MBA Thesis

Green Investments and Firm Profitability: An Analysis of Nordic Energy Companies

A statistical analysis of sustainability investments in the Nordic region based on a linear regression evaluating share price, net profit as profitability measures

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The authors declare that they have completed the thesis work independently. All external sources are cited and listed under the References section. The thesis work has not been submitted in the same or similar form to any other institution(s) as part of another examination or degree.

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Abstract

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During recent years, climate change has been a deeply investigated subject, leading various governments to ratify climate-related agreements, such as the Paris agreement. These agreements triggered an unprecedented transition towards sustainability in the energy industry, historically related to fossil fuels. The aim of this work is to understand the financial impact for the energy sector when investing within sustainability in the Nordics, as this region has been at the forefront when it comes to sustainability. Linear regressions were performed to evaluate correlations between firms' financial indicators and potentially underlying variables such as oil price and green investments. Equinor, St1, Neste, Preem, and Shell were the firms considered in this study. First, the share of green investments was evaluated, identifying the different investment strategies that firms may adopt. In addition, it was identified that green investments have a strong correlation with the enforced environmental policies, with new policies correlated with an average of 5% increase of the share of green investments. The study continues evaluating the percentage of net profit, showing a positive correlation with the oil price, indicating that increased profits are correlated with higher oil prices. Equinor is an exception, as its green investments show a unique correlation with net profit, likely due to its unique portfolio of offshore wind power. Finally, the study considers the share price as an independent variable, which has a negative correlation with green investments, indicating a risk-averse position from the shareholders. Additionally, the share price has a positive correlation with environmental policies, which is in line with previous studies arguing that it is beneficial for the overall sector to have a more regulated market. Equinor is an exception also in this case, as it shows a positive correlation with green investments, probably due to the increased profitability.

Keywords: Sustainability; Energy Industry; Financial Performance; Green Investments; Environmental Policy

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Lastly, we would like to thank **you, the reader**, for taking the time to engage with our work. We hope that our findings contribute meaningfully to the ongoing discourse on green energy investments and corporate performance.

Sweden, September 2025

Aksel Wännström & Francesco Montecchio

Table of contents

1. Introduction 1

1.1. Problem statement 1

2. Purpose and research questions 3

3. Previous research 5

3.1. Literature review 5

4. Research Methodology 11

4.1. Theoretical Framework 11
4.2. Methodology – Linear regression 12
4.3. Research Design 12
4.4. Procedure 18
4.5. Statistical robustness 20
4.6. Potential biases and limitations 21
4.7. Ethical considerations 21

5. Analysis and discussion 23

5.1. Green investment analysis 23
5.2. Net profit analysis 26
5.3. Share price analysis 30

6. Conclusion 35

References 37

Appendix A: Statistical robustness 49

Appendix B: Policies 51

Appendix C: Code 53

Appendix D: List of Sources for the data 56

List of Tables

Table 1. Summary of related studies and the target study, divided by market study type and analyzed variables 5
Table 2. Summary of the main investment sectors within sustainability, with the main companies investing in each sector. 14
Table 3: Abbreviations used with description and type. 17
Table 4. Dependent, independent and control variables in the different models. 19
Table 5: Summary of the checks on the regression results aimed at eliminating variables which are not statistically significant. 20
Table 6. Summary of potential biases and limitations affecting the results and conclusions, with possible consequences. 21
Table 7. Result summary of the regression with the share of sustainable investments as dependent variable and the number of environmental policies as independent variable. 25
Table 8. Result summary of the regression having the percentage net profit as dependent variable, divided by year. 27
Table 9. Result summary of the regression for Equinor having the percentage net profit as dependent variable and the share of sustainable investments as independent variable, divided by year. 29
Table 10. Result summary of the regression having the share price as dependent variable, divided by year. 32
Table 11. Result summary of the regression for Equinor having the share price as dependent variable and the share of sustainable investments as independent variable, divided by year. 33
Table 12. Summary of the skewness and kurtosis analysis via the Sktest for the dependent, independent and control variables. 49
Table 13. Summary of the Shapiro-Wilk Test for the dependent, independent and control variables. 49
Table 14. Summary of the skewness and kurtosis analysis via the Sktest for the ln-transformed version of the variable representing the share price. 50
Table 15: Summary of the environmental policies for each country considered. 51

