:

- How sensitive is the valuation to various drivers and forecast assumptions, both individually and in combination?

B. Methodology

The paper applies an assortment of theoretical frameworks, models and sources in its pursuit to define a fair value of equity for a marginal investor in NEL. The understanding and application of external resources must however be done with a critical eye. By applying multiple sources for similar analytical input, one may avoid or minimize potential biases associated with public information from a multitude of sources. In essence, the paper follows a "post-positivistic" mindset (Tracy, 2012, pp. 39-40).

Theory

The theory applied throughout this thesis is presented in the section in which it is applied. The rationale for this is a paper that flows naturally and logically between the theoretical and practical application. Furthermore, the thesis assumes that readers are comfortable with financial and economic terminology. All theory and external resources are referenced through the Harvard Anglia format, and a full list of references can be found in on page 76.

Data Collection and criticism of sources

The thesis is written from the perspective of a marginal equity investor, and as such only publicly information is applied. The paper will take into account both qualitative and quantitative data from annual reports, industry research and academic research papers etc. The importance of critical thinking in regard to data quality, both related to data gathering and presentation, has been emphasised (Rienecker & Jørgensen, 2011, p. 248). This is important because public information may be biased and fuelled with personal agendas. The thesis has sought to diminish such bias by looking to the original sources, and by analysing and gathering insights from a multitude of sources.

For example, much information in this thesis is gathered from NEL's annual and quarterly reports. NEL is not an unbiased source of insight, as the company may have several agendas luring behind its corporate communication. At the same time, the risk of false information is low as NEL is a listed company, and must adhere to both general accounting standards and regulations set forth by the exchange. Nonetheless, it has been deemed appropriate to remain critical when analysing information published directly from NEL (Rienecker & Jørgensen, 2011, p. 291).

The analysis of the hydrogen industry is largely based on quantitative and qualitative data from NEL, various competitors, research institutions and industry organisations. These data include expectations regarding market growth, as well as insightful information as to the potential pitfalls and risk climate. Other sources, such as policy-papers from the EU and research papers, confirm much of the information gathered from NEL and the Hydrogen Council, and this thesis therefore places a high degree of comfort in the validity of these reports.

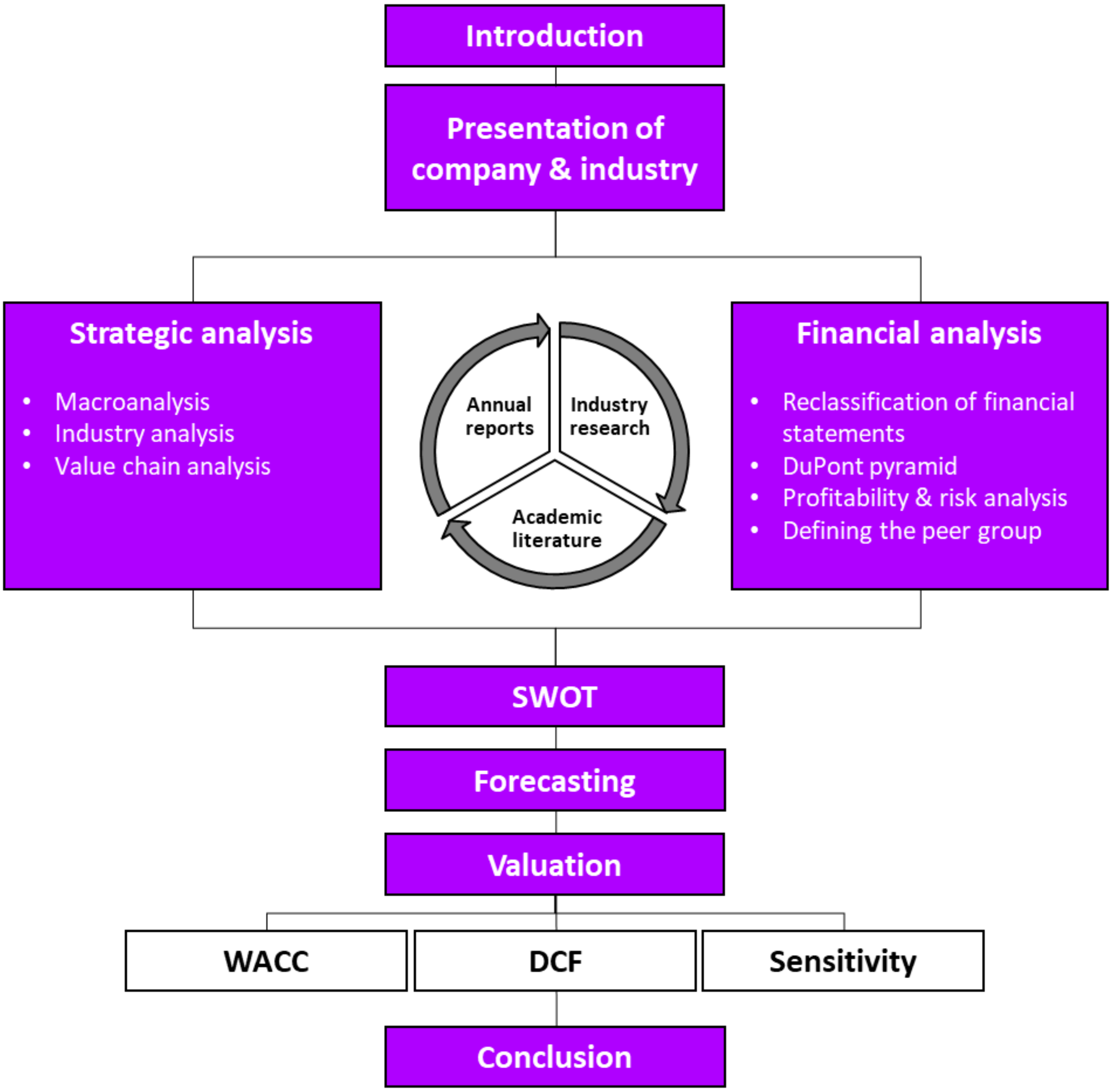
Data relating to the defined peer group has been gathered through their respective annual and quarterly reports, as well as gathering stock quote data from financial data banks such as yahoo and google finance.

Other sources applied in this thesis relate to the information from various non-governmental organizations, accompanied by a wide assortment of financial literature.

C. Research Structure

The structure of this thesis is based on the defined sub-questions and the methodology. In total, the thesis comprises eight sections. Each section will add to the following section by linking the different analyses and findings. The applied thesis structure will support a consistent approach linked to the overall problem statement.

Figure 1.1: Research Structure



Source: own compilation

D. Delimitation and Assumptions

Due to the vast array of factors which could have a potential impact on the equity value of NEL, the thesis must make certain delimitations and assumptions. The following list gives an overview of the natural limitations of this paper.

- The thesis is constrained to applying public available data and information only.
- The financial analysis will be based on the historical period of five years, from 2016 up until 2020.
- The cut-off date for the equity value estimation is set to 30/04/2021. This cut-off date applies to all information applied in this thesis, meaning that no publicly available information published after the cut-off date will be taken into account.
- Annual reports are not fully comparable across companies, and in this case, NEL's peer group. Different accounting standards and accounting periods may complicate the ability to make justifiable comparisons. This may have an effect on the peer group analysis, but is assumed to be negligible
- The thesis assumes that NEL will not conduct M&A activity going forward, but rather grow organically. This is a practical assumption for the thesis, and is deemed rather unlikely, as the hydrogen industry is fragmented and in its infant stage.
- Some analytical and insightful material might be presented through appendices. Such material is deemed insightful, but not critical, for this thesis ability to answer the overall problem statement.
- The factors analysed in the strategic analysis represent those which objectively are deemed most critical to understand value creation in NEL, unknown factors which may play an important role in the future are always a possibility.
- Furthermore, this overview represents the most critical assumptions. The thesis will present other assumptions deemed relevant and applicable.

2. Presentation of company and industry

NEL has its origin in 1927. The company was part of Norsk Hydro, a larger Norwegian company, which in 1927 ventured into hydrogen production as part of its fertilizer business. During its lifetime, NEL has been part of several large Norwegian companies. In 1993 the manufacturing of electrolysis was shut down with the remainder of the business unit being sold to Statoil. In 2011 Statoil sold its hydrogen business to a group of professional investors, and as part of the transaction the company was renamed to Nel Hydrogen. By 2014 Nel Hydrogen went bankrupt, but was acquired by Diagenic in what can best be described as a professional financial takeover (Diagenic was a pharmaceutical company with no operational need for hydrogen technology). Diagenic changed its name to Nel ASA.

Since 2014 NEL has been a listed company on the Oslo Stock Exchange with a mission to deliver optimal solutions to produce, store and distribute hydrogen from renewable energy (Nel Hydrogen ASA, 2021).

A. Presentation of NEL

Today NEL manufactures systems for electrolysis as well as storing and distribution stations (hereafter "fuelling stations"). Its client base is varied as they serve industry, energy and gas companies. For example, NEL sells its electrolysers to power companies producing electricity. Such companies apply electrolysis to convert produced electricity into hydrogen, especially relevant when there is a surplus of electricity which otherwise would be lost or sold at a low price. Another client example is Nikola, which is a company that manufactures heavy-duty hydrogen vehicles (lorry-trucks) and wishes to build a network of fuelling stations. The latter can be compared to Tesla which in addition to manufacturing electrical cars also operates a network of charging stations. A third client type is industry. These are companies that implore hydrogen as part of its production. For example, the fertilizer industry might need hydrogen for their production setup.

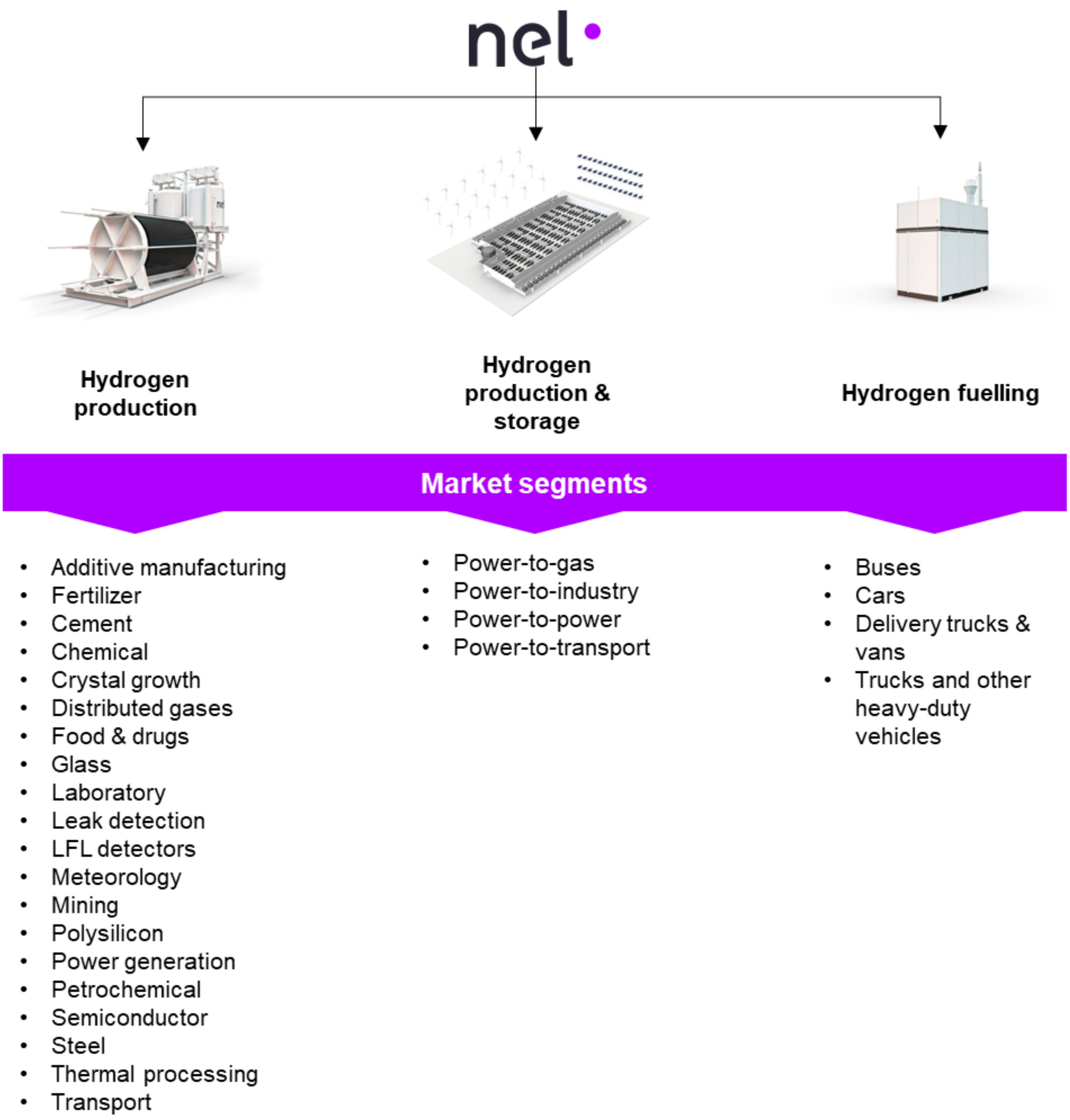
The systems offered by NEL are highly technical, to some extent proprietary. Their patent portfolio is varied, both for its electrolyser technology and for its fuelling station systems.

NEL is a leading supplier of its product portfolio with a long historical record, and has sold its systems across more than 50 countries.

Business model and strategy

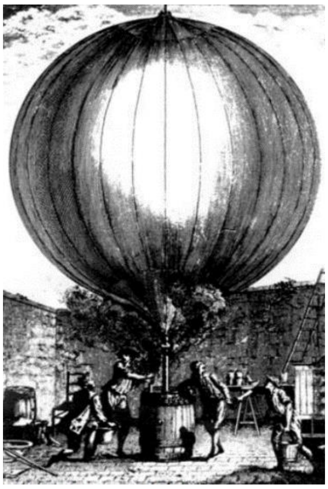
As mentioned NEL operates primarily with two segments, hydrogen production and hydrogen fuelling systems. Several industries are in demand for hydrogen and systems that enable them to produce, store and distribute hydrogen. For NEL, a key part of its on-going strategy is to improve the cost associated of manufacturing and utilizing these systems. Key factors herein, is scaling the production systems in size, in order to deliver systems that can produce hydrogen at a comparable cost to fossil fuels, thereby enabling mass market application.

Figure 2.1: NEL's Business Model



Source: own compilation based on data from Nel ASA

B. Presentation of the Hydrogen Industry



In 1774 hydrogen was discovered. It took seven years before hydrogen was burned, with the result of only obtaining water (Anon., 2021). Two years later, in 1783, the first balloon was filled with hydrogen, approximately 25 m^3 of hydrogen was needed. One of the value propositions of hydrogen as a fuel, is the fact that hydrogen is the lightest element in the periodic table. The energy per kilo is thereby significantly higher than other means of energy storage. The fact that hydrogen, to this day, continues to be a topic of interest and research is therefore fully understandable. Yet, 247 years after its discovery, hydrogen is not as widespread in application as one might had hoped.

Still, the application for hydrogen is extensive in today's world. The chemical industry applies a large part of the global hydrogen production, in order to synthesise ammonia which is used for fertilisers and various plastic materials (Anon., 2021). Another large consumer group of hydrogen is oil refineries, which apply it in order to separate sulphur, nitrogen and other impurities.

In later years, as hydrogen technology has improved its efficacy, the application of hydrogen as an energy carrier has attracted more attention. Most of the hydrogen industry growth is expected to come from this new market segment. The combination of an ever-increasing demand for energy, driven by population growth and continued industrialisation, and the fact that the world needs to transmission to more CO_2 friendly energy sources, has fuelled strong growth in hydrogen related businesses.

The hydrogen industry consists of a wide assortment of companies. From companies that manufacture systems which enable hydrogen production or fuelling like NEL, but also companies that deliver sub-components to these systems, and hydrogen transportation. In addition, there are companies developing/producing end-products that utilize hydrogen as an energy source.

Today there are three main methods of producing hydrogen: 1) natural gas reforming, 2) natural gas reforming with carbon capture and 3) water electrolysis. NEL is focused on hydrogen production through water electrolysis. These three methods are often referred to as *Grey*, *Blue* and *Green* hydrogen respectively. Where Grey hydrogen is associated with a high emission of CO_2 and Green hydrogen is associated with low or no CO_2 emissions.

Understanding the different classifications of hydrogen is an important starting point when seeking to understand the industry dynamics.

The majority of today's supply of hydrogen stems from what is referred to as Grey hydrogen. A small fraction of the hydrogen is supplied through Green and Blue methods. The growth projection for the industry, which impact NEL, is twofold. For one, it is expected that the overall demand for hydrogen will increase drastically. Secondly, it is expected that Blue- and Green hydrogen will represent a growing fraction of the total supply and demand.

One foundational criterion for growth is first and foremost that hydrogen production reaches a cost-parity with fossil fuels. Secondly, this must happen for production methods that lead to low or zero CO_2 emissions.

The Blue Hydrogen approach is based on continued hydrogen production by utilizing energy from natural gas. Most of the players taking this approach are companies currently in the oil & gas business. In simple terms, this is the approach of current market leaders that currently supply Grey hydrogen. They are researching the possibility of capturing the CO_2 before emission and storing it, thereby being classified as "clean" hydrogen.

The Green Hydrogen approach entails using electricity and water electrolysis in order to produce hydrogen. For the last decade energy companies have invested more and more into solar and wind-based energy production. These industries see hydrogen as a storage and means of transferring their produced energy to other markets, and not just directly into the electrical grid.

The introduction of hydrogen as a more commercial fuel is a direct and concrete solution to much of the environmental dilemmas associated with CO_2. Such a shift could change much of the energy industry. In such a world the oil & gas industry will come closer to the power industry increasing the competitive landscape.

The hydrogen industry is thereby ripe with companies that seek its share in the hydrogen economy. Some are seeking to take part in this shift while at the same time utilizing its existing energy reserves (ref. oil & gas industry). These companies are protecting its existing position, and one might question whether they would want the hydrogen economy to become reality later, rather than sooner. Companies operating with renewable energy see hydrogen as a means to compete with fossil fuels in markets that are energy intensive, but still, or to a large extent, operate on fossil fuels.

The following strategic analysis delves deeper into the industry and the market position of NEL

3. Strategic Analysis

The strategic analysis acts as the cornerstone and foundation for this thesis' ability to estimate a fair market value of the NEL equity. As a company, NEL is in early commercialisation. The value is defined by the ability to capture market share and build a strong position in the fast growing, but still uncertain, hydrogen market, both commercially towards its clients and backwards in its value chain. One of the key aspects is hence to understand the strategic possibilities for NEL on its road towards positive cash flows.

A. PESTEL

During the 1980's more academics started applying the PESTEL-framework, and today this is an outbred methodology applied in order to evaluate macroeconomic factors and their effect on for example an industry. In this paper the PESTEL-framework will help assess the hydrogen industry from a commercial, as well as a political perspective. The PESTEL-model consists of six areas of analysis; political, economic, social, technological, environmental and legal. This section will analyse the hydrogen industry based on its current state and the potential future development, and reflect on NEL's participation in the industry. The original structure of PESTEL will in this thesis be slightly altered, but only with the aim of increasing readability.

a. Political & Legal factors

The market for hydrogen is experiencing sharp growth, where part of the explanation is that there is a growing political demand for low carbon energy. The European Union has an ambition of becoming carbon neutral by 2050 (The European Union, 2021).

As mentioned in section 2 commercial hydrogen is often split in three categories: Grey, Blue and Green hydrogen. With the current political landscape growth is expected to come through the market of Green- and Blue hydrogen as these represent the low-carbon alternatives. For this shift to become a reality the cost must come down to market competitive levels. Governments and other political institutions can affect this in different ways, some being: increased taxation for high carbon energy, various subsidies for companies participating in the hydrogen value chain, research financing for universities and corporations focusing on hydrogen, and legislation that requires given industries to incorporate the use of hydrogen at a fixed or semi-fixed level. Some of the most significant developments, from a political perspective, affecting the hydrogen industry will be investigated below.

Most of today's hydrogen is characterized as "Grey". This production method entails CO_2 emissions, and is expected to represent a decreasing share of hydrogen production going forward.

Much of the rationale for this is CO_2 taxation. In Norway, the current tax for CO_2 emissions is around EUR 60 per ton. The tax has increased between two and ten percent per annum, thereby growing above inflation and pressuring the industry to emit less CO_2 (Bellona, 2021). In the Netherlands the CO_2 taxation was recently increased and will continue to increase to EUR 125 per ton in 2030. The same development is also likely to happen in Norway, where the most recent suggestion is to increase the tax from EUR 60 to EUR 200 (Bellona, 2021).

In order for hydrogen production through the methane steam reforming method to be exempt from CO_2 taxation, carbon capture technology must be implemented. This technology is not yet available at cost levels that enable the oil & gas industry to fully commercialize, and research projects are still undergoing. The EU holds carbon capture as an important part of becoming carbon neutral, and has a legal directive in place that aims to ensure rightful acknowledgement of carbon capture, as well as safety. Through the NER 300 programme, the EU has funded several projects. The initial fund size was 3 billion EUR for the development and implementation of carbon capture technology. The fund is now closed and issued around 2.4 billion EUR (The European Union, 2021). The fact that not all earmarked funds were distributed, indicate that the EU was not able to find enough "good" projects to invest in.

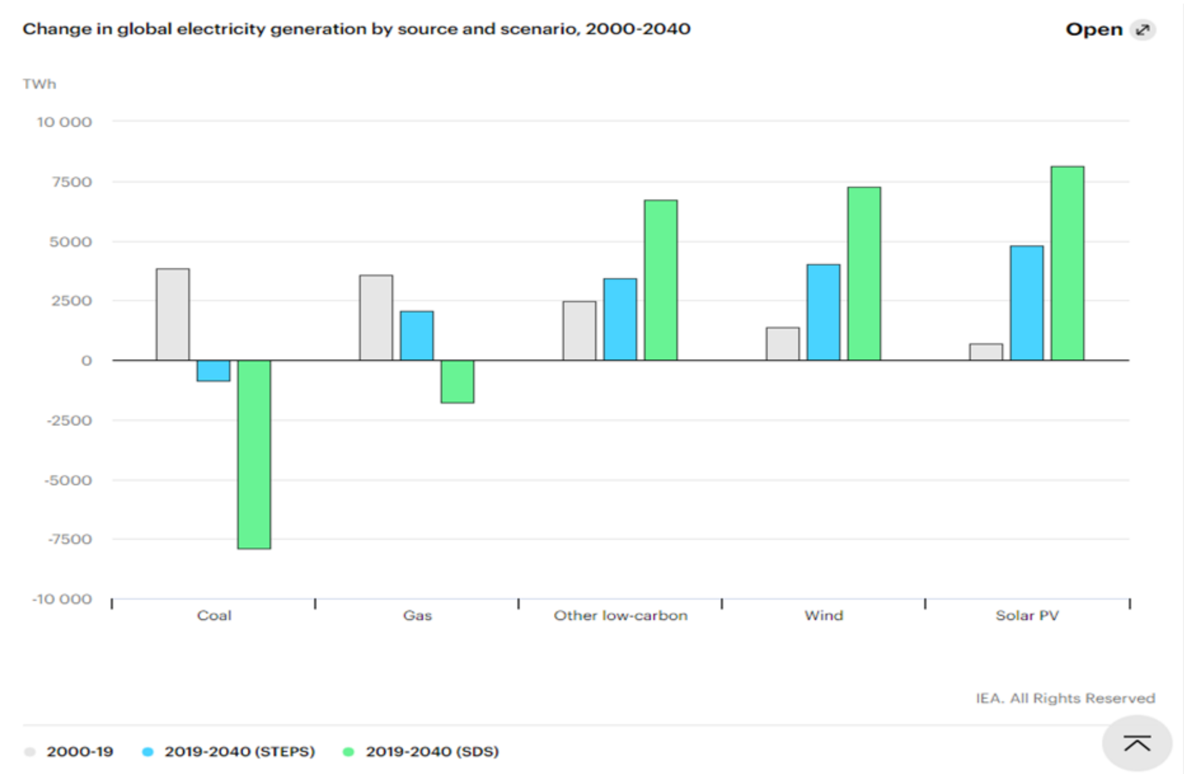
For the oil & gas sector carbon capture could be characterized as a "must win battle". Without it, their natural gas resources would lose relevance in a world that values low CO_2 emissions, and taxes the polluters to an extent that inherently makes their end-products too expensive for the market. Today, and for several decades, the oil & gas industry has developed, grown and profited from the world's increasing energy need. The industry has strong political pull across the globe, in some countries much of the industry is state owned (i.e. Norway and Arab states), and on a global scale the industry acts as an oligopoly through the OPEC. In Norway much of the oil industry is under state ownership, the "smooth" transition of this industry to a "greener" and more sustainable industry is therefore in the interest of the state. In some instances, this creates the possibility of legislation, research programmes and other initiatives that focus on carbon capture instead of other hydrogen production methods that are less dependent on natural resources which are held by the oil & gas industry.

From a political perspective there are powerful factors related to energy supply, which is defined geographically. It gives a small country like Norway, a bit more "say" together with countries strongly affiliated with OPEC. In a world where hydrogen is fully accessible, the natural resources are not as geographically defined, since electricity can come from a multitude of sources which are available for most countries (solar, wind, hydropower etc.) and the energy can be converted on-site, locally. In a fully scaled scenario, with efficient technology, regions can become self-sufficient. From a global political perspective and for multinational companies, this is a direct threat for their position, and it is interlinked with the current political power balance.

b. Economic factors

There are many economic factors affecting the scaleup trajectory for hydrogen. This section seeks to understand and lay forth the most important economic factors for the years to come. As NEL's business segments are focused on hydrogen from renewables, this section has a more specific focus on this segment.

Figure 3.1: Change in Global Electricity Generation by Source



Source: IEA, 2021

The IEA reports, in their 2020 energy outlook, on the expected future energy mix if the world is to develop according to the current policies and the sustainable development scenario. In both scenarios a decline in coal is expected, but the extent is highly variable. The strongest growth is expected for solar and wind, which is good for renewable hydrogen, as scalable renewable energy solutions with increased cost efficiency, should lead to more competitive production costs (International Energy Agency, 2021). An alarming factor is the reported pace of technological advancements, which are not on the trajectory needed to hit the targets set forth in the sustainable development scenario.

For renewable hydrogen to take centre-stage in the global energy market, more than political backing is needed. Renewable hydrogen must become the cost-effective solution relative to other energy alternatives. In this regard there is still some way to go. A recent study by McKinsey on behalf of the Hydrogen Council found that more than 300 billion USD will be invested in hydrogen towards 2030, almost 90 % of these investments are still at a preliminary study stage (Hydrogen Council, McKinsey & Company, 2021). Most of the investment are directed towards production and end-use application, while around 20 % is directed towards distribution of hydrogen (Hydrogen Council, McKinsey & Company, 2021). The number of projects is growing rapidly and a clear example of this is the fact that the projected production capacity in 2019 for 2030 was 2.3 million tons a year. Fast forward one year and the expectation is 6.7 million tons, a whopping +190 % increase in production expectations. Now, much of this growth in expectation stems from hydrogen projects that are at an early stage and therefore represent high uncertainty.

The hydrogen council expects that around 60 % of hydrogen will come from renewables in 2030. This represents a significant change from today's level. To reach this level, renewable hydrogen must as a minimum become cost effective relative to low-carbon hydrogen (methane reforming with carbon capture). This means that hydrogen production costs must come down from current levels. Members of the hydrogen council expect production costs to reduce by 60 % before 2030 (McKinsey, 2021). However, production costs for renewable hydrogen should decrease by another +50 % in order to be competitive with other hydrogen production methods, and this change is expected to happen gradually with an equilibrium in 2050.

The decline in production costs is driven by three main areas: 1) Reduced CAPEX for electrolysers, 2) Declining cost for renewable energy and 3) Increased utilization of electrolysers.

The current total production cost per Kg hydrogen in USD is around 5.4 for regional systems with wind energy as a source, while it is 3.9 USD pr. Kg when the energy source is solar. The difference is close to 40 %. The current difference between wind- and solar based systems is that the CAPEX associated with a solar based system is lower than a wind-based system, while the cost of energy is substantially lower from a solar based system. Both options are expected to experience reduced costs in CAPEX: for wind-based systems the expected reduction is 1 USD/Kg, while it is 1.6 USD/Kg for solar based systems. The main reduction for wind-based systems is energy cost which is expected to diminish by 1.9 USD/Kg, while it is 0.6 USD/Kg for solar. In total, the cost of renewable hydrogen production is expected to lie between 1.4 and 2.3 USD/Kg for solar- and wind-based systems respectively. The relative difference between the two systems is however increased to more than 60 % in favour of solar (McKinsey, 2021).

A large driver for cost reduction is CAPEX per USD/Kg. This is expected to be driven by increased electrolyser capacity and utilization. Current systems are associated with a cost of 1,120 USD/kW while expectations towards 2030 are that costs will reduce to around 230 USD/kW, implying an 80 % reduction

In addition, there are costs related to conversion and transmission, as well as distribution. Conversion costs are expected to lie between 0.5 and 3.5 USD/Kg, with the highest estimates related to international travel of more than 9,000 km. Distribution costs are expected to lie between 0.1 and 2 USD/Kg, with distribution by lorry representing the more costly alternatives. That puts the expected cost of hydrogen in 2030 somewhere between 2 and 7 USD/Kg.

To put the cost level into context, 1 Kg of hydrogen represents 33.33 kWh of energy and hence the cost per kWh is between 0.06 and 0.42 USD (Hydrogen Council, McKinsey & Company, 2021). The price per kWh for German households at the end of 2020 was 0.384 USD/kWh (GlobalPetrolPrices, 2021). Germany is a country with a high household cost per kWH, meaning that in many countries, even at a 2030 cost level, hydrogen will not be a cost-effective alternative to current energy sources. However, an interesting calculation is comparing the cost of hydrogen to that of gasoline. One litre of gasoline produces the equivalent of 8.9 kWh of energy (Natural Resources Canada, 2021), with a cost today between 1 and 2 USD per litre, the equivalent cost to 1 Kg hydrogen lies between 4.25 and 7.5 USD/Kg. Making hydrogen a cost-effective alternative.

The above example is of course only relevant if no significant changes are made to the cost structure of gasoline production and distribution. There could be both reduced prices and increased prices. The political backing for more environmentally friendly solutions dictates the latter, as CO_2 taxation could push fossil fuel costs upwards. According to the Hydrogen council and McKinsey, CO_2 taxation is expected to rise dramatically from 2030, making renewable hydrogen cheaper for end-users compared to methane based hydrogen without carbon capture, and affects the relative cost relationship between commercial hydrogen and fossil fuels in favour of renewable hydrogen.

Short summary: The main economic factors affecting the scalability of hydrogen are cost reductions related to production and transportation. Companies operating within hydrogen are expected to invest and develop more scale and effective systems. Furthermore, cost reductions are expected to occur throughout the value chain. Another important factor is infrastructure, mainly pipelines, which could increase the accessibility of hydrogen. Although there is political backing and financing, in the end, the industry must deliver cost reductions

c. Socio-cultural factors

The hydrogen industry is riding a mega trend. The mega trend is global warming which is at the global centre stage for public opinion. The Greta Thunberg phenomenon gave young generations a political voice and pushed further the environmental agenda, at least communicatively. In this regard, it is difficult to see socio-cultural factors negatively affect the continuous growth of hydrogen application. However, there are other aspects of hydrogen that can lead to, or is leading to, a negative public opinion. In particular the safety aspect, but also in regions where much of the economy is related to fossil fuels, one should expect some unrest as these industries lose market share to hydrogen which could result in increased unemployment.

In a world where cars and heavy-duty vehicles are fuelled by hydrogen, there will be a need for hydrogen fuelling stations. Several hydrogen stations already exist today, but numerous safety incidents have also been reported. Safety incidents are mostly related to hydrogen leakage, and some of these incidents have led to fire (Sakamoto, et al., 2018). Safety measures and regulations must of course be in place when hydrogen fuelling stations are to be further rolled out in the public space, but like many things, accidents can happen. Public opinion could affect such a roll out in the case of "safety fears". The incidents that have taken place are both due to mechanical errors such as leakage from joints and faulty sealage, but also from human error.

In 2019 a hydrogen fuelling station in Norway, just outside of Oslo, exploded (Dagens Næringsliv, 2019). The fire was controlled within hours, but two people needed medical attention, and the incident made national news in Norway. An immediate effect was that companies in Norway immediately shut-down other fuelling stations, and car dealerships selling hydrogen vehicles halted sales activity for a few days. Although not certain, it appears likely that such incidents have a negative impact on public opinion. Singular cases are to be expected, and there are several cases of fires and safety incidents regarding gasoline and diesel fuelling stations as well. Regarding the incident in Norway, the fault was an incorrectly mounted plug highlighting the severe effects of human error.

A public opinion study from Wales highlights the general public's lack of knowledge regarding hydrogen. The study goes through several focus groups with participants from the general public, and it is evident that public knowledge of hydrogen is low, both in terms of safety and in terms of environmental impact. The trust in government is mixed with some participants having strong belief in hydrogen as a "new" fuel if the government has approved it, while others remain sceptical.

Some draw a connection to hydrogen bombs and picture a world in which all cars may wreak nuclear havoc (Cherryman, et al., 2008).

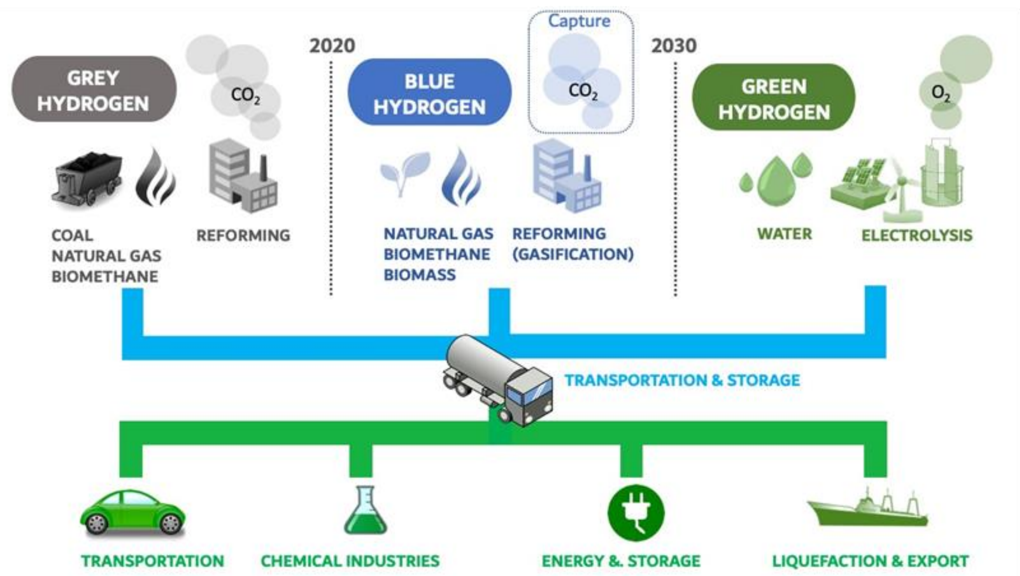
Socio-cultural factors could impact the scalability of hydrogen, both in a positive and negative manner. Politically there is a willingness and need to move towards a hydrogen future, and the main hurdles relating to hydrogen's public opinion are believed to be price of fuel and electricity, as well as safety, all of which appear manageable.

d. Technological factors

NEL is operating in a highly technical industry. Not just from direct competitors working with different hydrogen related solutions, but also from other energy solution providers. Since the final product is energy, whether it comes from hydrogen, solar or fossil fuels, it becomes crucial to understand the full spectre of the energy supply in order to understand the future prospects of NEL. This section seeks to understand the most relevant aspects of the energy landscape. The section is split into four parts: 1) Sources of energy, 2) Hydrogen production 3) Hydrogen storage, and 4) Hydrogen transportation.

Energy sources: There are many sources of energy that to some extent affects the market and industry composition of hydrogen. For example, existing infrastructure related to natural gas, and the gas itself, can be used for the production of hydrogen. Natural gas therefore becomes both a competing energy source to hydrogen, as well as a possible "raw" material in the hydrogen

Figure 3.2: Energy Sources



Source: Chem.4.us, 2021

production. Other energy sources can also be applied in the production process by utilizing the generated electricity in the process of electrolysis, which is a common method for hydrogen production.

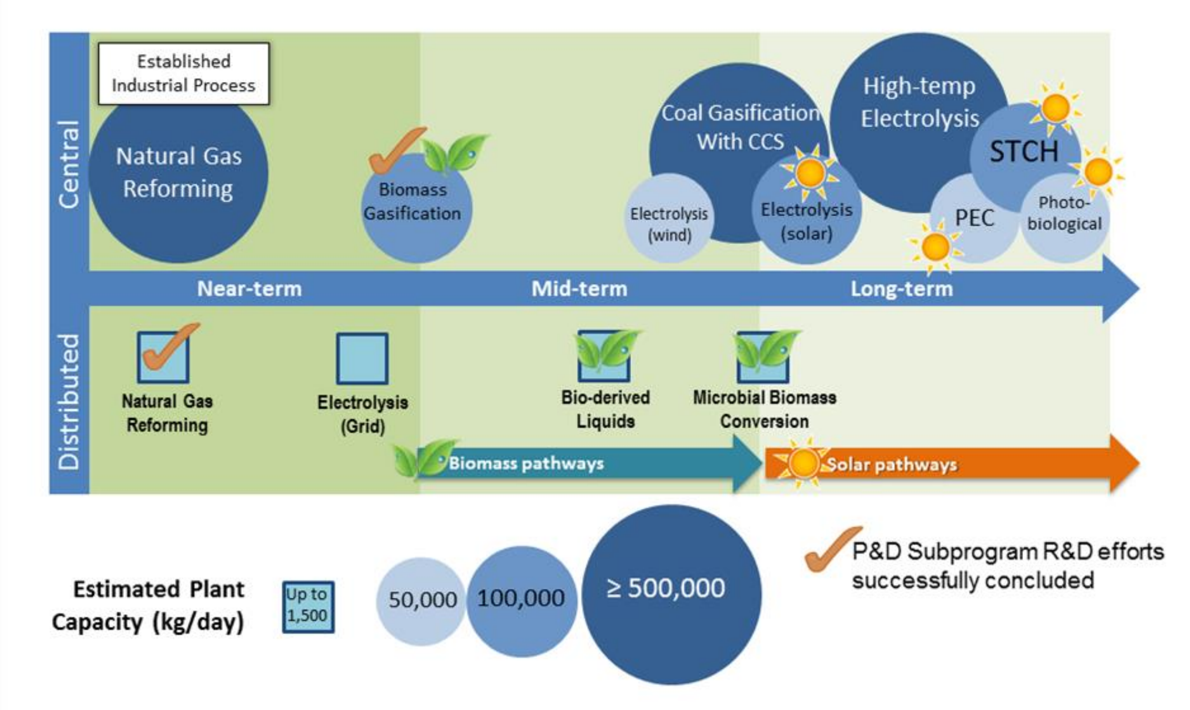
Through a thermal process it is possible to produce hydrogen with natural gas. Natural gas contains methane gas, and with this it is possible to apply what is called a steam-methane reformation (The U.S. Department of Energy, 2021). In the United States around 95 % of hydrogen is produced with this method (The U.S. Department of Energy, 2021). Globally, this method accounts for short of half of the hydrogen production (SINTEF, 2019). Indicating in large that the United States is far behind other countries in the "green" energy shift. Technological advancements related to carbon capture and storage are expected to affect the longevity of natural gas in the production of hydrogen. In the long run, hydrogen production is expected to come mainly from renewables, but natural gas is a steppingstone that can bring hydrogen to market faster today (The U.S. Department of Energy, 2021).

Hydrogen can also be produced by splitting water into hydrogen and oxygen. This process is done through electrolysis which applies electricity. The source of electricity can vary, but is expected to increasingly stem from renewable energy sources such as hydro, wind and solar. The more cost effective the electricity production becomes, the more cost effective the hydrogen production will be. Most renewable energy sources are variable, windmills generate electricity when there is wind, hydropower needs water movement to produce electricity, and solar cells produce electricity when there is sunlight. In common for all, is a need to store electricity during periods of surplus, and to convert energy into mediums that are more easily consumed. This could be batteries, or hydrogen for later application into heavy duty vehicles, ships etc.

From a technological point of view, the cost of energy and the production method is expected to experience strong development, both lowering cost, but also increasing the production capacity.

As mentioned, there are numerous ways of producing hydrogen. Natural gas and biogas can undergo a process of steam methane reforming, and electrolysis applies electricity to split water.

Figure 3.3: Established Production Processes



Source: U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy

The above figure illustrates the official opinion of the U.S. Energy Information Administration. In the near-term they expect that natural gas and electrolysis will represent most of the commercially produced hydrogen. Other methods are expected to enter the supply chain in the future. Amongst them are coal gasification with carbon capture and storage, as well as various other methods still in the R&D phase of commercialisation. The paper will not go into details as to how the various methods of hydrogen production operate, but some overview of the methods is important to note, as it directly relates to the future potential of NEL.

NEL has focused much of its operation on electrolysis. There are many facets to the future potential of electrolysis which are important to assess in order to arrive at a fair valuation of NEL:

1) Will electrolysis become the preferred production method for hydrogen?
2) What is the likelihood that other production methods will prove to be more cost efficient?

In the current climate there is much focus on hydrogen that is based on steam-methane reforming. It is a clear chosen method in the US, and the most widely applied method globally. However, strong growth is expected in other manufacturing methods, such as electrolysis. Mainly because these open the ability to utilize renewables as an energy source, and because the cost of electrolysis is expected to diminish significantly going forward.

As mentioned in the section regarding political factors, the global reduction of CO_2 output is a major driver of the expected growth in electrolysis. The steam-methane reforming method, which is the most prevalent today, can incorporate other technologies to stay relevant for a longer time period. One such technology is carbon capture and storage. By capturing CO_2 and storing it, the hypothesis is that the carbon-footprint is significantly reduced and hence the production method could continue to represent a large share of the hydrogen production. This could have a negative impact for NEL, as it could affect the growth rate of sales and put pressure on prices.

Carbon capture storage is a technology that has strong Norwegian ties. It is backed financially by the government, and according to SINTEF, the city of Trondheim is the global capital for this specific technology with much R&D activity being exercised in this area (SINTEF, 2019). The technology is heavily backed by large corporates in the oil & gas industry, such as Equinor, Shell and Total. In a scenario where renewable energy sources are not able to meet the total global energy demand, the world will continue to be dependent on oil & gas with a CO_2 output. If one at the same time wishes to meet the two-degree goal from the Paris accord, one needs to be able to significantly reduce oil & gas related CO_2 emissions. This creates a rather logical link from the technological environment to the economic circumstances.

NEL has a strong focus on electrolysis, and a strong growth is dependent on a strong growth in the commercialisation of electrolysis. The continuation of steam-methane reforming is therefore a potential hurdle for the growth trajectory of NEL.

Hydrogen storage: According to Hydrogen Europe there are several methods for hydrogen storage, but it can be segmented into two groups: physical- and material-based storage (Hydrogen Europe, 2021). In this section the two segments are introduced, in order to establish a basic foundational knowledge.

The most commercial and applied methods for storing hydrogen are physical based and in gaseous form (Hydrogen Europe, 2021). Physical based storage can be separated into three areas: 1) compressed gas 2) cold/cryo compressed and 3) liquid H_2. Liquid H_2 is a storage method that is in high demand amongst certain industries that require a high level of purity, but it is also a method that is significantly more costly.

The material-based storage alternatives are on the development stage and are not commercially relevant, as they are not economic and scalable. The material-based technologies can be separated into three categories: 1) hydride storage 2) liquid storage and 3) surface storage. Hydride storage seeks to apply heat, in order to incorporate hydrogen into elemental form together with a metal.

Liquid storage is a chemical binding method that works with N-ethylcarbazole and toluene (Hydrogen Europe, 2021). Surface storage technologies store hydrogen as a sorbate through adsorption in materials that hold high adsorption opportunities, this can be powders, nanotubes and crystalline to mention a few.

Hydrogen transportation: According to Hydrogen Europe there are several transportation methods existing today for hydrogen. A common method of storing is compressed gas which is held in gas cylinders. Such cylinders can be transported by truck, and therefore represent an easy transportation method utilizing available infrastructure. Another method for transportation is through pipelines which is deemed as the best transportation method should hydrogen become a large fraction of the energy supply. Some pipelines already exist for large scale hydrogen penetration within the energy market, these are mostly controlled by hydrogen manufacturers. Another variant of pipeline transportation is to utilize the existing natural gas pipeline network, in this scenario, the proposal is to mix hydrogen and natural gas during transport and then separate the gases at end-point (Hydrogen Europe, 2021).

Short summary of technological factors: Natural gas reforming and electrolysis is expected to remain the main sources of hydrogen production for years to come. Natural gas reforming is expected to become more environmentally friendly than it is today, when carbon capture is incorporated, but in the long run, the most environmentally friendly production solution is expected to be electrolysis drawing its energy from various renewables. Storage and transportation solutions exist, but not in the scale that is needed for hydrogen to take a position as a main energy/fuel source in the global market.

e. Environmental factors

Since 1990 the atmospheric CO_2 level has increased by more than 15 %. In 2019 the world emitted 35 billion tonnes of CO_2, to put that in perspective the level was around 20 billion in 1990. The Center for International Climate Research, other institutions and scientists have found it likely that global temperatures will rise between 4 and 5 degrees Celsius if no climate policies are undertaken. Current policies set a foundation for limiting the temperature increase to about 3 degrees Celsius, but much more is needed if the world is to diminish the upcoming impact of climate change.

During the UNFCCC in 2015, participating countries signed what is best known as the Paris climate agreement. In this agreement several countries committed to pursue emission reductions that will help the world reach a 1.5-degree Celsius target. Much can be said about the likelihood of reaching this target, as it requires dramatic changes in CO_2 output. One thing is for sure, there is political backing for solutions that reduce CO_2 emissions, and whether the bottom line is 1.5, 2, 3, 4 or even 5 degrees Celsius - the energy market is in for major changes over the next few decades.

In order to reduce levels of CO_2, it is crucial that the energy industry and the energy supply mix is moved away from oil and other fossil fuels, and into renewable energy sources. Hydrogen becomes an important part of this shift as it represents a way to contain and store renewable energy at a point in time that is significantly later than the time of production. Other strong reasons for hydrogen are that there are no emissions related to it at the point of combustion. Thereby, hydrogen could contribute to another environmental problem, namely air quality.

The growth projections for NEL and the hydrogen industry, is heavily tied with the political pressure towards cleaner and more environmental solutions. The evidence of the environmental problem that serves as the rationale for the energy shift is outside of the scope of this thesis.

PESTEL summary: There is positive political and socio-cultural pressure for a cleaner environment, and as of today, hydrogen holds a strong position in the political agenda for how the world will reach a net zero CO_2 output. The continued political pressure is a major driver for the overall business case for hydrogen. The main risks are associated with other alternative technologies and a failure to deliver on expected cost development.

B. Porter's Five Forces

Porters five forces framework was first presented in 1979 through the article "How Competitive Forces Shape Strategy" (Porter, 1979). Like the PESTEL-framework, porters five forces are meant to help analyse an industry, the difference however is that more emphasis is put on the company at hand's role in the given industry. All five forces are linked to a company's financial situation. This analysis will look at how industry drivers affect pricing, costs, and investment needs in relation to NEL's ability to attain and ascertain a sustainable competitive advantage. Hence, this section is important in assessing growth and profitability drivers which help estimate the fair market value.

The following analysis will be performed with respect to each revenue stream: electrolysers, fuelling and hydrogen solutions.

a. Bargaining Power of Supplier

NEL ASA is to some extent dependent on certain third-party suppliers. This is especially the case when it comes to electrolyser- and fuelling station components. Specific details are difficult to specify, but NEL states that it seeks a strategy of dual supply chains for all components (Nel Hydrogen ASA, 2021). It also states that in the cases of single source supply chains, there usually are alternative components serving the same need. The ambition of dual sourcing appears logical: reduce the dependency on specific suppliers. The fact that NEL holds this as a communicated strategy, likely means that NEL is dependent on some specific suppliers and in these cases the bargaining power is at best moderate and most likely low. This should come as no surprise; hydrogen technology is in constant development and the projected commercialisation and market growth is dependent on new innovation. A hypothesis is that NEL is dependent, and will continue to be dependent, on sourcing latest technologies that yield more efficient hydrogen system. Some innovations will come from in-house activities and through collaborative research projects between NEL, other market players, government institutions and academia, while some components may have to be sourced from those companies obtaining patents and know-how.

In an industry that is fast moving, technologically savvy and fuelled by intense investment globally, it is likely that several players will attempt to set their touch on technological and commercial development. Technologies that enable more cost-efficient electrolysers or safer fuelling stations should end up being highly sought after. NEL will in any case represent a strong company, with production capacity, that offers sub-components a fast ramp up. On the other hand, NEL has competitors and should expect to compete for patent rights, patent application agreements and exclusivity arrangements just to mention a few risk areas.

Such dependencies should be expected to pose a risk for NEL, and limit the possibility for dual sourcing. NEL operates with both alkaline and PEM electrolysers, in addition to fuelling systems, and it should be expected that sourcing risks could affect all business areas. In exactly what way, is difficult to predict, but new industries, rifled with technological advancements should expect for some technological dependencies to come up, as new standards may be set going forward, some even with patent protection.