List of Figures

Figure 1. Average oil price for the past 25 years of West Texas Intermediate (Macrotrends, 2025) _ 2
Figure 2. Comparison between the low-carbon investments (as % of the total CAPEX) and the average oil price. 24
Figure 3. Comparison between the low-carbon investments (as % of the total CAPEX) and the average number of cumulative policies. 25
Figure 4. Results of the T-test and p-value analysis for each independent variable, divided by years of investment (net profit analysis). 27
Figure 5. Results of the t-test and P-value analysis for dependent variables, divided by years of investment (share price analysis). 31

1. Introduction

1.1. Problem statement

Recent agreements such as the Paris agreement (The Paris Agreement, 2015-12-12) highlight the requirement for transitioning from a linear economy based on fossil resources into a circular model where renewable resources are used as raw material. It is understood that a significant shift in terms of energy generation is needed in the next few years. However, such a transition requires significant investments as several business sectors need to drastically modify their ecosystem (Bataille et al., 2018). The energy sector is in the midst of this transition, albeit with fossil resources still widely used for energy production. One example is the usage of coal in China, which accounted for 65% of the energy mix in 2019 (Abbasi et al., 2022). In addition, the energy sector still invests heavily in fossil-based energy, due to the increased demand based on the growing population as well as decreased supply due to global instability. As per the International Energy Agency, the total investment of the energy sector into fossil fuels still accounted for over 1000 billion USD in the year 2024 (International Energy Agency, 2024). As these investments have continued for a long time, the energy sector has established a large ecosystem fully based on fossil resources. Therefore, since this industry is planning to switch to renewable resources, an equivalent large amount of investment is needed which additionally needs to be readily available within a short period of time, due milestones set by e.g., the Paris agreement. Therefore, it is important for energy companies, their shareholders, and policy makers to understand the impact of investments into renewable technologies. In this context, countries that seek to maintain, and enforce significant investments into renewable technologies need to be aware of the risk and opportunities involved, with additional considerations in terms of profitability against traditional oil and gas operations. Additionally, these companies need to have clearer indications if such investments are likely to positively or negatively impact their profits in the short and long run of their business operations.

In this context, even if recent developments aim at sustainability, energy companies have had a past of being reluctant to invest in the green transition, due to an uncertain policy framework, an uncertain margin of profitability and return on investments in green energy when considering an already profitable oil and gas business. Additionally, regarding profitability, the price of crude oil has been generally at a high level in the last year, often above 100 USD per barrel, see Figure 1. This high price might hinder alternative investments in sustainability, as they may be seen not as profitable. However, in recent years, even if there was a temporary surge in price due to the war in Ukraine, the oil price has plummeted, and it is unclear if the old price level can be reached again.