Another important supply source is human resources with know-how related to system installation at client sites. In normal circumstances this resource is internal, and NEL controls the supply. However, during the on-going covid-pandemic, NEL has been forced to hire external resources. This has driven costs up and likely extended project timelines (Nel Hydrogen ASA, 2020). Currently the bargaining power of these suppliers should be categorized as high. NEL and its clients do not have the same manoeuvrability in terms of selection as there are global travel restrictions set by governments. In addition, there are several health & safety requirements that external suppliers must adhere to, all in all creating limitations which could reduce bargaining power.

b. Bargaining Power of Buyers

In the latest annual report from NEL, several clients and purchase orders are presented. These are: Lhyfe (alkaline electrolyser), Nikola Corporation (alkaline electrolysers and fuelling station), Everfuel (alkaline electrolyser), US Navy (PEM electrolysers), Iberdrola (PEM electrolysers), Iwatani Corporation of America (fuelling stations), Hydrogen Energy Network Co. (fuelling stations).

Three of these companies mainly operate as energy producers, however with varying types of energy sources. Lhyfe is a smaller company focused on regional energy production and conversion to hydrogen in France, all based on clean energy. Iberdrola is a large energy supplier owning and operating large energy infrastructure operations, but also with a strong sustainability approach. Meaning they focus on solar and wind. Iwatani mainly operates with natural gas (LPG and LNG). This showcases that the electrolysers from NEL are relevant for a wide array of energy companies.

The Hydrogen Energy Network is an EU initiative seeking to understand the potential of hydrogen on behalf of European energy ministries. The purchase order is likely part of a research project. Such order probably come with little bargaining power, as they are part of a larger project that also yields a strong reference case and "stamp of validity" for new technology offered.

Orders related to the military industry also bear some degree of research intention, and likely do not yield large volume orders in the short run. However, when military vehicles are hydrogen fuelled one should expect this business segment to really be of interest.

The Nikola corporation is often mentioned as one of the key customers for NEL, as they have a long-term agreement regarding the supply of electrolysers. Nikola is a company engaged in the production of heavy-duty trucks that run on hydrogen, in order to create this market, they are also engaged in setting up hydrogen fuelling stations.

The bargaining power between NEL and its customers is likely moderate. Most companies involved in hydrogen production equipment, actual production or manufacturing of vehicles that utilize hydrogen, share a common goal. They need hydrogen to play a more prominent role in global energy markets. A matured market for electrolysers is dependent on consistent demand upwards in the value chain. At the moment, few of these companies are profitable, there is a need to build up scalable infrastructure, and it would likely be counterproductive if one part of the value chain tried to squeeze profits to their short-term advantage.

c. Threat of Substitution

In most ways hydrogen is the threat of substitution in regard to other energy sources. As such the risk is that hydrogen does not come down at a cost that is enough in order to become the primary choice of energy storage, when comparing to fossil fuels. Given the precondition that the world needs to move towards more environmentally friendly energy, the threat is limited compared to fossil fuels as an energy storage.

There are other means of storing renewable energy which also are deemed as sustainable. Batteries is the most common rival. Should battery technology prove to be the main go-to for vehicles in the future, then the need for hydrogen will be limited. One of the benefits of batteries is that you can skip the step where you turn electricity to hydrogen, this step is inefficient and leads to energy loss.

However, hydrogen deliver some aspects that batteries do not: 1) With hydrogen, vehicles can travel a longer distance before having to be refuelled 2) Refuelling is a much faster process with hydrogen vs. batteries 3) A hydrogen motor probably holds a better longevity compared to a battery 4) Batteries requires a more complex recycling value chain 5) Batteries function well in warm climates, and less so in cold climates 6) With hydrogen the carry-load of any vehicles is less than a comparable battery driven vehicles (Cao, 2020).

One aspect is the threat of substitution of hydrogen as an energy fuel. Although the time to maturity for hydrogen is difficult to assess, the risk of substitution appears low. The risk of substitution might however be more related to the actual process of producing hydrogen and the systems NEL manufacture. A thought example would be that some players in the market develop a significantly more efficient method of water-splitting, potentially pushing NEL out of the market. In such a case NEL's products would become second tier, leaving NEL with few options: 1) Operate in the market with a less efficient electrolysis system 2) Invest heavily in developing their own upgraded system 3) Source patents that enable them to engage in the market with equally efficient systems. Given the fact that the hydrogen industry still is in its infancy stage, it seems unlikely that one or a few players would be able to exercise a monopoly situation. The hydrogen demand is surely much larger than the possible supply of hydrogen. Hence, there should be a market for multiple tier systems. Those with cheap energy supply might be less sensitive to the efficiency of an electrolyser, compared to those with more cost intensive energy supply. Should someone invent a new method that revolutionises the industry further, it is also likely that they would be willing to license the process as this most likely would benefit themselves, and because there never is a guarantee that the final and best approach is ever invented.

The risk of substitution is thereby deemed as moderate, both in terms of hydrogen and supporting infrastructure. The real risk is more likely related to when the hydrogen market reaches a steady state.

d. New Entrants

The risk of new entrants is likely high. There is some protection in terms of investments, given the fact that a company wishing to participate in the market for electrolysis systems and/or hydrogen fuelling systems need to undertake substantial investments. One aspect is the investment in intellectual property, and another is the investment in scalable and efficient manufacturing of these systems.

With that said, there are several companies operating with energy supply, for example the oil & gas sector. The success of hydrogen is most likely unilaterally related to a demise of the oil & gas industry. Hence, oil & gas companies represent a real threat as several of these might make a shift towards hydrogen production, services and equipment. These companies also hold a vast array of human capital that qualify for a shift towards the hydrogen industry. In addition, these companies have strong balance sheets and positive cash flows, which in turn enables them to invest in hydrogen. The obvious crux of these companies is that investments in the hydrogen market put their current operations at risk, and as such, they find themselves in a catch-22 situation. This might give other players, such as NEL, time to create a significant gap, thereby increasing the barriers to entry.

The risk of new entrants is believed to be high. Not just from the oil sector, but in general any company in the energy sector might find a profitable business case in hydrogen technology investments. The main question is how high the barrier to entry is when it comes to technical systems, such as electrolysis and hydrogen fuelling stations. These aspects are difficult to assess without uncertainty. This thesis concludes that the risk of new entrants is high if the industry is still in its high growth stage. When the industry reaches a steady state, the barrier to entry is likely much higher.

Other potential barriers to entry are related to legislation and government support. Some governments might have a stronger focus on building up the hydrogen industry and infrastructure, and companies operating from these countries might ascertain the barriers to entry as substantially lower than companies in other countries. The geopolitical situation is not expected to represent a high affinity for market change.

e. Competitive Rivalry

No player in the hydrogen markets holds a strong market leadership position. Buyers of either electrolysis or hydrogen fuelling systems likely operate with tenders. Meaning that most sales activity is in competition. Buyers of electrolysis systems will look at three main factors when assessing their business case: 1) What is the cost of our electricity supply 2) What is the utilization grade of each given electrolysis system and 3) What is the investment cost for each. Hence, systems with a lower utilization, but at the same time a lower investment cost might yield stronger business cases. The same goes for buyers with cheap and accessible energy who might not place a high value in moderate differences in utilization.

The business landscape is deemed to be highly competitive. Both in terms of actual cost and pricing, and in terms of technical quality. The fact that hydrogen is not a cost-competitive fuel in the first place, means that companies must focus on cost improvements. This is a known fact amongst clients and suppliers of electrolysis systems, and likely means that pricing will be kept at a minimum level.

f. Summary of the Five Competitive Forces

In conclusion, the main risk appears to be related to the time it takes for hydrogen to become a mature market and a cost competitive market (when assessing the full value chain). As NEL is operating with negative cashflows, there is a high risk that the company will not be able to survive indefinitely. The hydrogen market must continue its strong growth, and NEL must continue to be able to support the demand growth with technological relevant systems. The systems should improve the cost-benefit equation further, and here there is an unquantifiable risk that NEL is not the one leading such improvements. The company has communicated strong cost improvement goals. Third-party research and government strategies all rely on reduced cost and improved utilization as primus motors for continued growth, and enablers of a fossil free energy economy.

C. VRIO Analysis

In order to evaluate the long-term competitive situation for NEL, the thesis also applies the VRIO-model which is grounded in the "resource-based view" (hereafter referred to as RBV). The prior frameworks, PESTEL and Porters Five Forces, take industry into account when analysing NEL. The VRIO-model however takes NEL's resource accessibility into account when assessing the competitive advantage. According to RBV resources must be heterogenous and immobile in order to support a sustainable competitive advantage (Barney, 1991, pp. 105-106). Through the model, the thesis assesses NEL's resources in terms of value, rarity, in-imitable and organisation.

Barneys definition of a sustained competitive advantage is:

"*A firm is said to have sustained competitive advantage when it is implementing a value creating strategy not simultaneously being implemented by any current or potential competitors and when these other firms are unable to duplicate the benefits of this strategy*." (Barney, 1991, p. 102)

Figure 3.4: The VRIO framework

	Valuable	**R**are	**In**-imitable	**O**rganization
Tangible				
Intangible	Is the resource in demand?	Is it difficult to obtain?	Is it possible to copy the resource?	Is the organization in position to take advantage of the resource?
Capabilities				
Competitive landscape	Competitive parity	Temporary competitive advantage	Unexploited competitive advantage	Sustained competitive advantage

Source: own compilation based on (Barnley & Hesterly, Strategic Management and Competitive Advantage, 2006)

In this paper resources are defined as assets owned by NEL, together with information and knowledge, organizational processes, cultural characteristics and more. These resources are furthermore split into three categories: Tangible, intangible and capabilities.

Tangible resources are defined as financial, physical and technological assets, such as cash & cash equivalents, production facilities, raw material inventory and other assets befitting the description that are depicted in NEL's balance sheet.

Intangible resources are defined as human capital, brand recognition and NEL's ability to exploit its tangible resources.

Tangible resources

NEL holds several tangible resources. Mainly cash & cash equivalents, and production facilities. Cash positions are certainly tangible and valuable, but not rare. They do not lead to any form of sustained competitive advantage for NEL, but merely act as a means to operate and build a sustainable market position.

The main relevant tangible resources in NEL are production facilities. The company holds three production facilities: 1) Alkaline electrolysers are manufactured in Norway, 2) PEM electrolysers are manufactured in the US and 3) Fuelling stations are manufactured in Denmark.

In addition, NEL is investing heavily in increased production capacity of its alkaline electrolysers. The new facility is in Norway, and will likely become active from the summer of 2021 (E24, 2020). According to NEL the new facility will be the most modern and high-tech facility for electrode production in the world. The new facility will enable NEL to manufacture 12x their current capacity (Nel Hydrogen ASA, 2021). Furthermore, the facility will be highly automated and significant cost efficiencies are expected. In total, the expected investments in this new facility lie around 300 MNOK (Nel Hydrogen ASA, 2021).

Furthermore, in 2018, NEL completed the construction of the world's largest manufacturing plant for hydrogen fuelling stations, which holds a 300 a year capacity (Nel Hydrogen ASA, 2021).

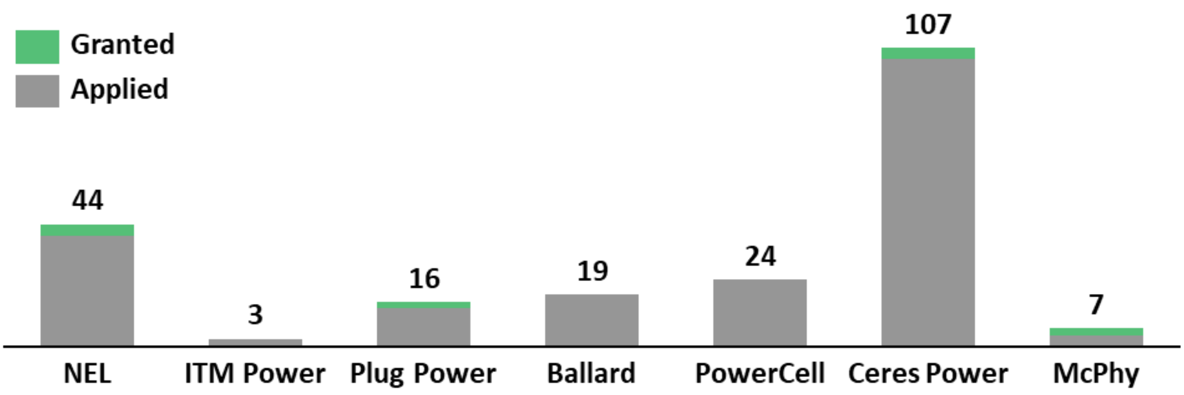
The manufacturing plants are key in order to reach cost-competitive hydrogen electrolysers and fuelling stations. They are both valuable and rare, but probably not inimitable unless the production systems are dependent on firm-specific intellectual property and knowledge. According to RBV this represents a temporary competitive advantage. This resonates well given the fact that the industry is in a growth stage and is not matured, since who can really know which companies are positioned for a sustained competitive advantage, until one or more companies are actually able to offer an end-product that is cost effective compared to batteries and fossil fuels?

Intangible resources:

The main intangible resource in NEL is its patent portfolio. As mentioned earlier in this paper the hydrogen industry in general must develop means of production and systems that enable a competitive production of hydrogen. This likely starts with how sub-components are developed, manufactured and applied in larger systems, such as alkaline and PEM electrolysers. The expectation is that new designs and technologies will lead to cost reductions. The end-goal is set, but how the industry gets there is a bit more uncertain. Different technological approaches might lead to competitive market terms for hydrogen, and the individuals, organizations or companies that develop the more cost-effective systems will most likely seek to protect their investments.

As mentioned in the section regarding tangible resources, although NEL holds a competitive advantage with its production facilities now, it will likely need to continue its development in order to set itself in a position for sustained competitive advantage. In this section, the focus is on NEL's patent portfolio as a proxy for NEL's ability to develop unique and firm-specific knowledge. Determining the value of NEL's patent portfolio is outside the scope of this thesis, and likely requires more expertise within the natural arts. However, patents tell a story of which way a company is focusing its R&D efforts, and granted patents tell, to some extent, whether a company is successful in its R&D activities.

Figure 3.5: Patent Statistics from 2018 - present



Source: own compilation based on data from Google Patents (2021)

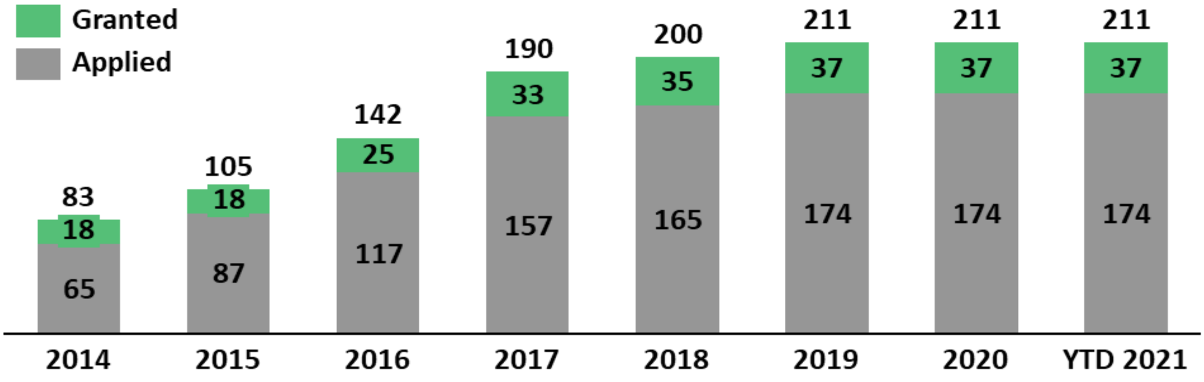
Looking at the patent applications since the beginning of 2018, for NEL and some of its competitors, one sees that NEL is the company with the second most applied patents, only topped by Ceres Power. The overview is created by finding all patent applications from each company, that include the same highlights related to electrolysis and hydrogen. When it comes to granted patents, NEL has obtained four grants since 2018, this is equal to Ceres Power. It is not possible to assess the quality of the entire patent portfolio with the above information. Patents are granted for +15 years, and one must look further back than 2018 to assess the totality. However, what the above numbers could indicate, is that NEL is able to go from research to granted patent. The number of applications also indicate that there is a high level of activity compared to its peers. The main rationale for not looking further back than 2018 is that, given today's market condition for hydrogen, the most important inventions and patents are more likely in front of us, and hence companies need to sustain R&D activities. The actual quality of the patents cannot be assessed.

The same keywords were also applied on a more general basis, in order to see which companies are the most active. The most active companies when it comes to patent activity are from Japan. There are also a long range of Chinese companies. One of the main risks for NEL and its peers, is that they are not the ones who will end up with the most cost-effective technology. With cost-levels being the proclaimed hurdle for continued scalability of hydrogen technologies, not being able to keep up in the cost reduction race would lead to competitive disadvantage and likely a subsequent exit.

Therefore, it could be perceived as a bit alarming that NEL has not applied for new patents since the beginning of 2020. This could be a direct result of the Covid19-pandemic which has led many to work from home, and hence limit the ability to work together with colleagues and research partners. This effect could put a delay on both research activity and on patent process activity. With a stagnation on both granted and applied patents the effect could be both.

The same trend for patent development is present for several other companies. With that in mind, it is difficult to ascertain whether the halt in patent applications is a firm-specific or industry trend. Nevertheless, in an industry where the consensus is that new technologies must be invented, it is either alarming that there appears to be a halt in patents, or it is a sign of a maturing industry. This might indicate that companies are focusing on scaling current technologies and optimizing cost.

Figure 3.6: Patent Statistics for NEL and Subsidiaries

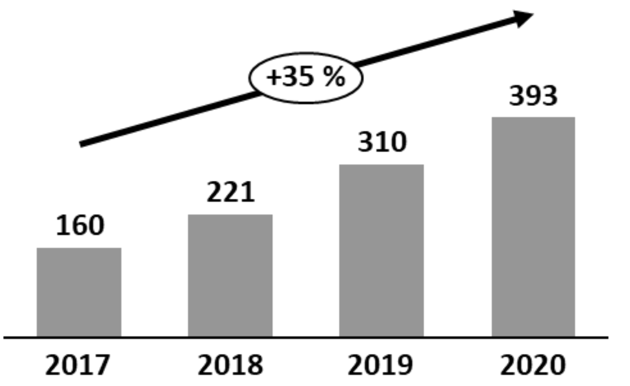


Source: own compilation based on data from Google Patents (2021)

Is the organization able to exploit?

If NEL holds a strong and valid patent portfolio, one may argue that NEL holds an unexploited competitive advantage. In order to set the stage for a sustained competitive advantage, NEL needs an organization that can take advantage of its resources.

Figure 3.7: Number of Employees at NEL



Source: own compilation based on data from annual reports (2018 - 2020)

Looking at the mere number of employees, it is clear that NEL has not landed a final organization. Organizations are "living" and subject to change. At NEL the annual growth in number of employees has on average been +35 %. The high growth is related to its production facilities and M&A activities. The acquisition of ProtonOnSite and the manufacturing plant for PEM electrolysers in the US, is a likely contributor to the employee growth from 2017 till 2018. The finalization of a new manufacturing site for NEL's fuelling systems in Denmark is the main explanation for the employee growth from 2018 till 2019. Much of the growth in employees in 2020, is attributed to the newest manufacturing facility in Herøya.

One of the most rapid growing costs for NEL is their personnel cost. The fact that this, to a large extent, is connected to production capability and the manufacturing sites, is natural and to some extent a cause of concern. This could indicate that NEL at the moment does not have the organization in place to fully exploit the potential of NEL's resources. If you need to grow personnel expenses by more than you are growing sales, then you are not yet scalable. The CEO of NEL has mentioned that the new manufacturing site for alkaline electrolysers will inhibit a much larger extent of automations, and that costs should go down (E24, 2020). In 2019 personnel expenses were 42.7 % of sales, and in 2020 it grew to 50.5 %. These are obviously levels that are unsustainable. For NEL to achieve a sustained competitive advantage, it needs to get a hold of its personnel expenses.

Summary: The main resources for NEL are believed to be its manufacturing sites and its intellectual property, to some extent these may be interconnected. These resources are valuable and rare, and are not easy to copy if patent protection is in place (unless you operate from China..). It is not believed that NEL holds a sustained competitive advantage at the moment.

4. Financial Analysis

The financial analysis will look into the historical performance of NEL compared to a peer group, which is also defined in this section. The peer group serves as a benchmark and is important in order to assess the performance of NEL in relation to its peers, all of whom operate in the same industry. In order to effectively compare NEL against its peers, this thesis conducts a reclassification of all financial statements from 2016 up until 2020. The reclassified statements are presented in appendix H.

The conducted financial analysis looks at the return on invested capital and its underlying drivers, as well as the profitability and credit risk. The analysis contributes to the evaluation of the short- and long-term liquidity situation, and is an important analytical addition to the thesis.

A. Reclassification of Financial Statements

The goal of reclassifying the financial statements is to increase the transparency, and better understand what drives value in NEL. In this thesis, the financial statements from 2016 until today have been reclassified, and act as a basis for the historical financial analysis. Since NEL is a company in its early stages, with large financial changes from year-to-year, the analytical value of analysing a wider historical window is believed to be low.

In order to fully understand and forecast NEL's future free cash flows, the thesis must seek an in-depth understanding of today's situation, understand the strategic environment, and the possibilities and pitfalls NEL might face in the coming years. Publicised financial statements are not necessarily consistent in format, and do not necessarily separate between operational & financial activities- and assets. It is believed that the value of the financial statements and the historical data which lies within these statements, will yield more analytical insight if reclassified, and will help understand the drivers for fundamental value creation (Petersen & Plenborg, 2012, p. 68).

The analytical income statement explained

The published income statements from NEL give a straightforward overview of the accounting items that are "operational", and those which are "financial". Nonetheless, some breakdowns are deemed necessary in order to improve the analytical value.

Operational expenses: There are three main sources of revenue; *fuelling*, *electrolysers* and *other*. However, it is not possible to correctly split the cost of goods sold per each revenue stream, and this has direct implications on the analytical value of the income statements, and the value of revenue forecast.

Operational expenses, which include cost of goods sold, can be split by the three revenue segments. Operational expenses are a combination of various fixed and variable administration & staff expenses, together with depreciation and cost of goods sold. To better understand the real differences across revenue streams, some financial engineering is applied. The depreciation is noted and split up by segments in the annual report, and can therefore easily be subtracted. The staffing and administration costs are not, these are assumed divided by the distribution of revenue.

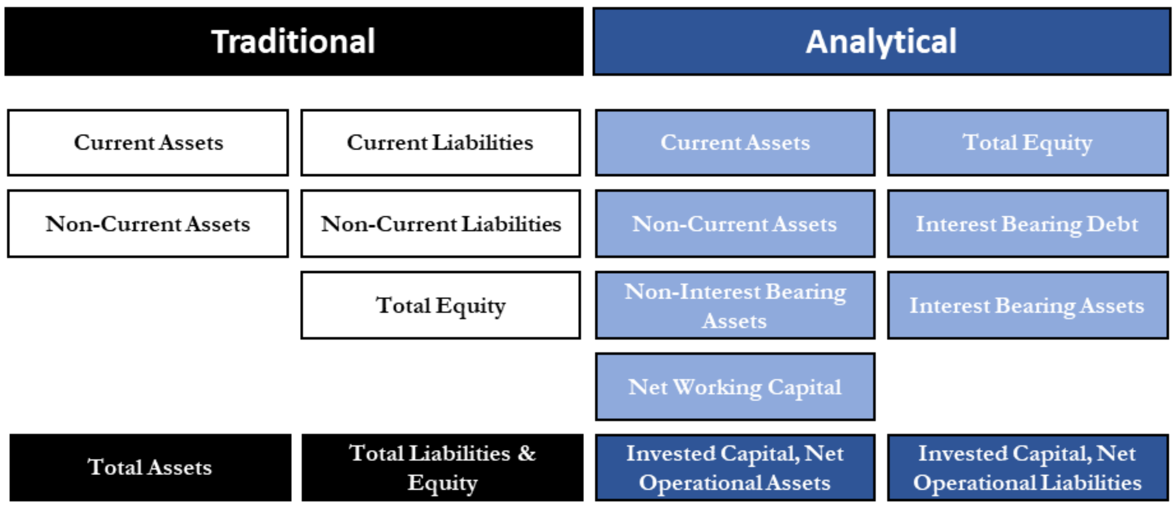
Income tax and tax shield: NEL has delivered a negative result for years, and hence the income tax is negative. For the analytical income statement, the NOPAT (Net Operating Profit After Tax) will be calculated. To do so, tax must be split by what can be linked to operational activities, and what is a result of financial activities. The split is calculated by assessing the tax advantage generated from NEL's financial expenses. The tax advantage is then subsequently added back to EBIT (Petersen & Plenborg, 2012, p. 73).

$$Tax\ advantage\ =\ Tax_{rate} * Net\ Financial\ Expenses$$

The analytical balance sheet explained

The thesis has analysed the annual reports from 2016 and onwards. The balance sheet, as reported together with a detailed understanding of the balance sheet items (by carefully studying the notes), allows for a more accurate division between the "operational" and the "financial" items. This exercise allows for an understanding of NEL's invested capital.

Figure 4.1: From Consolidated to Analytical Balance Sheet



Source: own compilation

Current & Non-current assets

All items in the consolidated balance sheet, except for cash & cash equivalents, are deemed "operational". Hence, they constitute part of the "net operational assets" in NEL. Cash & cash equivalents are deemed interest bearing, and in the analytical balance sheet NEL's items related to non-current financial assets are mostly related to shareholdings in other companies, such as Nikola. These shareholdings are operational in nature, and are therefore not moved to interest bearing assets. The thesis acknowledges that there are grounds for classifying "non-current financial assets" differently, because the value of such holdings in the end are valued based on a discount rate, and as such, applies an interest-bearing perspective. However, this thesis deemed such a factor as negligible in the current environment.

Current Liabilities

All items categorised as "current liabilities" are classified as "non-interest bearing". The balance mainly consists of trade payables and contractual provision, which are assumed to not be interest bearing.

Non-Current Liabilities

From non-current liabilities, the following items are deemed as interest bearing: "non-current interest-bearing debt", "long term debt" and "other long-term debt". The remaining items are categorised as non-interest bearing, this includes deferred tax. Some professionals perceive deferred taxes as semi-equity, because the time to maturity is long and sometimes never even redeemed (Petersen & Plenborg, 2012, pp. 431-433). In the end, taxes are a result of the company's operations and we therefore treat it as an operational activity.

Total Equity

The thesis has not applied any changes to total equity.

B. Defining the Peer Group

In order to understand the historical performance of NEL, it is important to compare the performance against other companies operating in the same industry. This section defines the benchmark group of companies. When defining the peer group, various characteristics have been considered, such as accounting standards and risk profiles (Petersen & Plenborg, 2012, pp. 64-65,).

The peer group consists of companies that hold similar characteristics when it comes to drivers of operational performance. Meaning, the firms should hold similar growth prospects (Koller, et al., 2010).

In addition to analysing growth and ROIC (Return on Invested Capital), the section will also analyse EBITDA margins and share price development.

Although the peer group hold similar characteristics, it is not expected that these metrics will be close to equal. The geographical presence is different across the peer group, tax rates differentiate, and the operational metrics most likely differ as well, this is normal (Koller, et al., 2010, p. 306). However, differences in tax rates are expected to be small, as most of these firms operate across the globe, there may be differences in accounting practices such as IFRS and GAAP, but the implications of this are insignificant.

Figure 4.2: Defined Peer Group

Source: own compilation based on images from various company websites

Short description of peers:

ITM Power PLC is a British manufacturer of electrolysers which was founded in 2001. In 2020 sales amounted to GBP 3.3 million, which was 28 % less than their sales in 2019. The EBITDA development is dismal, with a loss of GBP 18.1 million, equating to a 148 % increase. Despite burning cash, the market capitalization is just north of GBP 3.5 billion, indicating a price-to-sales multiple above 1,000x (Yahoo! finance, 2021).

Plug Power Inc is an American company founded in 1997 focusing on hydrogen fuel cell systems. In 2020 revenue amounted to 100 MUSD, with an EBITDA of -535 MUSD. The price-to-sales ratio is around 110x, and the market capitalization is around USD 13.5 billion (Yahoo! finance, 2021).

Ballard Power Systems Inc is a Canadian manufacturer of fuel cell products, primarily directed towards heavy duty vehicles such as buses and trams. The company was founded 1979, and today the market capitalization is around USD 9.8 billion with a price-to-sales ratio of 44x. From 2019 to 2020 revenue fell to USD 103.9 million, from USD 106.3 million. The EBITDA also developed negatively, from USD -22.6 million in 2019 to USD -45 million in 2020 (Yahoo! finance, 2021).

PowerCell Sweden AB is a Swedish company founded in 2008 that produces various fuel cell alternatives. Revenue in 2020 was SEK 103.5 million, up 55 % from 2019. Furthermore, the company can show to a negative EBITDA in 2020, at about SEK 52 million. The market capitalization lies at around SEK 20.5 billion, and the enterprise value is at about SEK 11.5 billion (Yahoo! finance, 2021).

Ceres Power holding PLC is a British company focusing on fuel cell technologies. Its market capitalization is at GBP 2.5 billion, and revenue as of June 2020 landed at GBP 18.9 million, up 23.5 % from 2019. In addition, the company had a negative EBITDA of about GBP 6.5 million. Current valuation shows a price-to-sales at 134x (Yahoo! finance, 2021).

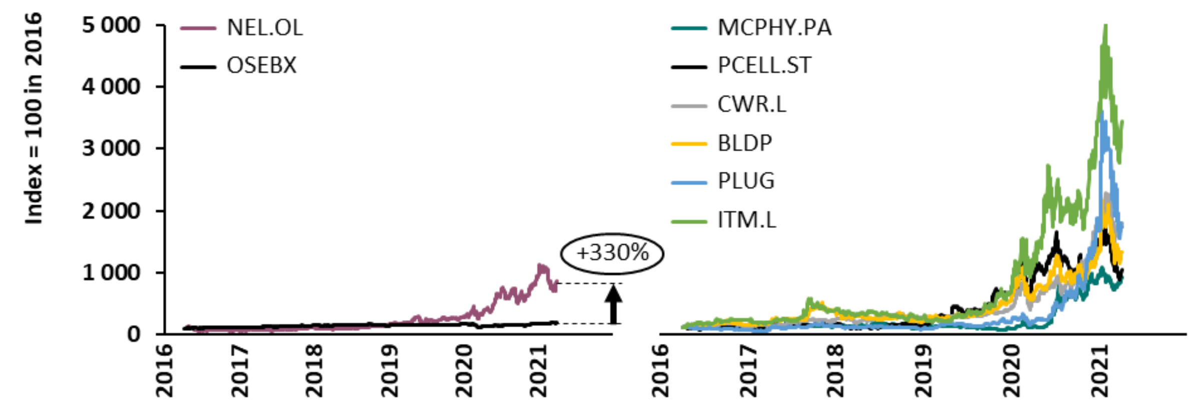
McPhy Energy SA is a French company developing hydrogen storage solutions and production applications for the hydrogen market. The price-to-sales ratio is at 52.7x. Revenue in 2020 was EUR 13.7 million, up 20 % from 2019. The EBITDA however, is still negative at EUR -8 million. The market capitalization is EUR 720 million (Yahoo! finance, 2021).

Everfuel is a Danish company. The market capitalization is DKK 5 billion and the price-to-sales ratio is +20,000x, revenue is insignificant.

Share price development: NEL and peer group

The last two years have yielded extremely high returns for shareholders in NEL, as well as within the peer group. Compared to the Oslo Stock Exchange, the share price of NEL has increased by 330 % more than the general market. However, compared to the development of the peer group, the increase in market value of NEL is relatively small, showcasing that the main driver for growth is most likely the hydrogen industry itself. During the period, NEL has seen strong sales growth, but the main crux for continued value creation is reducing cost levels.

Figure 4.3: Indexated Shareprice Development



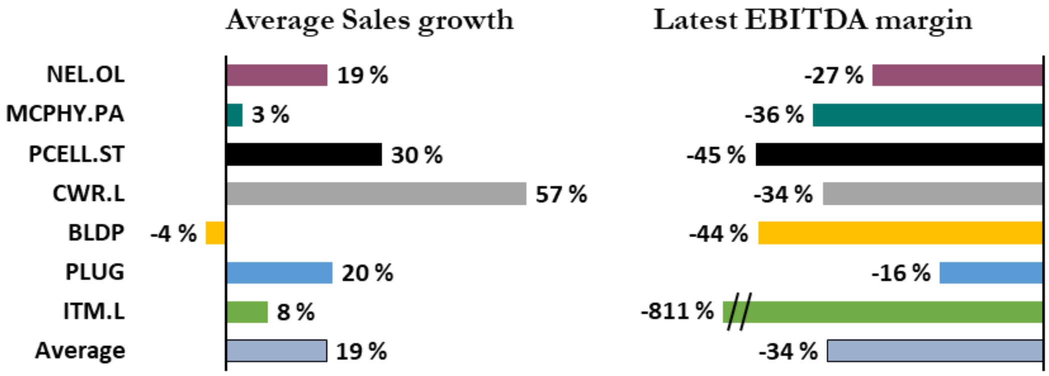
Source: own compilation based on data from Yahoo Finance (April 2021)

Sales growth and EBITDA levels: NEL and peer group

NEL has on average delivered a sales growth of 19 %. Compared to the defined peer group this places NEL at an average performance. It should be noted that the sales growth performance is scattered amongst the peer group, with PowerCell and Ceres delivering 30 % and 57 % respectively, while McPhy, ITM and Ballard delivering a below average growth. The peer group show the potential for strong growth. The fact that several players are not delivering strong growth, indicate that a few players are gaining market share and taking control of the market.

The peer group share negative EBITDA levels. This clearly showcase that the hydrogen market, and investing in hydrogen pure play, still is associated with high risk. Most companies in the space are, in varying degree, burning cash, and the EBITDA levels range from negative 16 % to negative 45 %, with the average at a negative 34 % (if we exclude ITM). For a valuation of NEL, both the projected sales growth and expected EBITDA levels are crucial. Growth numbers are high, and most likely must continue to stay double digit for several years to sustain a continued growth in market value. At the same time, cost levels must be reduced, preferably rather fast.

Figure 4.4: Peer Group Metrics



Source: own compilation based on data from Yahoo Finance (April 2021)

C. Profitability Analysis

Although NEL is not in a state where it is creating economic value, it is important to understand how metrics for economic value generation have developed. This insight is put forth through the application of the "DuPont model". The model was established by Donaldson Brown in 1912, but still serves the same purpose today and is therefore still applicable (Phillips, 2015). The model is simple, as it splits the Return on Equity in three sub-components: profit margin, asset turnover and equity multiplier. The segmentations add more insight into how economic value is added (Petersen & Plenborg, 2012, p. 94).

The following financial metrics are calculated for NEL and the defined peer group:

Eq. A $$Return\ on\ Equity\ (ROE) = ROIC\ x\ FGEAR$$

Eq. B $$Return\ on\ Invested\ Capital\ (ROIC) = PM\ x\ ATO$$

Eq. C $$Profit\ Margin\ (PM_{aftertax}) = \frac{NOPAT}{Revenue},\ PM_{beforetax} = \frac{EBIT}{Revenue}$$

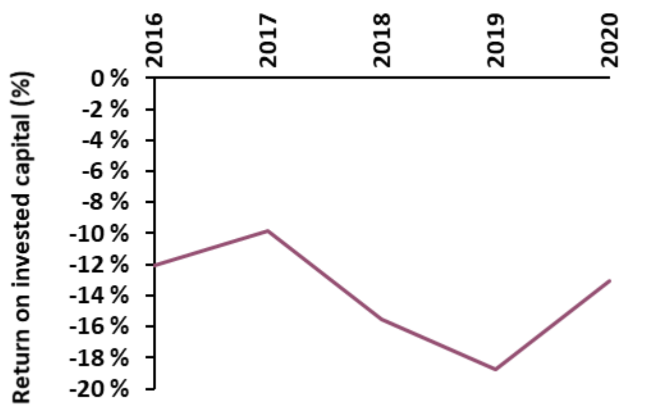
Eq. D $$Asset\ Turnover\ (ATO) = \frac{Average(Invested\ Capital_{t-1}, Invested\ Capital_t)}{Revenue}$$

Eq. E $$Financial\ Gearing\ (FGEAR) = \frac{Debt}{Equity}\ x\ (ROIC - \frac{Net\ financial\ expenses_{aftertax}}{Net\ interest\ bearing\ debt}$$

All calculations are based on end-of-year results, however, accounting periods may differ within the peer group. To smoothen the effect from differing accounting periods, the average change in metrics is also assessed.

In order to determine whether a company's return on invested capital (ROIC) is good, one can look at two factors: 1) is the ROIC stronger than its comparable peers? and 2) is the ROIC stronger than the expected WACC? (Petersen & Plenborg, 2012, p. 96). Neither approach is straight-forward. The peer group is not constant, and is difficult to define as NEL operates in a highly technological industry, where one should assume that there are significant technological differences amongst players. In addition,

Figure 4.5: ROIC Development



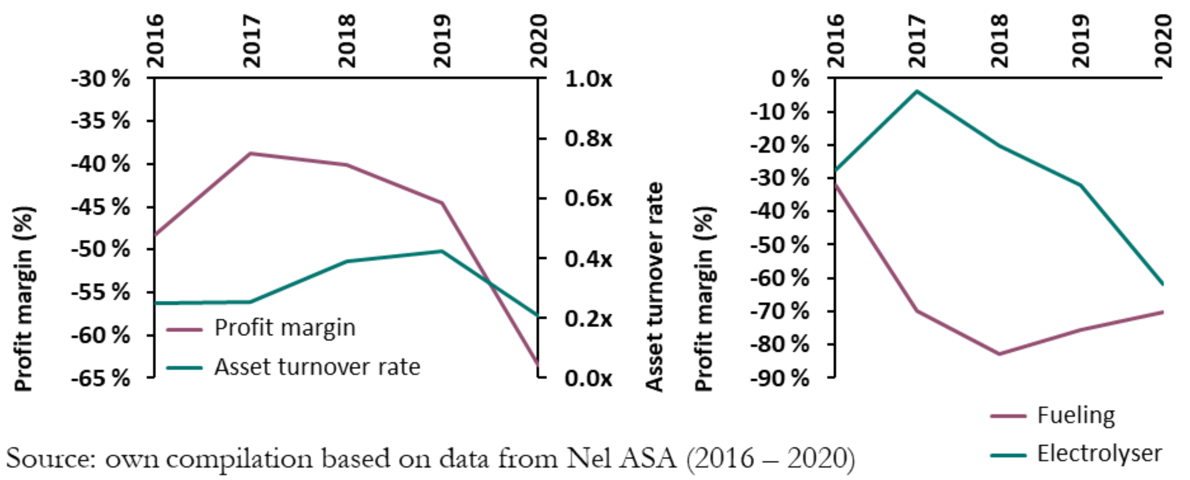
Source: own compilation based on data from Nel ASA (2016 – 2020)

accounting periods may differ, and this also complicates comparability. Comparing ROIC with WACC is equally complex and potentially biased, as WACC is a metric one estimates. NEL's ROIC is negative, which comes as no shock as the company operates with negative cash flow. The increasing ROIC the last year is counterintuitive as both ATO and PM have developed negatively. However, with negative PM, a negative ATO development becomes positive.

NEL's profit margin and asset turnover rate

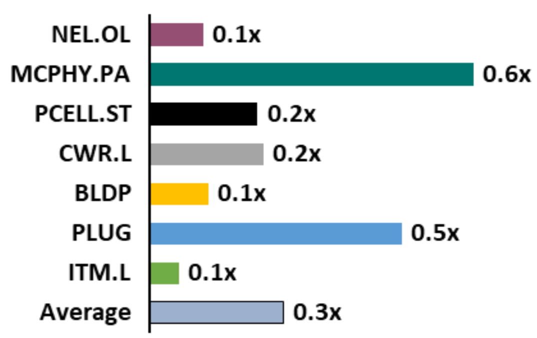
The relationship between sales and operational costs can be described by calculating the profit margin. The below graph shows the profit margin before tax. This is calculated by taking the EBIT from NEL's annual reports and dividing by revenue. As NEL is company with negative profit margin, we look at the before tax measure as opposed to an after-tax approach. The reasoning is that a before tax perspective yield a more comparable metric. The asset turnover is calculated as the average invested capital during a period as a fraction of revenue.

Figure 4.6: NEL's Profit Margin (before tax) & Asset Turnover



Source: own compilation based on data from Nel ASA (2016 – 2020)

Figure 4.7: Peer Group ATO

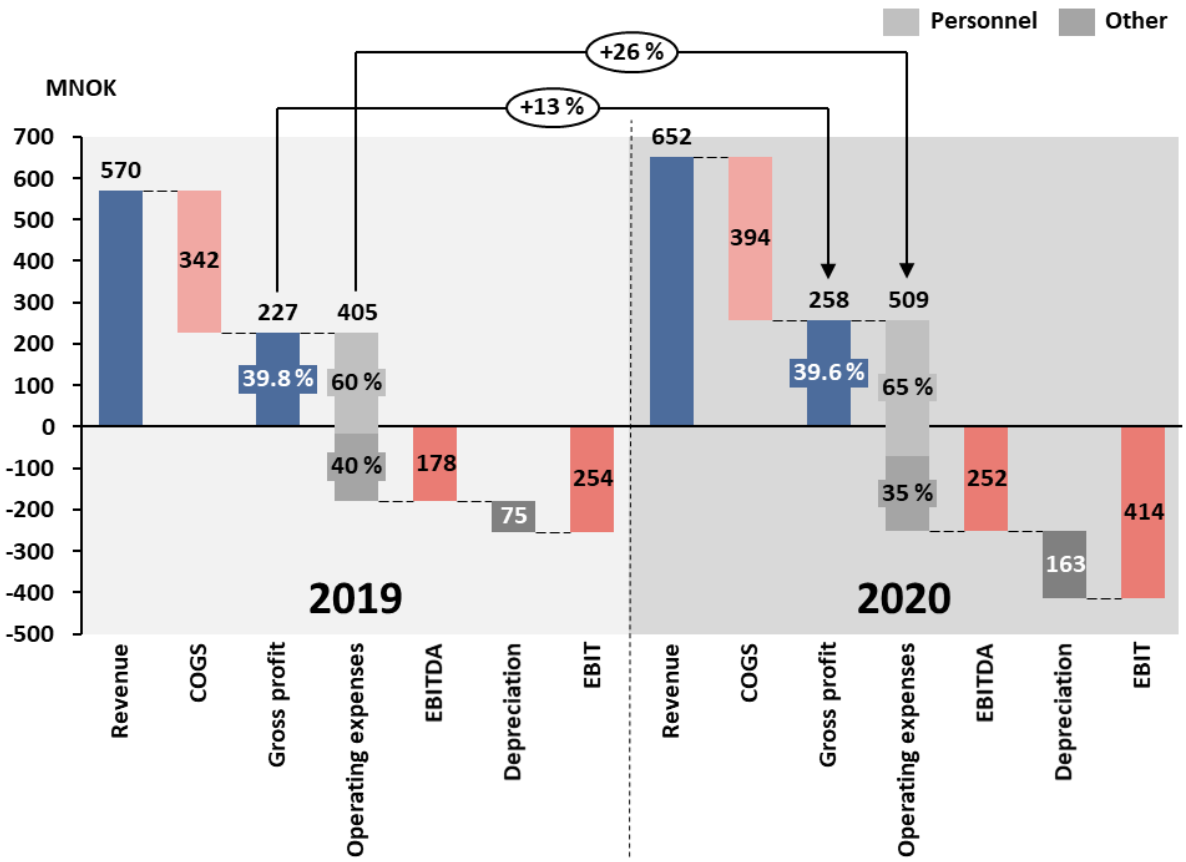


Source: own compilation based on data from Yahoo Finance (April 2021)

The higher the profit margin, the more profitable the company will be per unit of revenue. While the higher the asset turnover rate is, the more effective the company is at generating revenue from its investments (Petersen & Plenborg, 2012, p. 108)

The profit margin has seen a strong negative development. This is a bad sign when taken into account that the company is operating at negative margins. When splitting the profit margin for NEL's two main revenue streams, one sees that the negative trend is mainly due to the electrolyser market where margins have gone from negative 20 % to negative 65 % in 2020. The main difference in margin development is depreciation. The gross profit for electrolyser appears less stable, and one could hope that this is just an effect of time specific impairments. In the latest annual report NEL communicates an impairment loss of ~60 MNOK (Nel ASA, 2021). This explains the majority increase in depreciation.

Figure 4.8: Breaking Down The Income Statement



Source: own compilation based on Nel ASA financial statements 2019-2020 (2021)

The ATO has decreased the last two years. This indicates a reduced ability to generate revenue from its invested capital, and is not a healthy development. An explanation for this, or at least a counter argument, is that NEL has invested heavily in new production facilities indicating that the company is making efforts towards improving ATO, and that there may be a lead-lag relationship herein. In comparison to its peer group the ATO is below average.

Increasing invested capital

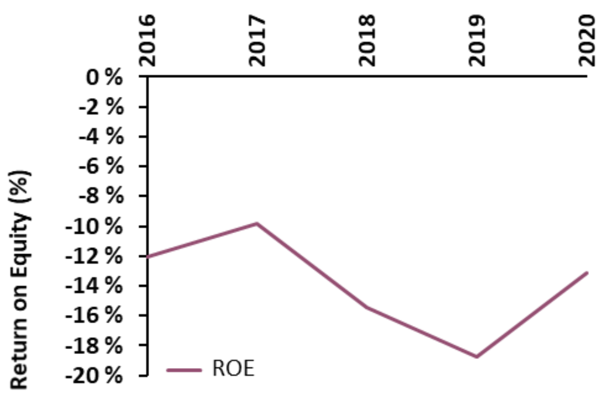
Since 2016, revenue has grown by 470 %, while the invested capital has increased by 590 % (see table 4.1). Up until 2019, revenue growth was stronger than the growth in invested capital, with the latter jumping significantly in 2020, after an equity raise which increased the invested capital substantially. As long as NEL operates with a negative EBITDA, and is burning investor capital, one should expect the ROIC to remain negative. The profitability case of NEL is first and foremost to turn EBITDA positive, then it should apply means of optimizing its invested capital further, in order to increase ROIC. As a company, NEL is not at a stage where such efficiencies are main priority, operational profitability is.

Table 4.1: Index analysis of NELs balance sheet	**2016**	**2017**	**2018**	**2019**	**2020**
Revenue	**100**	**264,0**	**427,2**	**497,7**	**569,4**
Total Equity	100	210,0	235,2	275,1	814,7
Net interest bearing debt	100	104,1	148,8	232,7	1081,4
Interest bearing debt	100	584,0	261,8	243,6	241,3
Interest bearing assets	100	130,8	155,1	233,3	1034,7
Invested Capital, Net Operating Liabilities	**100**	**259,1**	**275,4**	**294,8**	**690,8**
Non current assets	100	255,1	282,5	301,7	333,4
Current assets	100	388,0	384,8	681,8	3032,6
Non-interest bearing debt	100	356,7	420,4	699,7	806,6
Invested Capital, Net Operating Assets	**100**	**259,1**	**275,4**	**294,8**	**690,8**

Return on Equity (ROE)

The return on equity is not significantly different than the return on invested capital. The reason is simply that NEL operates at a negative net interest bearing debt, and the debt they do have, is rather small in relative terms to its equity. Therefore, the difference between ROE and ROIC is in terms of NEL insignificant. The ROE is negative ~13 %, and in order to turn investor profitability positive, a focus on positive operating margins and cost reductions must be implemented. As previously discussed, this is the case at NEL, with management communicating strong ambitions to cut costs by 75 % over the next years. The same applies for NEL's peer group, as all players are operating with negative operating margins.

Figure 4.9: ROE Development



Source: own compilation based on data from Nel ASA (2016 – 2020)

D. Risk Analysis

Liquidity Risk Analysis

The liquidity risk analysis is an important aspect of assessing NEL, mainly because NEL is operating with negative profit. Hence, investors will be keen to understand how long NEL can continue its operations until it will need to raise capital, as well as the understanding of which circumstances must change for NEL's liquidity risk to reduce. A poor liquidity situation and a negative capital-at-hand development, leave business less able to respond to market events. For example, NEL might be less able compared to its competition, to undertake larger M&A activity, as a result of poor liquidity and cash flow development. Continuous negative operational profit may also put NEL in a situation where it is not able to meet the expectations of its customer and supplier relationships. In other words, poor liquidity can lead to various issues, amongst them: supply chain risk, bankruptcy, payment suspension, and R&D could be set on hold. Poor liquidity hence affects a firm's ability to put itself in a position to create positive free cash flows (Petersen & Plenborg, 2012, p. 150).

The following analysis applies different metrics to understand the liquidity situation at NEL. The metrics are based on the annual reports from NEL, and the analysis is split into two parts. The first part assesses the short-term liquidity, and the second part investigates the long-term liquidity.