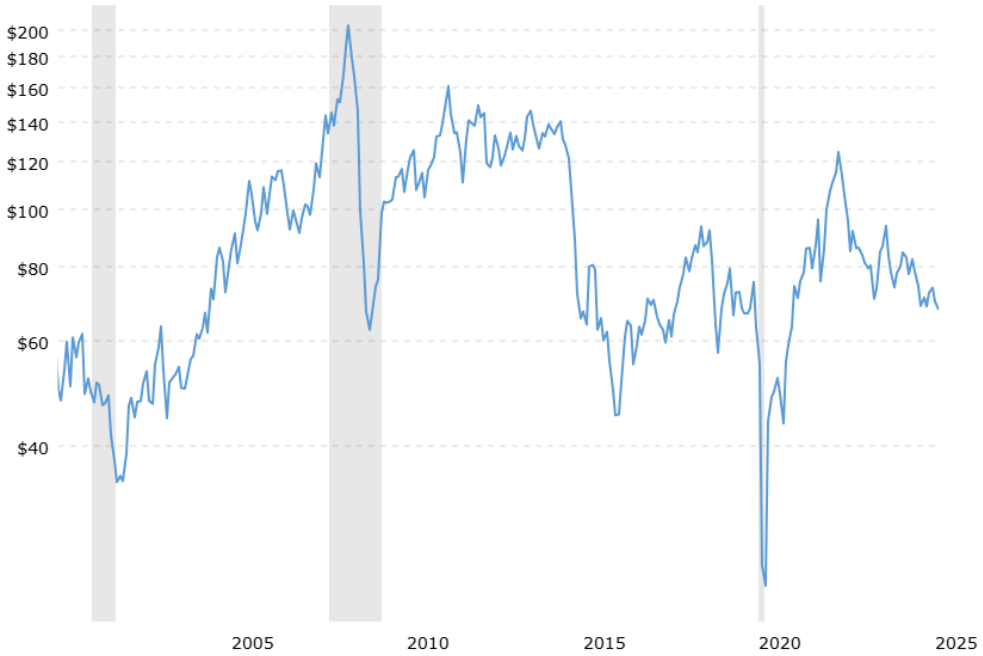

Figure 1. Average oil price for the past 25 years of West Texas Intermediate (Macrotrends, 2025)

Currently, even if investments in fossil resources are still high, investments in renewable energy were almost twice as much in 2024 (International Energy Agency, 2024) compared to investments in oil and gas for the same year, reaching a total cumulative amount estimated between 0.7 and 2 USD trillion globally (Renewable Energy Policy Network for the 21st Century, 2025) (BloombergNEF, 2025). After years of stability the energy sector is facing challenging times. On one hand, there are clear signals to abandon fossil fuels, but on the other, there is no clear framework on the next steps (SEI, Climate Analytics, E3G, IISD, and UNEP, 2023). Additionally, it may no longer be viable to keep doing business as usual, so different business models need to be explored. While an energy transition needs to happen relatively soon, the amount of investment required is quite considerable. This investment gap is proving an obstacle for energy companies in taking more decisive steps. In this context, it is currently unclear on what time frame all required investments are going to generate a return on the investment, or whether all required investments are going to be recovered. These large uncertainties on timing or profitability pose a dilemma for energy companies, particularly those which are listed on the stock market. It is assumed that such companies are pressured to show continuous growth in revenue and profit, as otherwise the overall company value could be significantly diminished. Thus, these companies face the challenging task of adapting to a completely new business model while keeping both profitability and growth high. In this situation, there is a desire to understand the correlation, and eventual impacts of investments within sustainability on profitability within the energy sector. Once any potential correlation is established, it would be easier to forecast investment trends within sustainability in the energy sector.

For the current investigation, it is worthwhile clarifying that the concept of sustainability is not universally defined, so it was considered as self-declared investments by energy companies. The focus of this work is on overall low-carbon / sustainability expenditure, broadening the scope beyond investments into research and development or those investments only made in improving e.g. the energy efficiency of existing sites and infrastructure. As each firm may have different considerations when defining their investment strategies, a deeper understanding on what investments are considered “green” would be helpful to better understand the impact of such advancements against climate change.

2. Purpose and research questions

The current uncertainty concerning future environmental policies is reflected in the type of investments from energy companies worldwide and in particular for those energy companies located in Europe, as they may fear losing profitability when focusing on increasing sustainability. It is worthwhile noting that, while there are various research studies performed in various geographic regions e.g. (Song et al., 2023) (Chen & Ma, 2021) (Cheng et al., 2023), these works address a very narrow geographical scope and thus they motivate the use of a similar analysis for different regions. As emphasized by Ribeiro et al. (Ribeiro et al., 2025) the effects of green technology investments may be dependent upon geographical factors. The purpose of this thesis is to analyze the financial impact of investments within sustainability from traditional energy companies, focusing on companies residing in the Nordics. Nordic is an unexplored region when considering the impact of firm profitability, and shareholder value generated when investing into renewable energy, despite often being cited as being at the forefront in terms of environmental policies (Block et al., 2024) while traditional energy companies are still operating in the region, often contributing substantially to the countries' GDP, such as Equinor in Norway. Previous literature, e.g., Shah et al. focuses on individual countries such as Norway, USA, and UK, and Cheng et al focuses on alternative regions such as China. However, it is currently not known how the amount of money invested in sustainability impacts the energy sector's overall financial performance. In addition, the potential impact of policies enforced by the EU or local governance is also not clearly defined. Therefore, this report considers the effect of environmental policies as can be further seen in Chapter 3.1.2. It is worth noting that the selected time interval for the current study (last 10 years: 2014 – 2023) is particularly suitable for analyzing the impact of environmental policies, as the number of enforced policies greatly increased during this time interval (Bogmans et al., 2024).