Short-term liquidity risk

With the calculation of the following three metrics, the liquidity risk is assessed: "The liquidity cycle", "the current ratio" and "the quick ratio":

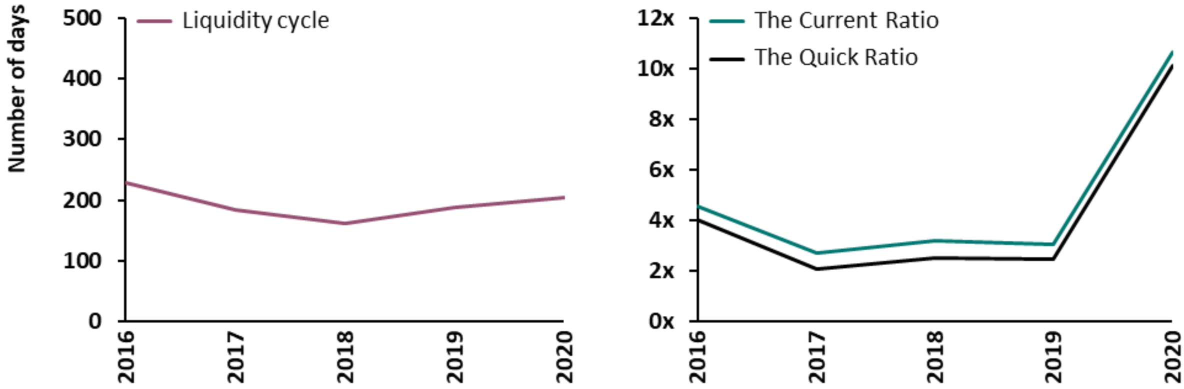
Eq. F $$Liquidity\ cycle = 365 * \left(\frac{1}{\frac{COGS}{Average\ inventory}} + \frac{1}{\frac{Net\ Sales}{Account\ Receivables}} - \frac{1}{\frac{COGS}{Average\ Payables}} \right)$$

Eq. G $$The\ current\ ratio = \frac{Current\ Assets}{Current\ Liabilities}$$

Eq. H $$The\ quick\ ratio = \frac{Current\ Assets - Inventory}{Current\ Liabilities}$$

The liquidity cycle shows us the amount of days it takes for working capital to generate cash. A short number of days indicates a strong liquidity (Petersen & Plenborg, 2012, p. 153). The current ratio is simply the fraction of current assets as a function of current liabilities, thereby indicating a firm's ability to cover its current liabilities should the need arise (Petersen & Plenborg, 2012, p. 155). The quick ratio seeks to indicate the same manoeuvrability as the current ratio, but is more conservative (Petersen & Plenborg, 2012, p. 155).

Figure 4.10: Short-term Liquidity Risk



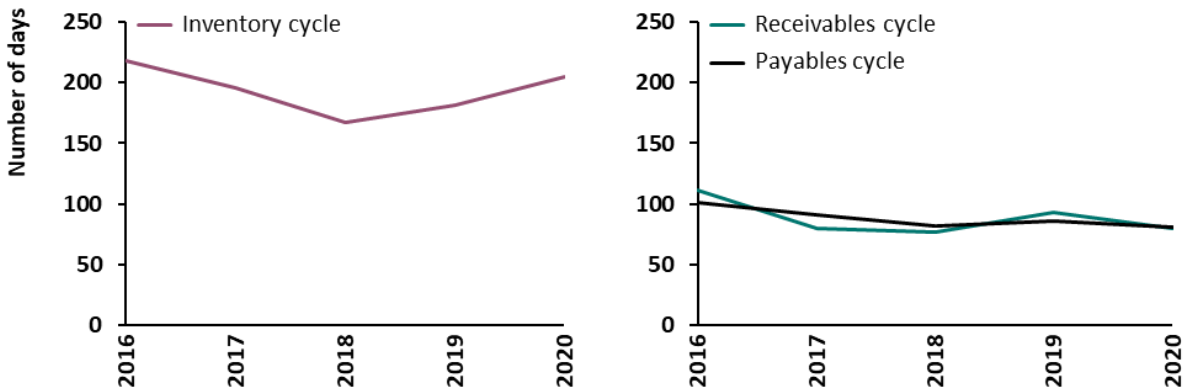
Source: own compilation based on data from Nel ASA (2016 – 2020)

The Liquidity Cycle

NEL's liquidity has been steadily increasing since 2018. Both the receivable and payables cycle are moving in close tandem, indicating that the liquidity cycle development is mainly a representation of the inventory cycle. A positive note is that the cycles for receivables and payables match, and follow each other closely. The cycles are long, close to 100 days, but this could be a result of the industry characteristics, and the fact that product deliverables are project based, highly technical, and probably suffer from long distance. In comparison, a retail industry firm focusing on consumer products usually lies between 30 and 60 days in payable and receivable cycles. For a company in a high growth stage which is still burning cash, it is positive that the cycles match. In a longer time-horizon it would be beneficial to see that the payables cycle was higher than the receivables cycle.

In the end, these things come down to company strategy and focus, there is usually a quid-pro-quo, with more beneficial payment terms usually meaning higher prices. In the longer run, this is one of the places where the bargaining power of a company is portrayed.

Figure 4.11: The Liquidity Cycle



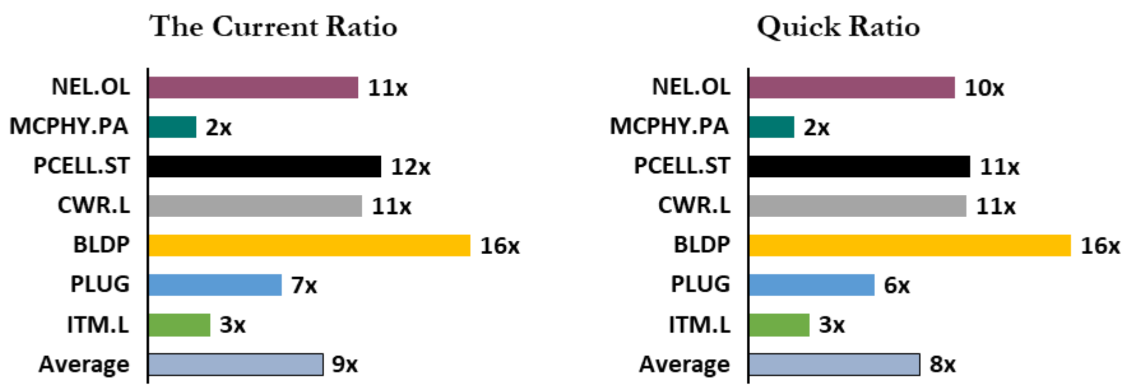
Source: own compilation based on data from Nel ASA (2016 – 2020)

The inventory cycle indicates that products stay on-site for about 200 days. This is twice and three times as long as some competitors, but well below the peer average. MCPHY is operating with half of NEL's cycle days, indicating that NEL should have operational capability to deliver more product faster, if it landed more sales.

The Current & The Quick Ratio

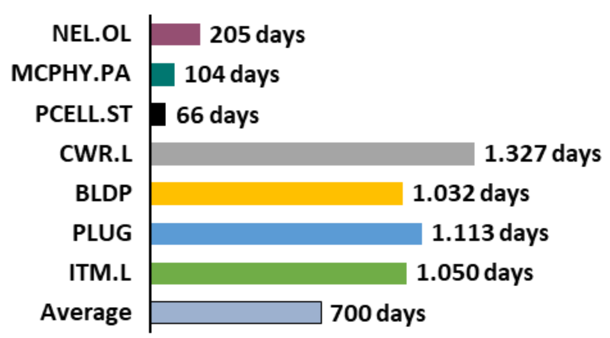
NEL holds a relatively high current & quick ratio when comparing to its own history. The ratios move in tandem, but have been close to 2x for several years. The explanation for the sudden increase in 2020, is an equity issue in November 2020, which increased cash at hand substantially. The peer group is spread in between ratios of 2x and 16x. As all companies in the peer group are operating at negative EBITDA, burning cash, and raising equity, these ratios may be used to indicate the likelihood of potential need for raising capital.

Figure 4.12: The Current & Quick Ratio (Peer group)



Source: own compilation based on data from Yahoo! Finance (2021)

Figure 4.13: Inventory Cycle (Peer group)

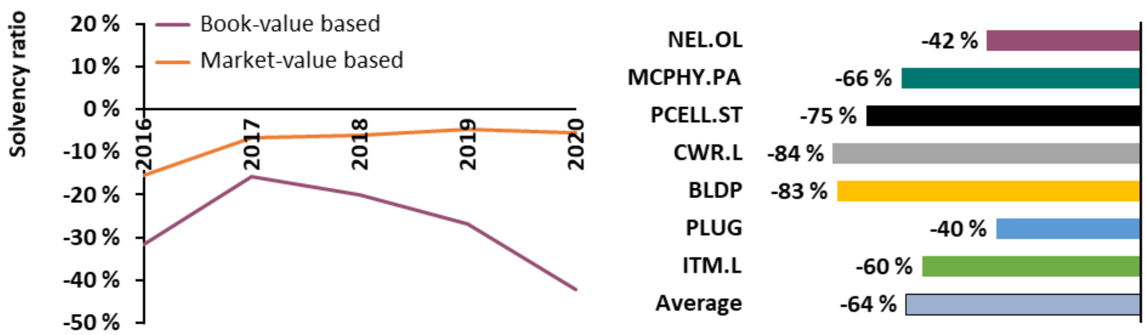


Source: own compilation based on data from Yahoo Finance (April 2021)

Long-term liquidity risk

Usually, the long-term liquidity risk assessment is an analysis of solvency ratios and debt-to-market value ratios. For NEL, the solvency ratio is negative, because of net interest-bearing debt being negative. In effect, NEL is a fully equity financed company. The same goes for its peer group. This is natural, as all companies are EBITDA negative, and this make credit rating incredibly difficult. These companies are not "eligible" for debt, unless it comes through special channels and pseudo-equity-debt schemes. This could be government funding with a debt aspect, to fuel hydrogen innovation or convertible debt notes from investors. These companies are likely not able to hold credit lines with their local bank, or issue "normal" bonds to debt investors in the credit market.

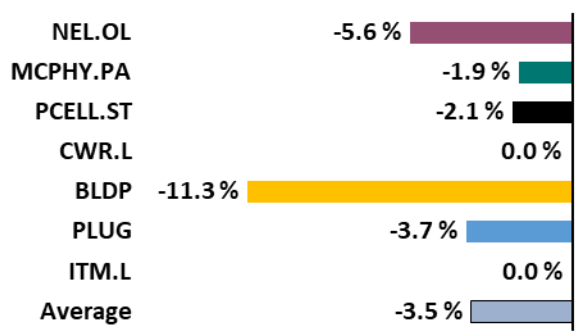
Figure 4.14: Solvency Ratio



Source: own compilation based on data from Nel ASA (2016 – 2020) and Yahoo Finance (April 2021)

Looking at the solvency ratio for NEL we see that: 1) the trend has been negative since 2017 (which coincidentally is a positive) and 2) that many of its peers are seeing solvency ratios that are substantially lower. The explanations could be many. What is known is that cash at hand, as a fraction of equity value for some of these peers, is high. Adjusting for market values, the story is a bit different. As a proportion of market value, the cash at hand is, relative to its peers, higher for NEL. Which is indicating that the liquidity risk might be perceived as higher for NEL than some of its peers.

Figure 4.15: Solvency Ratio, Market Value



Source: own compilation based on data from Yahoo Finance (April 2021)

5. SWOT

	Strengths	Weaknesses	Opportunities	Threats	Outlook
Macroeconomic					
Political & Legal	Positive agenda for hydrogen development		Increased CO_2 taxation	Alternative technologies	**Positive in the long run**
Economic	Cost-benefit improved through CO_2 taxation	Dependent on political pressure		Alternative technologies	**Positive in the long run**
Socio-cultural		Hydrogen is hazardous if handled incorrectly	Rapid comercialis-ation by the public	Public opinion perceives hydrogen as dangerous	**Neutral**
Environ-mental	Positive impact is driving societal need for hydrogen				**Positive in the long run**
Techno-logical	High degree of research	Unknows development	Improved energy utilization	Failure to innovate significantly	**Neutral**
Company specific					
Suppliers	Dual-sourcing strategy	Technological dependencies		Vertical integration and M&A activity	**Moderate risk**
Clients	Large clients	Consolidated client base	Client diversification	Alternative technologies	**Strong portfolio**
Market positioning	High capacity to deliver systems		Cost improvement	Alternative technologies	**Strong position**
Human Capital	Management with strong prior experience	Dependent on highly educated employees		Personnel expenses continue to rise excessively	**Neutral**
Profitability		Negative	Increased automation		**Negative**
Liquidity-risk	Strong cash position	Negative cash flows		Difficulties raising equity	**High risk**
Innovation	Historical strong patent activity	Few patents since 2020		Failure to obtain patent protection	**Neutral**

Source: Authors own compilation

6. Forecasting

By defining a forecast for NEL and its financial development, this thesis can perform an estimation of NEL's equity value. The analysis is based on a 10-year forecast period, and a subsequent terminal period, representing the expected financial performance in perpetuity when NEL has "matured". The longer the forecast period, the more the degree of accuracy is at risk. When a company is "matured", one can argue that there is no need for a long forecast period, and that the longer the forecast period is, the more the uncertainty risk will be. In regard to NEL, which is not a mature company, one needs a forecast period that runs up until the steady state. At the same time, industry expectations are that the industry will mature sometime after 2030. This means that you need a long forecast period when estimating the value of NEL.

The forecast of NEL is split in three periods for the most positive case, while in the more conservative case, the forecast period is split in two parts. There are two main drivers for value: 1) revenue growth and 2) change in operational expenses. The revenue growth estimates are largely based on information from the Hydrogen council and McKinsey, who annually publicise a market progress report. The expectations for future growth development are based on the communicated strategy by NEL, the strategic analysis, and takes into account various comparable cost-levels from other heavy engineering and technical business segments.

A valuation approach like the DCF model assumes a fixed growth in perpetuity in the terminal period. The terminal period therefore acts as an expected average for all future cash flows. It is important to note that the expectation for terminal growth, in terms of growth, should as a maximum be set equal to the general market. If the expected growth rate in perpetuity is significantly higher than inflation, one is in essence expecting that the company in time will constitute a significant majority of world markets, which in all due respect is unlikely.

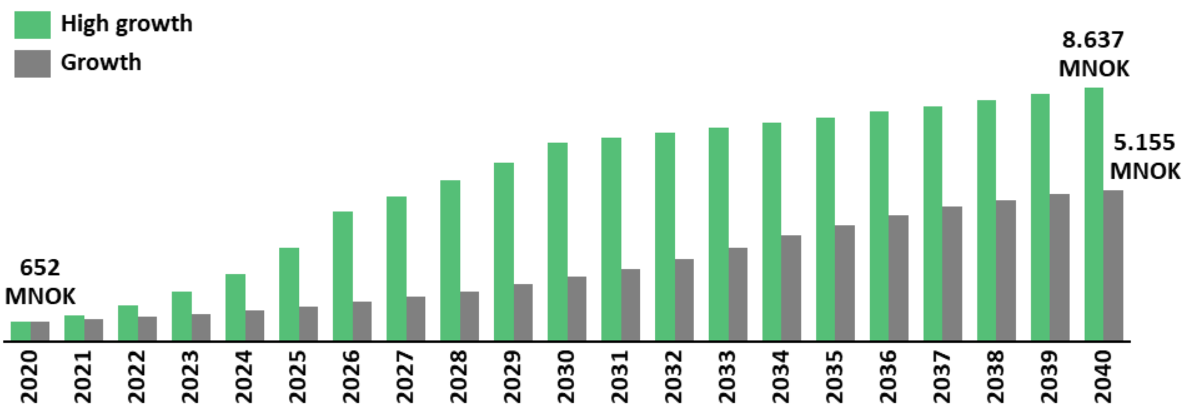
As previously mentioned, one of the main drivers for value is NEL's ability to grow its revenue and reduce its operational expenses. The forecast of costs and balance sheet items is therefore to a large extent either indirectly or directly affected by the expected revenue growth. As an example, several of the operational expenses are estimated as a percentage of sales. This approach is often applied and considered a compromise between the top-line activity, and its related costs and necessary investments (Koller, et al., 2010, pp. 188-189). In order to incorporate the uncertainties related to both NEL and the hydrogen market, this thesis defines two scenarios: "High growth" and "Growth". The main point in doing so is highlighting the risks associated with NEL, and showcase how sensitive the valuation of NEL is towards change.

A. Revenue Growth Forecast

From 2016 till 2020 the average revenue growth has been more than 50 %. Sales for fuelling station systems has on average grown by 43 %, while electrolyser sales on average have seen growth of 59 %. However, in 2020, sales of electrolysers were down from previous year by 6 %. This thesis does not place any significance into the reduced sales of electrolysers for 2020. There are two main factors affecting sales that year. One being the global pandemic which likely has led to some implications in terms of delivery and installation, and could have increased the lead time. The second is the fact that NEL is undergoing substantial changes and upgrades to its manufacturing plant, and in the short term that means that the focus likely is directed towards internal improvements rather than production of electrolysers.

In the "High growth"-case, the growth expectations are based on the latest forecasted industry development (Hydrogen Council, McKinsey & Company, 2021). In the "Growth"-case the projections from 2019 are applied (Hydrogen Council, McKinsey & Company, 2021). There are significant differences in the growth trajectory, where the 2019 estimates were based on even growth at around 13 %, the latest estimates indicate an industry growth of around 40% the next five years, and then a growth at around 11 % until steady state. The fact that the industry outlook can change that immensely from one year to the next, speaks volumes regarding the risk and the uncertainty surrounding the valuation of companies operating within the hydrogen marketspace. Another assumption in the "Growth"-case is that NEL and the industry do not reach a steady-state by 2030. This report "believes" in a strong growth, but given the requirements for hydrogen infrastructure needed in order for this industry to mature and reach a steady state, the forecast is based on a 20 year period in the "Growth" case.

Figure 6.1: Revenue Forecast



Source: own compilation

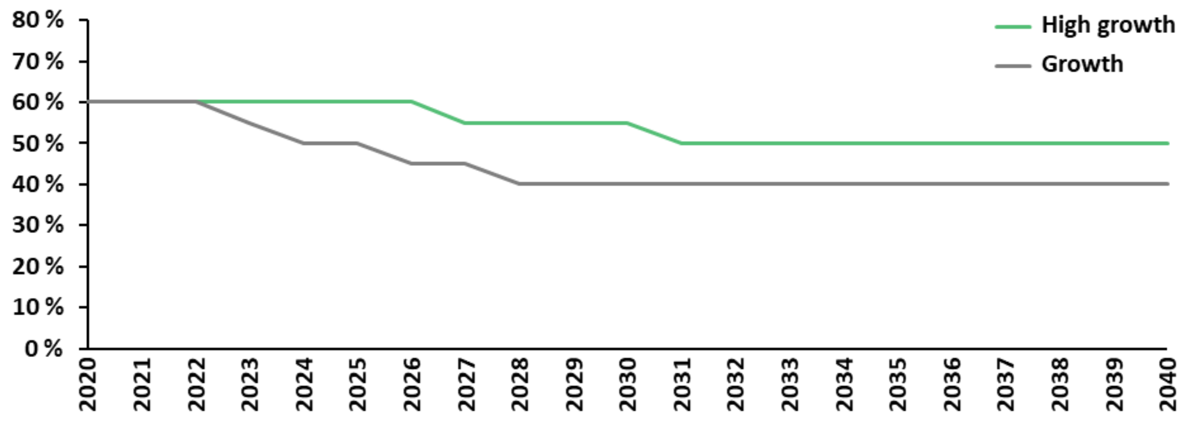
From the understanding of NEL and their strategic foothold in the market, it is realistic that the company will be able to take its share of market growth. NEL will in short time start manufacturing from their new site in Herøya, and with this should be well positioned to grow volumes.

An important driver for growth is that costs are reduced, not just in order to improve the margins for NEL, but also in order to improve the business case for end consumers. In the "bull"-case, an underlying assumption is that cost efficiencies are a major growth inhibitor, meaning that the sales growth projection is contingent on 1) that cost levels are reduced and 2) that this results in reducing pricing. Hence, unchanged margins. In the "base" and "bear"-cases, the assumption is lower growth trajectory, but the margins are consecutively improved.

B. Cost of Goods Sold

One of the main cost drivers are cost of goods sold. Both the industry and NEL has communicated strong ambitions for cost reductions. However, who will benefit from cost reductions is not loudly communicated. This thesis assumes that a major requirement for the projected growth in a "High growth" scenario, is reduced cost levels for clients who will need stronger business cases in order to justify investments towards hydrogen projects. In the more "conservative" "Growth" scenario, the cost improvements are expected to lead to improved margins for NEL.

Figure 6.2: COGS Forecast, % of Sales



Source: own compilation

In the "High growth"-case the analysis expects margins to slowly improve towards a 50 % level, from today's 40 % level. One aspect to bear in mind is the communicated ambitions to cut costs, another is comparable industries and their margins. A much more mature industry in the energy sector is the oil & gas industry. Here, companies delivering equipment experience margins between 50 % and 60 % (Damodaran, 2021). If NEL can reduce its cost-base, it therefore seems likely that some of these costs will lead to improved margins, but it is assumed that this is implemented further into the future, as in the short term more emphasis probably will be on growing sales and building a strong market position. As NEL manifests its position in the market and comes closer to a steady-state, it is believed that it could start to improve its margins.

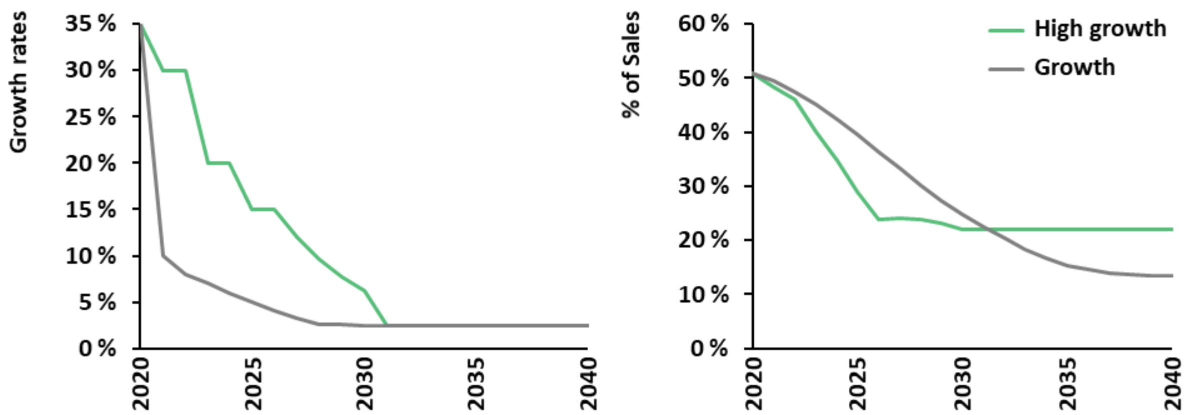
In the "Growth" scenario, it is assumed that improved margins can be effectuated much earlier, as growth is not being "chased" to the same extent. Meaning, there are higher prices in the market and less volumes. In such a scenario it is expected that NEL could be able to effectuate a stronger margin than in the "High growth"-scenario.

C. Personnel expenses and other operational expenses

The personnel expenses are estimated by growth rates and as fraction of sales. The last years, NEL has grown the number of employees substantially, with personnel expenses growing by 35 % from 2019 to 2020. The two scenarios expect this growth to continue, but at a reducing growth rate. As the company matures, the expectation is that the personnel expenses mature as well, and hence grow with inflation. The difference between the two scenarios is mainly found in the next coming years. In the high growth scenario, it is expected that personnel expenses will grow significantly (more than 20 % per annum), while in the growth case the expectation is that personnel expenses will grow at a much lower rate the next five years. The rational for this is mainly that many of the hires at the new manufacturing plant are in place, and because the new plant should be able to operate with a reduced headcount per output compared to other manufacturing sites.

Other operational expenses constitute costs related to research & development, utilities, sales related expenses, administration costs, travel expenses, IT costs, various provisions, and other costs. Some of these costs are defined as percentages of sales, while others are tied with growth rate expectations. The main expectation is that other operational expenses as a fraction of sales will

Figure 6.3: Personnel Expenses, Forecasted Growth Rates & % of Sales



Source: own compilation

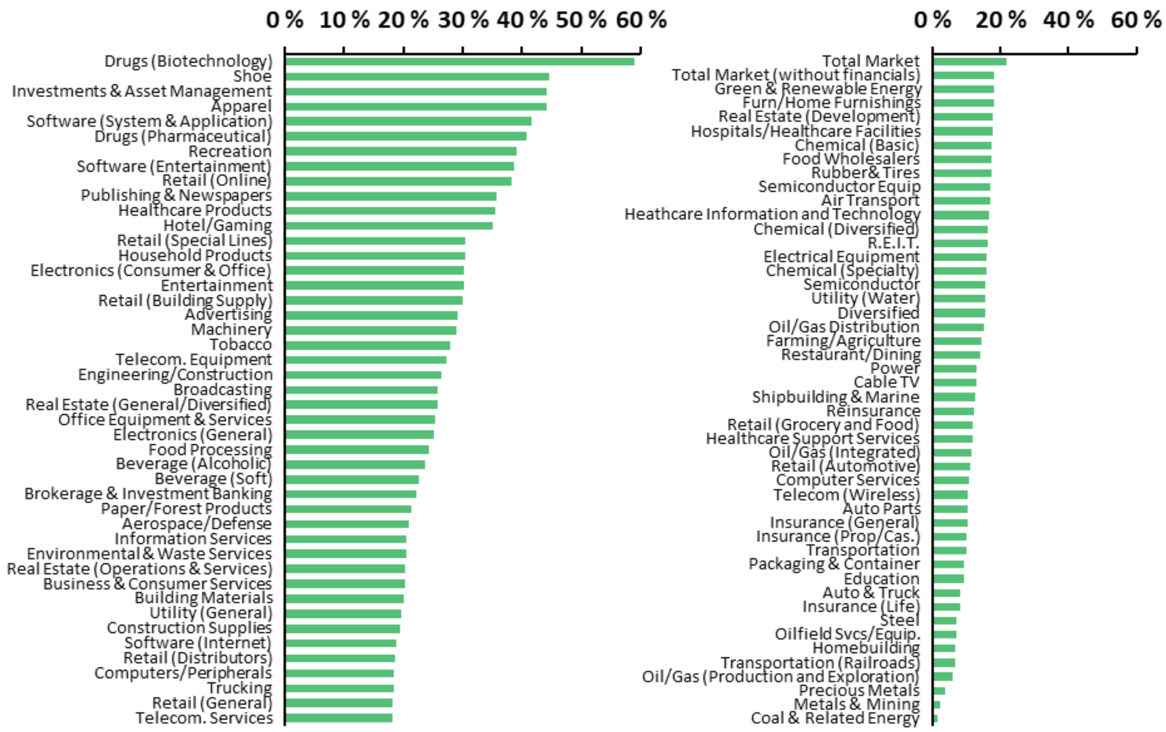
decline. In the high growth scenario this is expected to happen at a faster rate, mainly because sales also in this scenario are expected to increase sharply.

Figure 6.4: Other Operating Expenses, Forecasted Growth Rates & % of Sales

Source: own compilation

In a steady state the expectation is that operational expenses (personnel expenses + other operation expenses) will lie between 22 % and 30 %. This places NEL on a level that is above average, but at the same time it represents a substantial cost-level improvement from today's level. Further cost improvements could be argued as a result of increased automation, but is perceived as premature.

Figure 6.5: Operational Expenses by Industry, as a % of Sales



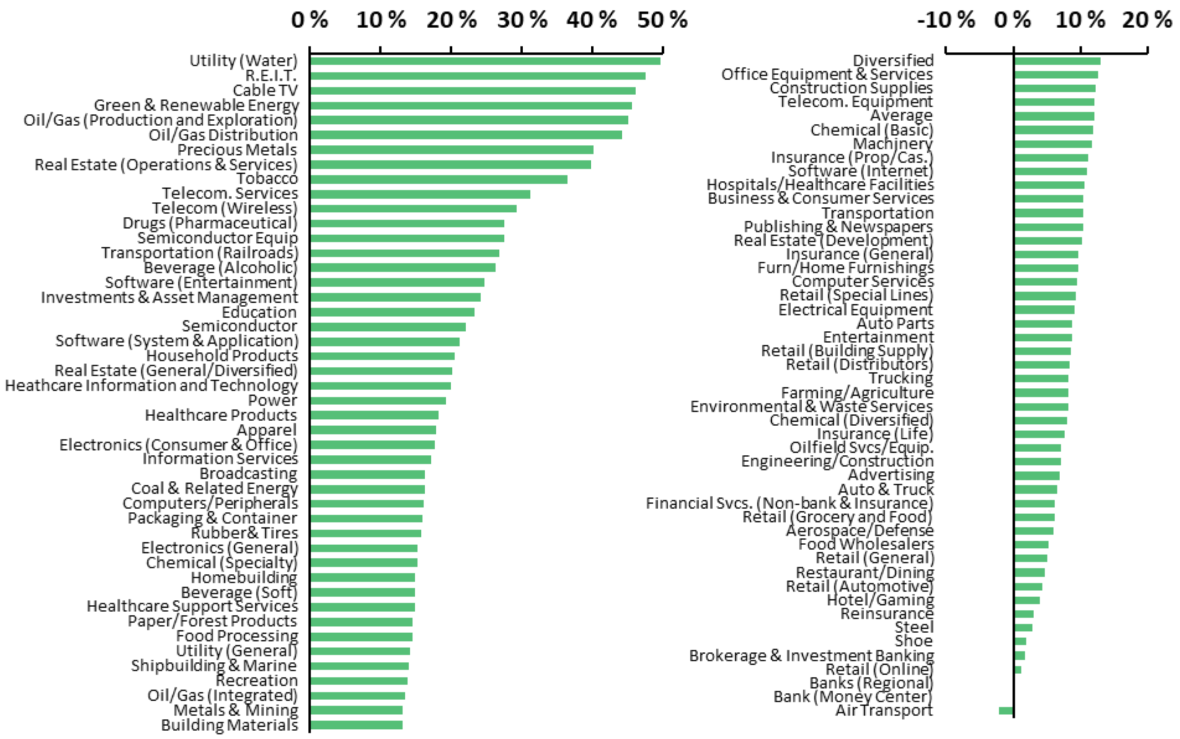
Source: own compilation based on data from Damodaran (2021)

D. Expected EBITDA margins

In both scenarios it is assumed that the EBITDA margins will gradually improve, and subsequently flatten. In the high growth scenario revenue is growing rapidly, and it is assumed that a precondition for such growth is lower cost for clients. One of the key differences between the two scenarios is sales growth and COGS. In both cases it is assumed that NEL delivers on its strategy to reduce costs, but in the high growth scenario it is assumed that these cost improvements primarily benefit the clients, while in the growth scenario the cost improvement benefit to a larger extent.

The EBITDA margin in the growth scenario is expected to lie just north of 30 %, which is in the high end. The oil & gas, and the renewable energy industries hold EBITDA margins closer to 40 %, and are to some extent comparable to hydrogen companies, but NEL is a manufacturing company and these usually hold higher costs (Damodaran, 2021). The high growth scenario expects EBITDA margins around 20 %, which is still above the total market average.

Figure 6.6: EBITDA Margins by Industry



Source: own compilation based on data from Damodaran (2021)

7. Valuation

By implementing the projected financial development of NEL, the thesis applies a discounted cash flow model to estimate current value of NEL. The estimate can subsequently be compared to the current market valuation of NEL, and thereby assess whether or not NEL could be either under- or overvalued in the market. Before the DCF-analysis is presented, a set of dependent criteria and evaluations must be made. Mainly this relates to the estimation of discount rates, which is arrived upon through the definition of several factors, as analysed in the following section.

A. Cost of Capital

The value of a company can be estimated by calculating the net present value of free cash flow. Besides raising the question: "What are the free cash flows going to be in perpetuity", one has to ask: "What discount rate should be applied". In a discounted cash flow model, the discount rate is defined as "weighted average cost of capital", hereafter WACC. The WACC must take into account opportunity cost; why should they invest in NEL, and not something else with a similar risk-return profile? (Koller, et al., 2010, p. 235). This section breaks down each component of the WACC, evaluates it in terms of NEL's risk profile, and establishes an estimate for WACC which consequently is applied in the valuation of NEL.

The estimation of WACC is an arbitrary exercise, which is highly open for interpretation. Research has pointed towards a wide difference amongst practitioners when estimating the WACC for companies. It is acceptable that there are many different ways to justify a lower or higher WACC. At the same time, the WACC is usually a component that highly affects the estimated value of a company. Therefore, this thesis emphasizes the importance of sensitivity analysis.

The Weighted Average Cost of Capital, WACC

The rationale behind the WACC is that the firm has two main stakeholders with significantly different risks; investors and debt holders. Both accept risk compensation, but the risk is different. In the case of bankruptcy, debt holders would receive compensation prior to investors, and hence their risk is lower. The WACC weighs the risk-return relation between these two stakeholders.

Eq. I $$WACC = R_E * \frac{E}{E+NIBD} + R_D * (1-t) * \frac{NIBD}{E+NIBD}$$

where: *RE = Cost of Equity* *RD = Cost of Debt* *t = marignal tax rate*

Each element in the WACC equation is arbitrary. The WACC is applied on expected cash flows, and the WACC must hence also be based on the expected conditions. This leaves a wealth of scenarios. A study published in the Harvard Business Review addressed this issue together with the Association of Financial Professionals in the US. The problem with arbitrary is that it most likely results in either over- or underestimation of WACC, and that in turn results in reduced profits and returns (Jacobs & Shivdasani, 2012). Another study performed by Bancel et al. found more than 100,000 different methods of estimating the WACC (Bancel, et al., 2013). Furthermore, the research applied these methods for three companies, and estimated the WACC. They found large differences in their WACC estimates ranging from 5 to 10 percentage points. This thesis will estimate the various sub-components of the WACC, with the aim of defining the "justifiable" range of WACC estimates, which later on will be applied in the sensitivity modelling and valuation estimation of NEL. This approach is deemed less biased than estimating one WACC alternative.

Cost of Equity

The return on equity is a key component of the WACC, and this report applies the capital asset pricing model in order to understand NEL's cost of equity. This approach is recommended through financial literature (Petersen & Plenborg, 2012).

The capital asset pricing model consists of three components; the risk free rate, the beta of equity and the market return.

Eq. J $$r_E = r_f + B_e * (r_m - r_f)$$

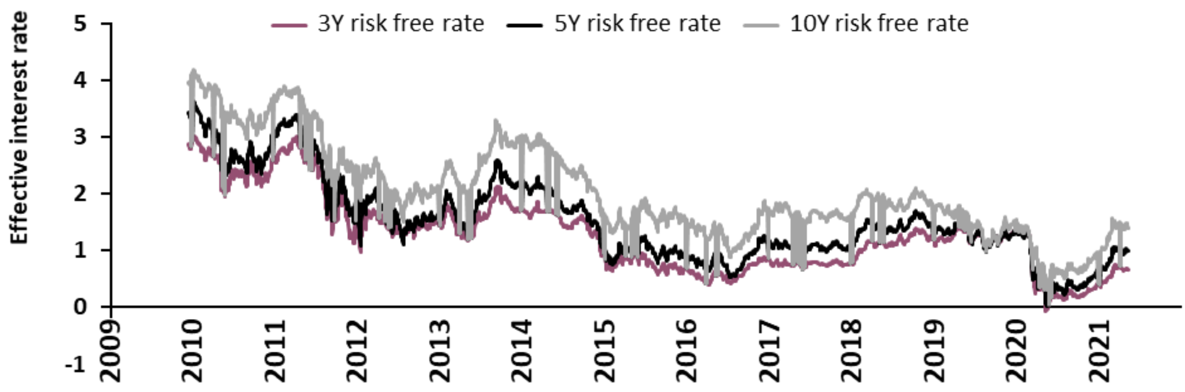
The thesis will not assess the underlying assumptions behind the capital asset pricing model (Pratt, 2002, pp. 77-78).

The risk free rate

Most valuation exercises, be it the valuation of a company or a financial derivative, applies the concept of a risk-free rate. The concept is simple, the return of an asset which holds no return uncertainty. A most interesting question is what assets truly fit this requirement!? In theory this means no risk regarding re-investments and default (Damodaran, 2006, p. 35). In application, the assets that are assumed to satisfy such conditions are long-term and liquid government bonds. The applied government bond should be in the same currency as the cash flows of the analytical object (Koller, et al., 2010, p. 237). In the case of NEL this means that the risk-free rate should be based on a Norwegian government bond.

In a company valuation the time horizon for cash flows is infinite, which indicates that long-term bonds are more appropriate. Jacobs et. al (2012), found that in practice, financial professionals use anything between 90 days and 30 years, with 46 % of their respondents indicating that they apply a 10-year term government bond. Practitioners argue that 10-year bonds are more relevant due to the, at times, illiquidity of 30-year bonds. Illiquidity may have an effect on rates (Jacobs & Shivdasani, 2012). This thesis will apply the 10-year Norwegian government bond as risk free, but will stress the valuation by taking into account the three- and five-year rates (Norges Bank, 2021).

Figure 7.1: Norwegian Government Bonds, Risk Free Rates



Source: own compilation based on data from Norges Bank (April 2021)

The last five years the 10-year government bond has been between 1.5 % and 2 %. The spread between the 10-year and the 3-year bond has been close to 1 % point. During 2020, the spread was marginal, likely due to the high uncertainty and sharp rate reductions implemented by the Norwegian central bank. The 30-day standard deviation is also sharply increasing during this period, where interest rates are sharply reduced. The current rate for a 10-year bond is approx. 1.5 %, while the three -year bond lies around 0.7 %. However, the last year has been somewhat "special", and therefore rate levels that existed prior to COVID19 effects has been taken into account. This thesis therefore applies the current 10-year rate in its main scenario, but will stress test the WACC according to the current level for the ten-year bond, which is around 1.5 %, and the highest level of the 10-year bond since 2016, which is around 2 %.

Systematic risk

The systematic risk is often referred to as the beta, which is a risk measure. A high beta indicates a high risk associated with the company compared to the general market, and the higher the risk the higher the expected return on equity (Petersen & Plenborg, 2012, p. 251). Most publicly available financial resources such as Bloomberg, Reuters, Yahoo! Finance and similar communicate a measure for beta, however, not always with the same applied methodology. The historical beta is calculated as the covariance between stock returns and the general market returns. In a valuation it is not the historical beta that is interesting, but the expected one. Therefore, it is commonplace to apply the Blume principle, developed by Michael E. Blume in 1975. The Blume principle assumes that in time, company betas will normalize at a level close to 1, meaning same risk as the general market (Blume, 1975).

Estimating Beta (with regression)

As mentioned, the historical beta is equivalent to the covariance between company share price returns, and the returns of the general market. The covariance between NEL and the Oslo Stock Exchange has been calculated through a standard OLS approach (Koller, et al., 2010, p. 249). The time period and dataset are based on monthly data over the last five years.

Eq. K $$R_i(t) = a_i + B_i R_m(t) + e_i(t)$$

The beta can be calculated differently. As mentioned previously, publicly available data banks provide beta estimates for listed companies. However, these differ across providers regardless of the underlying data being the same. The reason is the different time period application, both in terms of historical time-length (i.e. three or five years are often applied), and in terms of return intervals (i.e. daily, weekly or monthly returns). Other changeable parameters are the applied general market index, and the adjustment of beta for time instability. Valid arguments can be found for all of these differing approaches. With a long time horizon, the statistics will likely yield a more statistically valid covariance estimate. However, for a company like Nel, historical and future risk, is something entirely different, and some would argue that a shorter time span is more relevant. Despite the reduced statistical validity.

Different approaches can yield significant differences. Reuters has a beta of 0.57, while Yahoo Finance does not even offer a beta estimate for NEL. This thesis has applied an un-lever, and then re-lever approach to the beta-estimation. The calculated historical beta has been unlevered by applying the historical debt-to-equity ratio, and then re-levered by applying the expected debt-to-equity ratio.

Eq. L $$B_U = \frac{B_L}{1+(1-T_C)*\left(\frac{D}{E}\right)}$$

This thesis applies monthly stock returns as a basis for the calculation of covariance between the NEL share price movement, and the market return. The exercise of un-levering and then re-levering is not applied, as the debt-to-equity ratio is zero. The calculated covariance is 0.92.

Estimating Beta through comparable peers

A common approach to beta estimation is based on the unlevered beta of comparable peers (Rosenbaum & Pearl, 2013, p. 164). As the peer group in general does not hold any significant debt, the levered and unlevered beta are the same. Betas gathered from Thomson Reuters indicate the systemic risk across the peer group, when each member is compared to its specific market index. In addition, a beta calculation has been made for each peer group member, compared to the same market index as relevant for NEL, namely the OSEBX.

Peer Group	Thomson Reuters	Own calculation
ITM Power PLC	1.11	1.51
Plug Power Inc	1.42	1.59
Ballard Power Systems Inc	1.52	1.40
PowerCell Sweden AB	0.80	1.09
Ceres Power holding PLC	0.99	0.92
McPhy Energy SA	1.48	1.05
Everfuel	N/A	N/A
Nel ASA	0.57	0.91
Average	**1.13**	**1.21**

Adjusting Beta

Several financial databases and literature apply the notion of beta convergence towards one. This was presented in the 1970s by Michael E. Blume. The thesis will not delve into beta convergence research, but as this is a common practice it will be implemented in the analysis. The Blume adjustment method weighs current beta estimation by ⅔ and ⅓ to the convergence level, which is one (Blume, 1975).

Beta range going forward

The methods of beta estimation yield some differing results. In the valuation, a beta of 0.9 is applied in a base scenario, while the full range is tested in a sensitivity analysis. Some literature argues that best practice is the application of a peer-group based beta (Petersen & Plenborg, 2012, p. 254). At the same time, industry practice is a covariance OLS-estimate, which may or may not be adjusted according to Michael E. Blume's guiding principle. The beta of NEL is lower than the average of its peer group, and this thesis expects that it converges towards the peer group level.

In the forthcoming valuation, a range of beta-estimates will be applied. The lower band is set at the beta estimate from Thomson Reuters, which is at 0.6, while an upper-band estimate is set 1.2. The base case scenario will follow the calculated covariance for NEL against the OSEBX which landed 0.91.

Market risk premium

The spread between the risk-free rate (i.e. chosen government bond) and the general market return, is what defines the market risk premium (Petersen & Plenborg, 2012, p. 263). From an analytical point of view, this raises many of the same questions as when setting the beta for NEL, such as what historical time period to assess. Some research has found that you must look at a minimum of 20 years historical data in order to achieve a risk premium estimate that is significantly different from the standard error (Damodaran, 2006). Another factor is that the applied risk premium should be time relevant, and this argues for applying a shorter time-horizon than the 20-year average spread. Recent estimates by Damodaran suggests an equity risk premium in Norway at 4.72 %, while the global accountancy firm PwC recommends applying an equity risk premium in Norway of 5 % in 2020 (Damodaran, 2021) (PwC, 2021). Going forward, this thesis applies the average of these two estimates in its base case, and test sensitivities according to the full range. These estimates are in alignment with financial literature, Koller et al. (2010) lays forth that risk premiums usually lie in the range 4.5 and 5.5 percent.

Assessment of the cost of capital

Eq. M $r_f + B_e * (r_m - r_f)$

The overall assessment of the cost of capital for NEL is 6.3 %. Taking into account the uncertainties that have been discussed, the research finds it plausible that the real cost of capital may lie in the range 4.3 % and 8 %. The main uncertainty effect here is the company beta. A potential risk is that stock price development of NEL indicates a much lower risk than actually present. One hypothesis could be that irrational investor behaviour is hiding the "real" risk in NEL and in other hydrogen companies, and as such there could be an underestimation bias.

Scenario	Risk free rate	Beta	Market risk premium	Return on equity
Lower bound	1.5 %	0.6	4.7 %	4.3 %
Upper bound	2.0 %	1.2	5.0 %	8.0 %
Base case	**1.75 %**	**0.9**	**5.0 %**	**6.3 %**

Cost of Debt & Capital Structure

The return on debt is an important component. However, in the case of NEL, which holds little debt and has a negative Net Interest Bearing Debt (NIBD), the impact of this is non-existent, unless the thesis foresees a different capital structure. The cost of debt is the return that credit investors require in order to lend a company capital. The cost of debt is variable and can be split into two components; the risk-free rate and the credit spread. As long as NEL delivers negative EBITDA, it is not likely that the capital structure, in terms of debt, will change significantly. Furthermore, in terms of achieving a fair estimate of the valuation of NEL, it is deemed as an unnecessary estimation risk to introduce the effects of potential changing capital structures.

Capital structure does have an impact on valuation. According to the Modigliani Miller principle, capital structure can lead to tax benefits (Modigliani Miller, 1963). When it is assumed that the capital structure will not include significant debt, then one effect is that the tax benefit of interest is reduced or set to zero. It is acknowledged that changing the capital structure of NEL could be relevant in the future. However, from a valuation standpoint, the timing of this is highly uncertain and therefore it does not seem prudent to expect a changing capital structure to such an extent that it leads to significant tax benefits.

A common approach to set capital structure forecast is to analyse the peer group and apply the average. This assumes that capital structure reverts to industry mean values. In the case of NEL this is not perceived as a strong approach based on the previous stated argumentation.

For some foreseeable time, NEL will most likely be dependent on equity investors only. This assumption is based on two factors: 1) NEL has a negative EBITDA, and the credit risk at this point in time will be immense, and 2) If someone would be willing to offer credit to NEL, it would be with such a high credit spread that it most likely would not be relevant relative to raising equity through the capital markets.

In conclusion, the expected debt-to-equity ratio will be set to 0.

Tax rate

The Norwegian federal tax rate is currently at 22 percent, and will be applied in the valuation of NEL. It is not deemed applicable to expect changing tax rates in the forecast.

Estimation of the weighted average cost of capital

Eq. N $$WACC = R_E * \frac{E}{R+NIBD} + R_D * (1-t) * \frac{NIBD}{E+NIBD}$$

As a consequence of the assumption that the debt-to-equity ratio will remain at zero, the estimation of weighted average cost of capital will equal the estimation of cost of capital.

B. Discounted Cash Flow Model

This thesis mainly applied the DCF approach for value estimation. The method is common practice amongst academia and the financial industry (Koller, et al., 2010, p. 303). The approach is flexible, and the analysis could add a high extent of accuracy, however, the same flexibility also introduces a strong potential for subjective bias. The assumptions taken regarding forecasted sales growth, cost estimates and return requirements, are essential and associated with uncertainty.

By applying the forecasted financial development of NEL and discounting the FCFF ("free cash flow to the firm"), the enterprise value of NEL is estimated. For NEL, much of the value is expected to lie ahead. It is common for the DCF model to define the majority of an enterprise value to stem from what is referred to as the terminal period. The terminal period is the year where a company is expected to reach a steady state. The thesis has applied two forecasting scenarios. In the "High growth" scenario the terminal period is expected to lie in 2031, after a ten-year period of extensive and abnormal growth. The "Growth" scenario applies a terminal period in 2041 (See section 6.). To value the terminal period, the thesis applies Gordon's-growth model. The longer the forecast period is, the more sensitive an estimate will become to errors and biases. To sanity check for such bias, the analysis also applies an EV/EBITDA multiple approach.

The DCF approach can be represented as:

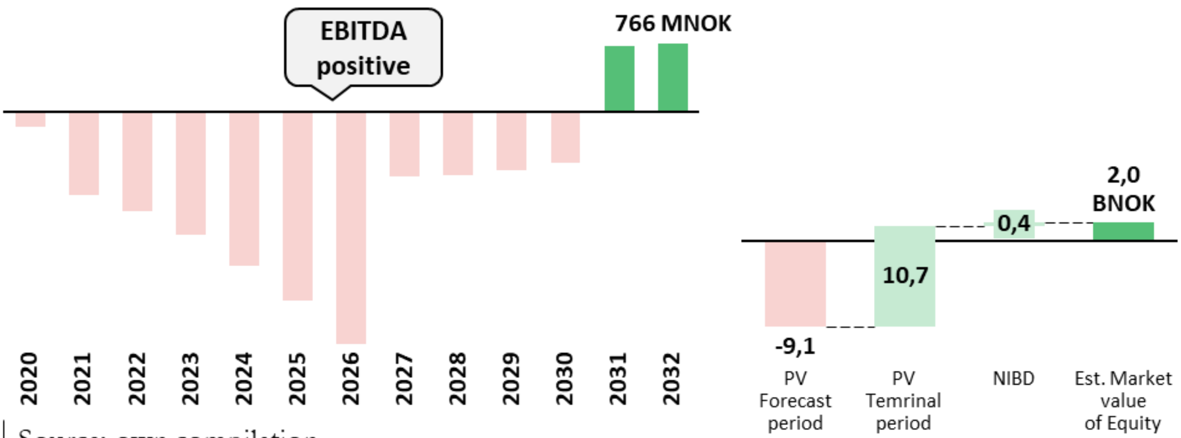
Eq. O $$\sum_{t=1}^{n} \frac{FCFF_t}{(1+WACC)^t} + \frac{FCFF_{n+t}}{WACC-g} * \frac{1}{(1+WACC)^n}$$

Eq. P $$\sum_{t=1}^{n} \frac{FCFF_t}{(1+WACC)^t} + EBITDA_{n+1} * \frac{EV}{EBITDA} * \frac{1}{(1+WACC)^n}$$

Both approaches will return an expected value of the enterprise value of NEL. When this is deducted for NIBD, the remainder represents the expected fair estimate of market value. The fundamental issue of Eq. O, and the Gordon growth approach is that it represents the in perpetuity average sales, cost and margin levels. The issue is that even after ten-or twenty years, it should be expected that there are still going to be major changes in the energy and hydrogen market. Hence, setting an estimate for the terminal period is prone to a high amount of risk. The EV/EBITDA multiple approach is not without risk either, but multiples based on the peer group and/or comparable industries serve as a tangible approach to estimate something rather uncertain. The multiple applied can be based on empirical findings and historical levels, and hence may reduce the potential for over- and underestimation bias of the terminal period.

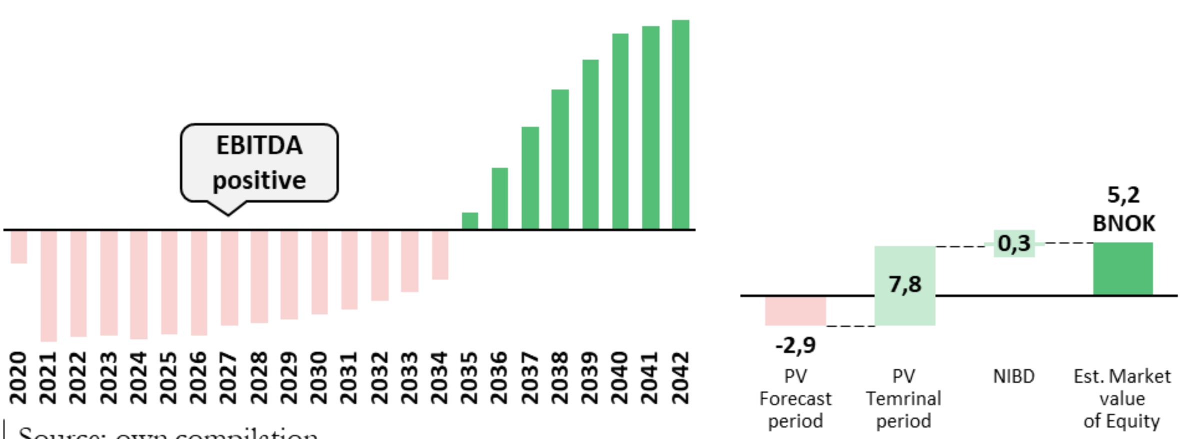
Utilizing a WACC of 6.25 %, the market value of equity is estimated as ~2 billion NOK in the "High Growth" scenario, and ~5.2 billion NOK in the "Growth"-case. The evaluation implies that the fair share price is between 1.6 and 4.3 kr. At the end of April 2021, the share price of NEL was more than 24 kr. per share, while the latest price as of 28/05/2021 was 18.1 kr. per share. The evaluation therefore indicates that NEL is highly overvalued. A major contributor to this result is that the thesis believes there is a strong rationale for increasing CAPEX as NEL grows its sales activities. Assuming much lower CAPEX levels would lead to a higher valuation. However, it is this thesis firm belief that building up a new industry, production capacity for electrolysers and being able to manufacture a network of fuelling stations, will require substantial CAPEX for years to come.

Figure 7.2: FCFF in «High Growth»-scenario, WACC = 6.25 %



Source: own compilation

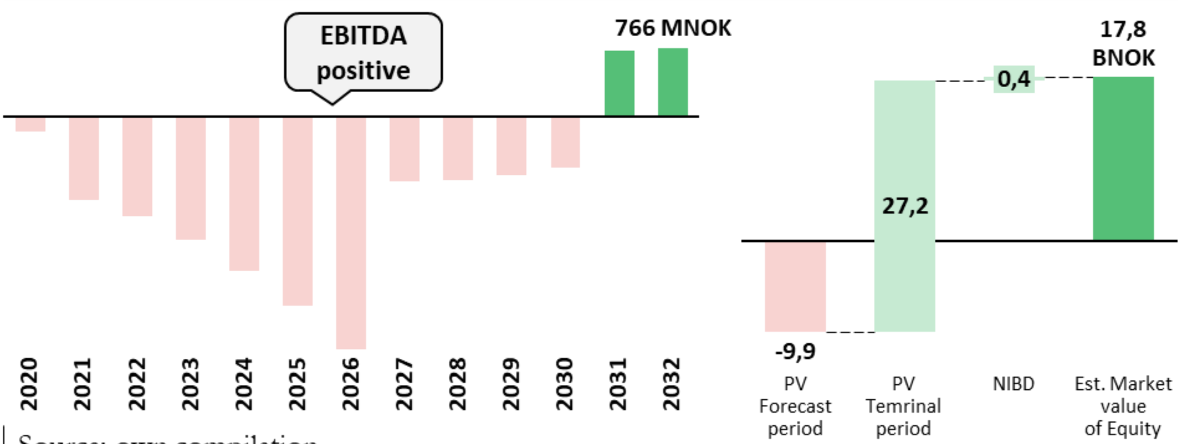
Figure 7.3: FCFF in «Growth»-scenario, WACC = 6.25 %



Source: own compilation

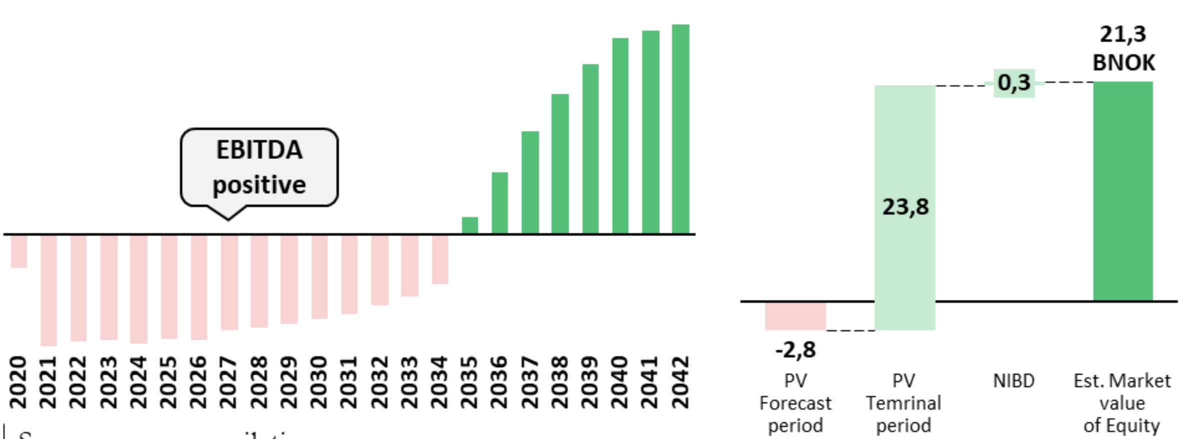
As presented earlier there is some uncertainty regarding the discount rate. The thesis has defined 6.25 % as the most likely discount rate. However, the lower bound assessment defined a WACC of 4.3 % which would lead to a different valuation of NEL. In that scenario, the estimated market value of equity lies between 17.8 and 21.3 billion NOK. This results in a fair price of equity per share between 14.5 and 17.4. kr. The conclusion is still that NEL appears overvalued.

Figure 7.4: FCFF in «High Growth»-scenario, WACC = 4.3 %



Source: own compilation

Figure 7.5: FCFF in «Growth»-scenario, WACC = 4.3 %



Source: own compilation

EV/EBITDA multiple

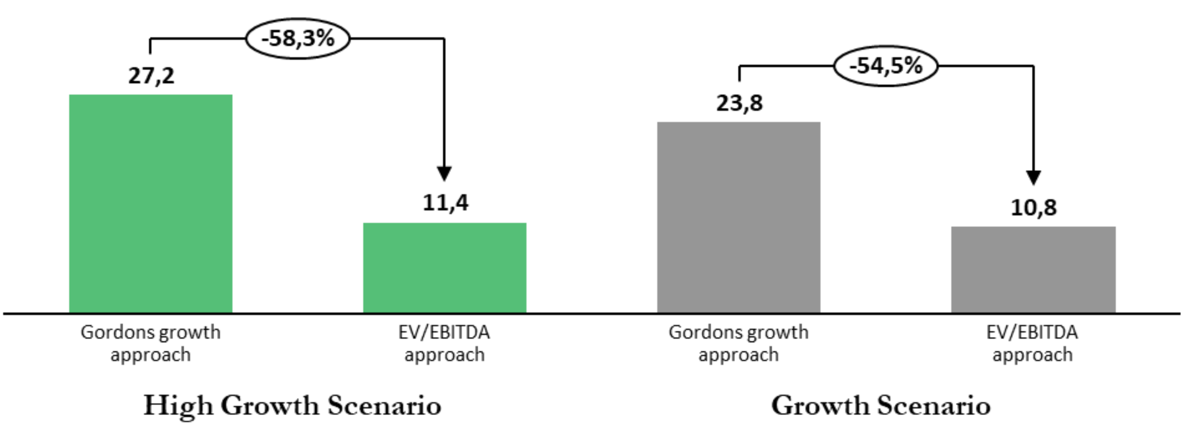
The EV/EBITDA multiples in the hydrogen market for pure players are negative, as most still operate with negative EBITDA. The thesis therefore takes into consideration EV/EBITDA multiples from similar industries, such as industrial technology firms within the energy supply business.

Damodaran, which collects international multiples for companies and industries finds the following multiples (Damodaran, 2021):

Industry / Company	EV / EBITDA multiple
Engineering	17.5x
Oil & Gas industry (supply)	6.4 – 10.4x
Electricity industry	11.9x
Average	**12.6x**
Source: (Damodaran, 2021)	

If one applies an EV/EBITDA multiple in the terminal period at 12.6x, the result will in all scenarios indicate a further reduction of the fair value estimates. Strengthening the overall assessment of NEL as significantly overvalued.

Figure 7.6: Gordon's Growth vs. EV/EBITDA Multiple Approach



Source: own compilation

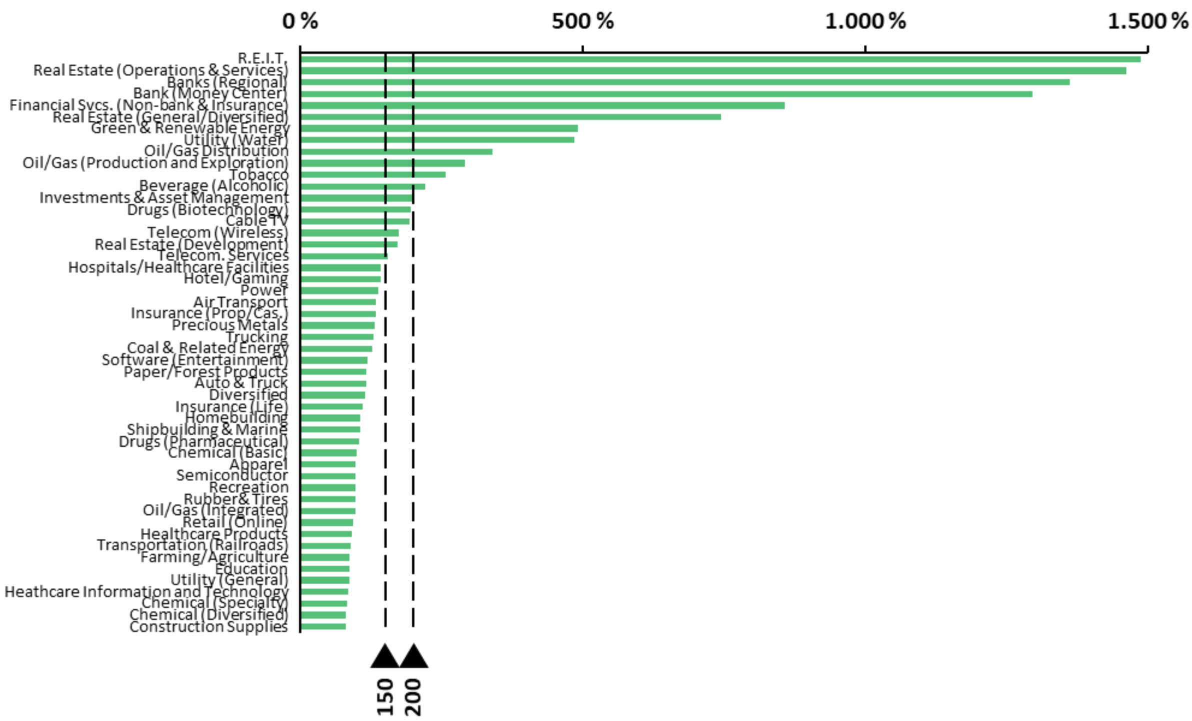
8. Sensitivity Analysis

All estimations are subject to uncertainty and risk of both over- and undervaluation. The model and the technical approach are well founded in both theory and practical application, meaning that the risk is associated with the assumption and beliefs of whomever is performing the exercise. This thesis has sought to reduce such risk by undertaking a thorough analysis of NEL and its industry.

There is little doubt that hydrogen will increase in application, and thereby become a more significant part of the energy value chain. One of the main questions raised in this thesis is the tempo and momentum of which the industry and companies will grow. This is tested through the two scenarios: “High Growth” and “Growth”.

For both the scenarios, a key impact on free cash flows is the need for capital expenditures. In order to grow and supply a growing number of electrolysers and fuelling stations, it is a firm belief that NEL and the industry must continue to invest heavily in manufacturing sites and capabilities. The estimation of invested capital was therefore set as a fraction of sales development, but it is also acknowledged that there is much uncertainty and potential for overestimation of the invested capital and capital expenditure.

Figure 8.1: Invested Capital as a % of Revenue



Source: own compilation based on data from Damodaran (2021)

Figure 8.1 illustrates the invested capital as a fraction of revenue in several industries. The scenario put forth in this thesis places NEL in the high end, but does not appear to be extreme by any level. Especially considering that this is a relative new industry being built up. In the sensitivity analysis the analysis tests for alternative valuation outcomes should this assumption change slightly.

Another key assumption, which has been highlighted already, is the application of different discount rates (WACCs). To showcase a broader impact of changing variables in the estimation of NEL's fair market value, the analysis applies different levels of WACC and invested capital.

"High Growth" scenario sensitivity

Estimated share price of Nel ASA		WACC					
		4,30 %	**5,00 %**	**5,50 %**	**6,25 %**	**6,50 %**	**7,00 %**
Invested Capital in the terminal period	**(as a % of Revenue)**						
	130 %	kr 57,3	kr 36,1	kr 27,2	kr 18,5	kr 16,4	kr 12,9
	140 %	kr 35,9	kr 21,7	kr 15,8	kr 10,1	kr 8,7	kr 6,4
	150 %	kr 14,5	kr 7,4	kr 4,5	kr 1,6	kr 1,0	-kr 0,1
	160 %	-kr 6,8	-kr 6,9	-kr 6,9	-kr 6,8	-kr 6,8	-kr 6,7

"Growth" scenario sensitivity

Estimated share price of Nel ASA		WACC					
		4,30 %	**5,00 %**	**5,50 %**	**6,25 %**	**6,50 %**	**7,00 %**
Invested Capital in the terminal period	**(as a % of Revenue)**						
	160 %	kr 38,8	kr 23,5	kr 17,3	kr 11,3	kr 9,8	kr 7,5
	170 %	kr 28,1	kr 16,8	kr 12,2	kr 7,8	kr 6,7	kr 5,0
	180 %	kr 17,4	kr 10,1	kr 7,1	kr 4,3	kr 3,6	kr 2,5
	190 %	kr 6,8	kr 3,5	kr 2,1	kr 0,8	kr 0,5	-kr 0,0

The above tables clearly illustrate the potential for underestimation of the market value of equity. By changing the assumption regarding the invested capital in the terminal period, and thereby the needed capital expenditures going forward, the valuation changes quickly. However, although this is a possible scenario, it is not believed that the likelihood of it is high at the moment. The current ratio is more than 200 %, and more investments will certainly be needed to meet future growth.

In essence, it is possible that the invested capital and capital expenditure needs of NEL will be lower. However, that trajectory is not indicated in its financial records, nor supported by industry demand at the moment. The new factory at Herøya will likely lead to improved efficiency and higher utilization, but the extent of revenue that this plant can deliver is not yet verified, and the uncertainty is high. Due to the uncertainty associated herein, the thesis has estimated conservatively regarding the investment and capital expenditure needs of NEL. In conclusion, the upside potential is there, but it is not deemed as likely enough at the moment to incorporate into a valuation.

9. Conclusion

This thesis has sought to present an unbiased analysis of NEL. The aim of the analysis has been to evaluate what the intrinsic value of NEL is as of 30/04/2021. Thereby adding value for marginal investors either holding or contemplating a position in the NEL stock. The share price of NEL at the time of writing is 18.29 NOK. This is substantially higher than the evaluated fair value as per the "Growth" scenario of 4.3 NOK, indicating that NEL is highly overvalued.

NEL has been, and continues to be, in the business of manufacturing and selling electrolysers, in addition to other larger hydrogen related systems. For several decades, NEL has sold its electrolysers to various industries which need hydrogen in their production setup, and has chosen to produce hydrogen themselves on-site. The rationale for the strong growth the last few years is not derived from these clients, but from demand by new client segments.

For several years, the energy production capacity from renewable energy sources has been growing. These companies operate with a variable production input which is highly dependent on weather conditions. As such, as the energy supply shifts to more renewables, the effects from these variabilities will have larger impact. Hence, energy storage of renewable energy is experiencing increasing importance. Hydrogen represents one of several methods to store such energy.

The strategic analysis took forth several of the company and industry specifics that may affect the value of NEL. The industry in which NEL operates is by no doubt experiencing high demand and growth. The analysis also expects this to continue as political pressure for a more environmental energy supply side is mounting. However, the current technology is not cost competitive. The technology must develop, and this will require substantial investments. The companies operating in the market today are not necessarily financially capable of these investments, while also not being able to operate with positive cash flow. The potential for competition from other industries that hold a more diverse revenue stream appears high.

In all scenarios, it is deemed as highly likely that NEL will continue to operate with both a negative EBITDA, and negative cash flows for years to come. This means, that NEL for the time being will be 100 % equity financed, which at the current trajectory lead to a high uncertainty regarding future equity issues, terms and dilution. In conclusion, NEL appears highly overvalued. In the medium-term, the risk is associated with NEL's ability to reduce its cost base. In the short-term, investors should be concerned of uncertainties and volatility relating to NEL's need for further equity issues.

10. Bibliography

Anon., 2021. *Nat.* [Internett]
Available at: http://www.nat.vu.nl/~griessen/STofHinM/ChapIShortHistoryOfHydrogen.pdf
[Funnet 25 05 2021].

Bancel, F., Lathuille, Q. & Lhuissier, A., 2013. Why is "your" WACC necessarily wrong?. *ESCP Europe,* p. 19.

Barney, J., 1991. Firm Resources and Sustained Competitive Advantage. *Journal of Management,* pp. 99-120.

Barney, J. & Hesterly, W., 2006. *Strategic Management and Competitive Advantage.* s.l.:Prentice Hall.

Bellona, 2021. *Bellona.* [Internett]
Available at: https://bellona.org/news/ccs/2021-02-norway-proposes-e200-per-ton-co2-tax-by-2030
[Funnet 06 05 2021].

Blume, M., 1975. Betas and their regression tendencies. *The Journal of Finance*, June, pp. 785-795.

Cao, S., 2020. *Observer.* [Internett]
Available at: https://observer.com/2020/11/hyperion-xr1-hydrogen-cell-car-battery-debate/
[Funnet 15 May 2021].

Chem.4.us, 2021. *chem4us.* [Internett]
Available at: http://www.chem4us.be/blue-green-gray-the-colors-of-hydrogen/
[Funnet 19 05 2021].

Cherryman, S. J. et al., 2008. An exploratory study of public opinions on the use of hydrogen energy in Wales. *Public Understanding of Science*, 05.

Dagens Næringsliv, 2019. *DN.* [Internett]
Available at: https://www.dn.no/marked/nel/hydrogen/industri/nel-stuper-pa-bors-etter-hydrogeneksplosjon/2-1-618489
[Funnet 17 04 2021].

Damodaran, A., 2006. *Security Analysis for Investment and Corporate Finance.* 2nd red. Hoboken, New Jersey: John Wiley & Sons, Inc..

Damodaran, A., 2021. *Damodaran.* [Internett]
Available at: http://pages.stern.nyu.edu/~adamodar/New_Home_Page/
[Funnet 2021].

Damodaran, A., 2021. *Equity Risk Premiums.* [Internett]
Available at: http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html
[Funnet 16 05 2021].

E24, 2020. *E24.* [Internett]
Available at: https://e24.no/ledige-stillinger/s/zg0mr9/var-nye-moderne-fabrikk-trenger-en-erfaren-og-fremoverlent-produksjonssjef-er-det-deg
[Funnet 16 May 2021].

Fernandez, P., Aguirreamalloa, J. & Linares, P., 2013. *Market Risk Premium and Risk Free Rate used for 51 countries in 2013: A survey with 6,237 answers,* Madrid: IESE Business School.

GlobalPetrolPrices, 2021. *GlobalPetrolPrices.* [Internett]
Available at: https://www.globalpetrolprices.com/
[Funnet 16 01 2021].

Google Patents, 2021. *patents.google.* [Internett]
Available at: patents.google.com
[Funnet 22 05 2021].

Hydrogen Council, McKinsey & Company, 2021. *Hydrogen Insights Report 2021,* s.l.: Hydrogen Council.

Hydrogen Europe, 2021. *Hydrogen Europe.* [Internett]
Available at: : https://hydrogeneurope.eu/hydrogen-storage
[Funnet 03 2021].

International Energy Agency, 2021. *IEA.* [Internett]
Available at: https://www.iea.org/
[Funnet 04 04 2021].

Jacobs, M. & Shivdasani, A., 2012. Do You Know Your Cost of Capital?. *Harvard Business Review*, July - August.

Koller, T., Goedhart, M. & Wessels, D., 2010. *Valuation, Measuring and Managing the Value of Companies.* 5 red. New Jersey: John Wiley & Sons, Inc..

Miles, A. J. & Ezzell, R. J., 1980. The Weighted Average Cost of Capital, Perfect Capital Markets, and Project Life: A clarification. *Journal of Financial and Quantitative Analysis*, September, pp. 719-730.

Natural Resources Canada, 2021. *NRCAN.* [Internett]
Available at: https://www.nrcan.gc.ca/energy-efficiency/transportation-alternative-fuels/personal-vehicles/choosing-right-vehicle/buying-electric-vehicle/understanding-the-tables/21383
[Funnet 15 05 2021].

Nel Hydrogen ASA, 2020. *Q4 2020,* Oslo: Nel ASA.

Nel Hydrogen ASA, 2021. *Annual Report 2020,* Notodden: Nel Hydrogen ASA.

Nel Hydrogen ASA, 2021. *NEL.* [Internett]
Available at: https://nelhydrogen.com/about/
[Funnet 25 05 2021].

Norges Bank, 2021. *Norges Bank.* [Internett]
Available at: https://www.norges-bank.no/tema/Statistikk/Rentestatistikk/Statsobligasjoner-Rente-Daglige-noteringer/
[Funnet 15 05 2021].

Petersen, C. V. & Plenborg, T., 2012. *Financial Statement Analysis.* 1st red. Edinburgh: Pearson.

Petitt, B. & Ferris, K., 2013. *Valuation for Mergers and Acquisitions.* New Jersey: Pearson Education.

Phillips, M., 2015. *The DuPont invention that forever changed how things work in the corporate world.* [Internett]
Available at: http://qz.com/569738/the-dupont-invention-that-forever-changed-how-things-work-in-the-corporate-world/

Porter, M., 1979. How Competitive Forces Shape Strategy. *Harvard Business Review.*

Pratt, S. P., 2002. *Cost of Capital: Estimation and Application.* 2 red. New Jersey: John Wiley & Sons Ltd..

PwC, 2021. *pwc.* [Internett]
Available at: https://www.pwc.no/no/publikasjoner/pwc-risikopremie-2020.pdf
[Funnet 26 04 2021].

Rienecker, L. & Jørgensen, P. S., 2011. *Den gode opgave.* s.l.:Samfundslitteratur.

Rosenbaum, J. & Pearl, J., 2013. *Investmet Banking: Valuation, Leveraged Buyouts, and Mergers & Acquisitions.* Hoboken, New Jersey: John Wiley & Sons, Inc..

Sakamoto, J. et al., 2018. Evaluation of Safety Measures of a Hydrogen Fueling Station Using Physical Modeling. *Journal of Sustainability*, 20 10.

SINTEF, 2019. *Hydrogen for Europe,* Trondheim: SINTEF Energy Research.

The European Union, 2021. *Europa.* [Internett]
Available at: https://ec.europa.eu/clima/policies/strategies/2050_en
[Funnet 04 05 2021].

The European Union, 2021. *Europe.* [Internett]
Available at: https://ec.europa.eu/clima/policies/innovation-fund/ner300_en
[Funnet 19 05 2021].

The U.S. Department of Energy, 2021. *Energy.* [Internett]
Available at: https://www.energy.gov/eere/fuelcells/hydrogen-production-natural-gas-reforming
[Funnet 04 2021].

The U.S. Department of Energy, 2021. *Energy.* [Internett]
Available at: https://www.energy.gov/eere/fuelcells/hydrogen-production
[Funnet 04 2021].

Tracy, S., 2012. *Qualitative Research Methods - Collecting Evidence, Crafting Analysis, Communicating impact.* s.l.:Blackwell Publishing Ltd..

Yahoo! finance, 2021. *Yahoo! finance.* [Internett]
Available at: https://finance.yahoo.com/quote/ITM.L?p=ITM.L
[Funnet 04 05 2021].

Yahoo! finance, 2021. *Yahoo! finance.* [Internett]
Available at: https://finance.yahoo.com/quote/PLUG?p=PLUG
[Funnet 01 05 2021].

Yahoo! finance, 2021. *Yahoo! finance.* [Internett]
Available at: https://finance.yahoo.com/quote/MCPHY.PA
[Funnet 01 05 2021].

Yahoo! finance, 2021. *Yahoo! finance.* [Internett]
Available at: https://finance.yahoo.com/quote/CWR.L?p=CWR.L
[Funnet 01 05 2021].

Yahoo! finance, 2021. *Yahoo! finance.* [Internett]
Available at: https://finance.yahoo.com/quote/PCELL.ST?p=PCELL.ST
[Funnet 01 05 2021].

Yahoo! finance, 2021. *Yahoo! finance.* [Internett]
Available at: https://finance.yahoo.com/quote/BLDP?p=BLDP
[Funnet 01 05 2021].

11. Appendices

A. Forecast Assumptions: "High Growth" Scenario

B. Forecast Assumptions: "Growth" Scenario

C. Forecasted Income Statement: "High Growth" Scenario

D. Forecasted Income Statement: "Growth" Scenario

E. Forecasted Analytical Balance Sheet: "High Growth" Scenario

F. Forecasted Analytical Balance Sheet: "Growth" Scenario

G. Forecasted Cash Flow Statement: "High Growth" & "Growth" Scenario

H. Reclassified Statements, Net Operating Assets

I. Reclassified Statements, Net Operating Liabilities

J. Supporting Schedule, Net Working Capital

A. Forecast Assumptions: "High Growth" Scenario

	Forecast driver	Year 2021	Year 2025	Year 2030	Terminal Period	Comment
Revenue growth	**% change from previous year**	**35,7 %**	**38,7 %**	**11,1 %**	**2,5 %**	
Fuelling systems	% change from previous year	40,0 %	40,0 %	11,2 %	2,5 %	Based on Hydrogen Council's most aggressive estimates for the development of production capacity.
Electrolysers	% change from previous year	40,0 %	40,0 %	11,2 %	2,5 %	
Other	% change from previous year	0,0 %	0,0 %	0,0 %	0,0 %	
Government grants	% change from previous year	2,0 %	2,0 %	2,0 %	2,0 %	Growth set to inflation (2.5 %)
Cost of goods sold	**% of Sales**	**60,0 %**	**60,0 %**	**55,0 %**	**50,0 %**	Multiple sources indicate that COGS must go down
Personnel expenses (growth)	**% change from previous year**	**30,0 %**	**15,0 %**	**6,2 %**	**2,5 %**	Expected to reach 25 % of Sales
Other operating expenses	**% of Sales**	**23,6 %**	**13,8 %**	**9,0 %**	**8,1 %**	Expected to reach 12 % of Sales
Research & development expenditure	% change from previous year	2,5 %	2,5 %	2,5 %	2,5 %	Set to grow with inflation
Utilities	% change from previous year	2,5 %	2,5 %	2,5 %	2,5 %	Set to grow with inflation
Selling and administrative expenses	% of Sales	8,6 %	8,0 %	5,5 %	5,0 %	Expected to reduce as business scales
Professional fees	% change from previous year	2,5 %	2,5 %	2,5 %	2,5 %	Set to grow with inflation
Travel expenses	% of Sales	1,6 %	1,2 %	0,7 %	0,5 %	Expected to reduce as business scales
IT and communication costs	% of Personnel expenses	5,0 %	4,5 %	4,5 %	3,5 %	Expected to reduce as business scales
Provision for potential fire	% change from previous year	2,5 %	2,5 %	2,5 %	2,5 %	Set to grow with inflation
Other expenses	% change from previous year	2,5 %	2,5 %	2,5 %	2,5 %	Set to grow with inflation
EBITDA	**% of Sales**	**-32,0 %**	**-2,7 %**	**13,9 %**	**19,9 %**	High compared to other industries
Depreciation	**% of sales**	**10,6 %**	**6,1 %**	**4,3 %**	**4,5 %**	Set to reach levels from other industries
Financial income	**% of Net Interest Bearing Assets**	**2,0 %**	**2,0 %**	**2,0 %**	**2,0 %**	Set to levels close to 2018/19
Financial cost	**% of Net Interest Bearing Debt**	**-20,0 %**	**-20,0 %**	**-20,0 %**	**-20,0 %**	Set to levels close to 2018/19
Reported tax payed	**%**	**28,2 %**	**28,2 %**	**28,1 %**	**28,1 %**	Set to reduce towards 22 %
Effective tax rate on operating activities	**%**	**22,0 %**	**22,0 %**	**22,0 %**	**22,0 %**	Set to 22 %
Net Working Capital	**% of Sales**	**25,0 %**	**25,0 %**	**25,0 %**	**25,0 %**	Set to 25 % (between 2019 and 2020 level)
Interest Bearing Debt	**% of Sales**	**2,5 %**	**2,5 %**	**2,5 %**	**2,5 %**	Set to 2.5 % (based on last three years)
Net Interest Bearing Debt	**% of Invested Capital**	**-20,0 %**	**-20,0 %**	**-20,0 %**	**-20,0 %**	Set to negative 20 %
Intangible & Tangible Assets	**% of Sales**	**205,0 %**	**185,0 %**	**160,0 %**	**150,0 %**	Set to gradually reduce and stabilize at a medium level, based on other manufacturing industries

B. Forecast Assumptions: "Growth" Scenario

	Forecast driver	Year 2021	Year 2025	Year 2030	Terminal Period	Comment
Revenue growth	**% change from previous year**	**12,4 %**	**12,8 %**	**13,2 %**	**2,5 %**	
Fuelling systems	% change from previous year	13,7 %	13,7 %	13,7 %	2,5 %	Based on Hydrogen Council's estimates from 2019 for the development of production capacity.
Electrolysers	% change from previous year	13,7 %	13,7 %	13,7 %	2,5 %	
Other	% change from previous year	0,0 %	0,0 %	0,0 %	2,5 %	
Government grants	% change from previous year	2,0 %	2,0 %	2,0 %	2,5 %	Growth set to inflation (2.5 %)
Cost of goods sold	**% of Sales**	**60,0 %**	**45,0 %**	**40,0 %**	**40,0 %**	Multiple sources indicate that COGS must go down
Personnel expenses (growth)	**% change from previous year**	**10,0 %**	**5,0 %**	**2,5 %**	**2,5 %**	Expected to reach 13 % of Sales
Other operating expenses	**% of Sales**	**26,3 %**	**21,0 %**	**15,2 %**	**8,9 %**	Expected to reach 9 % of Sales
Research & development expenditure	% change from previous year	2,5 %	2,5 %	2,5 %	2,5 %	Set to grow with inflation
Utilities	% change from previous year	2,5 %	2,5 %	2,5 %	2,5 %	Set to grow with inflation
Selling and administrative expenses	% of Sales	8,6 %	8,6 %	7,5 %	5,0 %	Expected to reduce as business scales
Professional fees	% change from previous year	2,5 %	2,5 %	2,0 %	1,5 %	Set to grow with inflation
Travel expenses	% of Sales	2,0 %	1,6 %	1,1 %	0,5 %	Expected to reduce as business scales
IT and communication costs	% of Personnel expenses	5,0 %	4,5 %	4,5 %	3,5 %	Expected to reduce as business scales
Provision for potential fire	% change from previous year	2,5 %	2,5 %	2,5 %	2,5 %	Set to grow with inflation
Other expenses	% change from previous year	2,5 %	2,5 %	2,5 %	2,5 %	Set to grow with inflation
EBITDA	**% of Sales**	**-35,8 %**	**-5,5 %**	**20,0 %**	**37,7 %**	Very high compared to other industries
Depreciation	**% of sales**	**11,5 %**	**9,2 %**	**7,0 %**	**4,0 %**	Set to reach levels from other industries
Financial income	**% of Net Interest Bearing Assets**	**2,0 %**	**2,0 %**	**2,0 %**	**2,0 %**	Set to levels close to 2018/19
Financial cost	**% of Net Interest Bearing Debt**	**-20,0 %**	**-20,0 %**	**-20,0 %**	**-20,0 %**	Set to levels close to 2018/19
Reported tax payed	**%**	**28,2 %**	**28,2 %**	**28,2 %**	**22,0 %**	Set to reduce towards 22 %
Effective tax rate on operating activities	**%**	**22,0 %**	**22,0 %**	**22,0 %**	**22,0 %**	Set to 22 %
Net Working Capital	**% of Sales**	**25,0 %**	**25,0 %**	**25,0 %**	**25,0 %**	Set to 25 % (between 2019 and 2020 level)
Interest Bearing Debt	**% of Sales**	**2,5 %**	**2,5 %**	**2,5 %**	**2,5 %**	Set to 2.5 % (based on last three years)
Net Interest Bearing Debt	**% of Invested Capital**	**204,9 %**	**199,4 %**	**192,7 %**	**180,0 %**	Set to negative 20 %
Intangible & Tangible Assets	**% of Sales**	**12,4 %**	**12,8 %**	**13,2 %**	**2,5 %**	Set to gradually reduce and stabilize at a high level, based on other manufacturing industries

C. Forecasted Income Statement: "High Growth" Scenario

Numbers in million NOK	Year 2017A	Year 2018A	Year 2019A	Year 2020A	Year 2021E	Year 2022E	Year 2023E	Year 2024E	Year 2025E	Year 2030E	Terminal Period(E)
Total Revenue and Operating Income	**302,2**	**489,0**	**569,7**	**651,9**	**884,7**	**1 210,1**	**1 665,0**	**2 301,3**	**3 191,6**	**6 748,0**	**7 088,7**
Cost of Goods Sold	163,6	298,5	342,4	394,0	530,8	726,0	999,0	1 380,8	1 915,0	3 711,4	3 544,3
Gross Profit	**138,6**	**190,5**	**227,3**	**257,9**	**353,9**	**484,0**	**666,0**	**920,5**	**1 276,6**	**3 036,6**	**3 544,3**
Personnel Expenses	130,0	182,7	243,2	329,4	428,2	556,7	668,0	801,6	921,9	1 489,8	1 565,2
Other Operating Expenses	86,0	139,4	162,2	180,0	208,5	249,5	301,9	369,6	441,7	606,0	571,4
EBITDA	**-77,4**	**-131,6**	**-178,1**	**-251,5**	**-282,9**	**-322,1**	**-304,0**	**-250,7**	**-87,0**	**940,8**	**1 407,8**
Depreciation & Amortization	39,8	64,5	75,5	163,0	192,5	223,5	261,0	305,8	359,4	462,5	483,2
EBIT	**-117,2**	**-196,1**	**-253,6**	**-414,5**	**-475,4**	**-545,7**	**-564,9**	**-556,6**	**-446,4**	**478,2**	**924,6**
Tax on Operating Activities	70,3	8,3	8,9	381,3	104,6	120,0	124,3	122,5	98,3	-104,9	-203,0
NOPAT	**-46,9**	**-187,7**	**-244,7**	**-33,2**	**-370,8**	**-425,6**	**-440,6**	**-434,1**	**-348,1**	**373,3**	**721,6**
Net Financial Expenses	-7,3	-1,4	-23,6	1 660,0	0,0	0,0	0,0	0,1	0,2	1,3	1,8
Pre-Tax Loss	**-124,4**	**-197,5**	**-277,2**	**1 245,5**	**-475,4**	**-545,7**	**-564,9**	**-556,5**	**-446,1**	**479,6**	**926,3**
Tax Expense	-72,0	-8,7	-7,5	-16,4	-104,6	-120,0	-124,3	-122,4	-98,2	105,2	203,4
Net Loss, attributable to equity holders	**-52,4**	**-188,8**	**-269,7**	**1 261,9**	**-370,8**	**-425,6**	**-440,6**	**-434,0**	**-347,9**	**374,4**	**722,9**

D. Forecasted Income Statement: "Growth" Scenario

Numbers in million NOK	Year 2017A	Year 2018A	Year 2019A	Year 2020A	Year 2021E	Year 2022E	Year 2023E	Year 2024E	Year 2025E	Year 2030E	Terminal Period(E)
Total Revenue and Operating Income	**302,2**	**489,0**	**569,7**	**651,9**	**732,6**	**824,2**	**928,1**	**1 046,1**	**1 180,2**	**2 177,9**	**5 416,3**
Cost of Goods Sold	163,6	298,5	342,4	394,0	439,5	453,3	464,1	523,1	531,1	871,2	2 166,5
Gross Profit	**138,6**	**190,5**	**227,3**	**257,9**	**293,0**	**370,9**	**464,1**	**523,1**	**649,1**	**1 306,7**	**3 249,8**
Personnel Expenses	130,0	182,7	243,2	329,4	362,3	391,3	418,7	443,8	466,0	539,3	725,3
Other Operating Expenses	86,0	139,4	162,2	180,0	192,6	206,2	221,1	235,4	248,4	331,8	480,5
EBITDA	**-77,4**	**-131,6**	**-178,1**	**-251,5**	**-261,9**	**-226,7**	**-175,8**	**-156,1**	**-65,3**	**435,6**	**2 044,0**
Depreciation & Amortization	39,8	64,5	75,5	163,0	173,2	183,0	193,6	205,0	217,2	293,2	390,0
EBIT	**-117,2**	**-196,1**	**-253,6**	**-414,5**	**-435,1**	**-409,7**	**-369,4**	**-361,1**	**-282,5**	**142,4**	**1 654,0**
Tax on Operating Activities	70,3	8,3	8,9	381,3	95,7	90,1	81,3	79,4	62,2	-31,3	-363,8
NOPAT	**-46,9**	**-187,7**	**-244,7**	**-33,2**	**-339,4**	**-319,6**	**-288,1**	**-281,7**	**-220,4**	**111,1**	**1 290,2**
Net Financial Expenses	-7,3	-1,4	-23,6	1 660,0	0,0	0,0	0,0	0,0	0,0	0,1	0,5
Pre-Tax Loss	**-124,4**	**-197,5**	**-277,2**	**1 245,5**	**-435,1**	**-409,7**	**-369,4**	**-361,1**	**-282,5**	**142,5**	**1 654,5**
Tax Expense	-72,0	-8,7	-7,5	-16,4	-95,7	-90,1	-81,3	-79,4	-62,2	31,3	363,9
Net Loss, attributable to equity holders	**-52,4**	**-188,8**	**-269,7**	**1 261,9**	**-339,4**	**-319,6**	**-288,1**	**-281,7**	**-220,4**	**111,2**	**1 290,6**

E. Forecasted Analytical Balance Sheet: "High Growth" Scenario

Numbers in million NOK	Year 2017A	Year 2018A	Year 2019A	Year 2020A	Year 2021E	Year 2022E	Year 2023E	Year 2024E	Year 2025E	Year 2030E	Terminal Period(E)
Non-Current Assets	1 180,5	1 307,7	1 396,4	1 542,9							
Current Assets	289,3	286,9	508,3	574,7							
Non-Interest Bearing Debt	282,1	332,6	553,5	638,1							
Net Working Capital	75,4	87,7	171,6	143,6	221,2	302,5	416,2	575,3	797,9	1 687,0	1 772,2
Intangible and Tangible Assets	1 112,3	1 174,4	1 179,6	1 335,9	1 813,6	2 420,1	3 246,7	4 372,5	5 904,5	10 796,8	10 633,0
Invested Capital, Net Operating Assets	**1 187,7**	**1 262,1**	**1 351,2**	**1 479,6**	**2 034,8**	**2 722,6**	**3 663,0**	**4 947,9**	**6 702,4**	**12 483,8**	**12 405,2**
Total Equity	1 409,4	1 579,0	1 846,6	3 782,1	2 441,7	3 267,1	4 395,6	5 937,4	8 042,9	14 980,5	14 886,2
Interest Bearing Debt	73,3	32,9	30,6	30,3	45,3	60,5	81,2	109,3	147,6	269,9	265,8
Interest Bearing Assets	295,0	349,7	526,0	2 332,9	452,3	605,0	813,8	1 098,9	1 488,1	2 766,7	2 746,9
Net Interest Bearing Debt	-221,7	-316,9	-495,4	-2 302,6	-407,0	-544,5	-732,6	-989,6	-1 340,5	-2 496,8	-2 481,0
Invested Capital, Net Operating Liabilities	**1 187,7**	**1 262,1**	**1 351,2**	**1 479,6**	**2 034,8**	**2 722,6**	**3 663,0**	**4 947,9**	**6 702,4**	**12 483,7**	**12 405,2**

F. Forecasted Analytical Balance Sheet: "Growth" Scenario

Numbers in million NOK	Year 2017A	Year 2018A	Year 2019A	Year 2020A	Year 2021E	Year 2022E	Year 2023E	Year 2024E	Year 2025E	Year 2030E	Terminal Period(E)
Non-Current Assets	1 180,5	1 307,7	1 396,4	1 542,9							
Current Assets	289,3	286,9	508,3	574,7							
Non-Interest Bearing Debt	282,1	332,6	553,5	638,1							
Net Working Capital	75,4	87,7	171,6	143,6	183,1	206,0	232,0	261,5	295,0	544,5	1 354,1
Intangible and Tangible Assets	1 112,3	1 174,4	1 179,6	1 335,9	1 501,3	1 677,5	1 876,3	2 100,5	2 353,4	4 197,3	9 749,3
Invested Capital, Net Operating Assets	**1 187,7**	**1 262,1**	**1 351,2**	**1 479,6**	**1 684,5**	**1 883,6**	**2 108,3**	**2 362,0**	**2 648,4**	**4 741,7**	**11 103,4**
Total Equity	1 409,4	1 579,0	1 846,6	3 782,1	2 021,4	2 260,3	2 530,0	2 834,4	3 178,1	5 690,1	13 324,0
Interest Bearing Debt	73,3	32,9	30,6	30,3	37,5	41,9	46,9	52,5	58,8	104,9	243,7
Interest Bearing Assets	295,0	349,7	526,0	2 332,9	374,4	418,7	468,6	524,9	588,5	1 053,3	2 464,4
Net Interest Bearing Debt	-221,7	-316,9	-495,4	-2 302,6	-336,9	-376,7	-421,7	-472,4	-529,7	-948,3	-2 220,7
Invested Capital, Net Operating Liabilities	**1 187,7**	**1 262,1**	**1 351,2**	**1 479,6**	**1 684,5**	**1 883,6**	**2 108,3**	**2 362,0**	**2 648,4**	**4 741,7**	**11 03,4**

G. Forecasted Cash Flow Statement: "High Growth" & "Growth" Scenario

Numbers in million NOK	Year 2017A	Year 2018A	Year 2019A	Year 2020A	Year 2021E	Year 2022E	Year 2023E	Year 2024E	Year 2025E	Year 2030E	Terminal Period(E)
"High Growth" Scenario											
NOPAT (+)	-46,9	-187,7	-244,7	-33,2	-370,8	-425,6	-440,6	-434,1	-348,1	373,3	721,6
Depreciation & Amortization (+)	39,8	64,5	75,5	163,0	192,5	223,5	261,0	305,8	359,4	462,5	483,2
Net Working Capital (-)	-66,4	-12,3	-83,9	28,0	-77,5	-81,3	-113,7	-159,1	-222,6	-168,1	-43,1
CAPEX (-)	-702,7	-126,6	-80,7	-324,5	-670,2	-830,0	-1 087,6	-1 431,6	-1 891,3	-1 234,6	-396,0
FCFF	**-776,3**	**-262,1**	**-333,8**	**-166,8**	**-926,0**	**-1 113,5**	**-1 381,0**	**-1 719,0**	**-2 102,6**	**-566,8**	**765,6**
NIBD (+)	-8,8	-95,2	-178,5	-1 807,2	1 895,6	-137,6	-188,1	-257,0	-350,9	-188,0	8,8
Net Financial Expenses (-)	-7,3	-1,4	6,1	1 658,8	0,0	0,0	0,0	0,1	0,2	1,3	1,8
Tax shield (+)	1,7	0,3	-1,4	-364,9	0,0	0,0	0,0	0,0	-0,1	-0,3	-0,4
FCFE	**-790,6**	**-358,4**	**-507,6**	**-680,1**	**969,6**	**-1 251,0**	**-1 569,1**	**-1 975,9**	**-2 453,3**	**-753,8**	**775,8**
Dividends	790,6	358,4	507,6	680,1	-969,6	1 251,0	1 569,1	1 975,9	2 453,3	753,8	-775,8
"Growth" Scenario											
NOPAT (+)	-46,9	-187,7	-244,7	-33,2	-339,4	-319,6	-288,1	-281,7	-220,4	111,1	1 290,2
Depreciation & Amortization (+)	39,8	64,5	75,5	163,0	173,2	183,0	193,6	205,0	217,2	293,2	390,0
Net Working Capital (-)	-66,4	-12,3	-83,9	28,0	-39,5	-22,9	-26,0	-29,5	-33,5	-63,3	-33,0
CAPEX (-)	-702,7	-126,6	-80,7	-324,5	-338,6	-359,2	-392,4	-429,2	-470,2	-756,1	-627,8
FCFF	**-776,3**	**-262,1**	**-333,8**	**-166,8**	**-544,3**	**-518,7**	**-512,9**	**-535,4**	**-506,8**	**-415,1**	**1 019,4**
NIBD (+)	-8,8	-95,2	-178,5	-1 807,2	1 965,7	-39,8	-44,9	-50,7	-57,3	-105,2	-54,2
Net Financial Expenses (-)	-7,3	-1,4	6,1	1 658,8	0,0	0,0	0,0	0,0	0,0	0,1	0,5
Tax shield (+)	1,7	0,3	-1,4	-364,9	0,0	0,0	0,0	0,0	0,0	0,0	-0,1
FCFE	**-790,6**	**-358,4**	**-507,6**	**-680,1**	**1 421,4**	**-558,5**	**-557,8**	**-586,1**	**-564,1**	**-520,3**	**965,7**
Dividends	790,6	358,4	507,6	680,1	-1 421,4	558,5	557,8	586,1	564,1	520,3	-965,7

H. Reclassified Statements, Net Operating Assets

Numbers in million NOK	**Year 2016A**	**Year 2017A**	**Year 2018A**	**Year 2019A**	**Year 2020A**
Non-Current Assets	**462 856**	**1 180 540**	**1 307 744**	**1 396 432**	**1 542 943**
Technology	57 854	377 677	422 040	451 736	427 341
Customer relationship	27 861	78 329	69 151	57 185	44 695
Customer contacts	-	9 575	-	-	-
Goodwill	317 629	591 735	608 837	609 154	619 731
Property, plant and equipment	45 804	96 198	135 383	256 170	378 052
Investments in associates and joint ventures	13 708	16 865	18 451	3 795	1 289
Non-current financial assets (financial fixed assets)	-	10 161	53 882	18 392	71 835
Current Assets	**74 552**	**289 282**	**286 908**	**508 260**	**574 707**
Inventories	36 266	138 723	134 804	205 234	237 129
Trade receivables	34 974	96 791	108 659	183 333	101 449
Contract assets	-	-	8 212	37 103	127 976
Other current assets	3 312	53 768	35 233	82 590	108 153
Non-Interest Bearing Debt	**79 105**	**282 147**	**332 564**	**553 478**	**638 095**
Lease liabilities	-	-	-	79 121	77 125
Deferred income	-	-	48 941	59 015	63 601
Other non-current liabilities	-	-	14 949	15 340	11 140
Trade payables	16 790	64 857	69 473	92 197	81 570
Lease liabilities	-	-	-	12 066	14 291
Contract liabilities	-	-	68 640	147 481	193 082
Provisions	-	-	23 396	33 704	74 735
Other current liabilities	47 046	145 957	37 684	51 211	67 407
Public duties payables	1 347	3 060	-	-	-
Tax payables	370	-	-	-	-
Deferred tax liabilities	13 552	68 273	69 481	63 343	55 144
Invested Capital, Net Operating Assets	**458 303**	**1 187 675**	**1 262 088**	**1 351 214**	**1 479 555**

I. Reclassified Statements, Net Operating Liabilities

Numbers in million NOK	**Year 2016A**	**Year 2017A**	**Year 2018A**	**Year 2019A**	**Year 2020A**
Total Equity	**671 220**	**1 409 386**	**1 578 978**	**1 846 618**	**3 782 123**
Interest bearing debt	**12 550**	**73 290**	**32 859**	**30 577**	**30 284**
Long-term debt	-	-	32 859	30 577	30 284
Other long-term debt	12 550	66 752	-	-	-
Non-current interest bearing debt	-	6 538	-	-	-
Interest bearing assets	**225 467**	**295 000**	**349 747**	**525 982**	**2 332 854**
Cash and cash equivalents	225 467	295 000	349 747	525 982	2 332 854
Net interest bearing debt	**-212 917**	**-221 710**	**-316 888**	**-495 405**	**-2 302 570**
Invested Capital, Net Operating Liabilities	**458 303**	**1 187 676**	**1 262 090**	**1 351 213**	**1 479 553**

J. Supporting Schedule, Net Working Capital

Numbers in million NOK	**Year 2016A**	**Year 2017A**	**Year 2018A**	**Year 2019A**	**Year 2020A**
Receivables & Inventory	74 552	289 282	286 908	508 260	574 707
Operating Current Assets	**74 552**	**289 282**	**286 908**	**508 260**	**574 707**
Payables	16 790	64 857	69 473	92 197	81 570
Tax payables & public duties payable	1 717	3 060	-		
Other current liabilities	47 046	145 957	37 684	51 211	67 407
Contract liabilities	-	-	68 640	147 481	193 082
Provisions	-	-	23 396	33 704	74 735
Lease liabilities	-	-	-	12 066	14 291
Operating Current Liabilities	**65 553**	**213 874**	**199 193**	**336 659**	**431 085**
Net Operating Working Capital	**8 999**	**75 408**	**87 715**	**171 601**	**143 622**

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