The evolving political landscape and financial pressures on corporations have led to two competing perspectives on green energy investments. First, tightening regulations may compel energy-sector companies to incorporate green investments, either incrementally or on a larger scale. If these investments negatively impact short-term profitability, financial markets may react unfavorably, preferring allocations to higher-yield alternatives. Consequently, there may be a negative correlation between green investments and immediate profitability.

Conversely, green investments might generate short-term financial gains due to political incentives or be perceived as providing long-term strategic advantages. In this case, financial markets may view such investments positively, leading to increased net profits or higher stock valuations.

This report aims to assess the financial viability of green energy investments among Nordic energy companies, considering both short-term and long-term profitability. Specifically, it examines the extent to which such investments correlate with changes in share price and profit margins.

Before deep diving into profitability, the study begins by analyzing potential triggers to sustainability investments which could provide relevant insights into the investment strategies of the various firms. Therefore, an analysis was carried out with the aim of finding potential correlations between the share of green investments (as dependent variable) and selected independent variables. The oil price and number of cumulative environmental policies were the selected independent variables. This analysis is later called as "Green investment analysis" in Chapter 5. The Null Hypothesis (H0) is the following:

There is no clear trigger or driver that causes energy companies in the Nordics to invest within sustainability.

A linear regression was consequently designed to test this hypothesis, analyzing if there is any correlation between green investments as dependent variable and oil price and number of environmental

policies as independent variables. This part of the current study aims at answering the following research questions:

1 Does a change in the global price of crude oil lead to more sustainability investments by Nordic energy companies?
2 Does an increase in local environmental policies lead to more sustainability investments by Nordic energy companies?

The first two research questions are suitable as research questions given that there is not one study performing a pan-Nordic evaluation of the impact of crude oil on sustainable investments. Shah et al. (2018) analysis the impact of oil and macroeconomic factors and policies on USA, UK and Norway. Thus, it seemed pertinent to answer the similar questions above to set a frame of reference for the Nordics for the deeper evaluation of the impact of renewable investments on firms' profitability and shareholder value for Nordic companies. For the sake of Hypothesis 0, energy firms are defined as companies that specialize in the production, distribution or sale of various forms of energy. As this work focuses on energy transition, the selected firms have a history of traditional operations depending on fossil fuels, as they are the most involved in the transition towards sustainability. The list of the selected firms is presented in Section 4.3.1, showing criteria for their assessment. It is worth noting that the Nordic region is defined as Finland, Sweden, Denmark, Norway and Iceland. Referring to section 3 Previous research, it becomes apparent that there is indeed a knowledge gap for comparing the effect of renewable investments on firm performance and shareholder value when attempting to view the Nordics as a geographical region.

After this investigation, the study continues by analyzing the impact of green investments within the profitability and share price of the analyzed firms. The null hypothesis (H0) presents that there is no correlation between green investments and firms' financial performance, and it is formulated as follows:

Hypothesis 0:
There is no statistically significant correlation between green investments and financial performance (profitability and/or stock valuation) of the selected Nordic energy firms within the years 2015 - 2024.

Such a result would indicate that these green investments would not influence the profitability of energy companies, and thus that there may not be an incentive for these companies to invest into sustainability. To test this hypothesis, linear regressions were designed to evaluate any correlation between the extent of green investments and selected KPIs within financial performance.

When it comes to research questions within the scope of the part, answers to the following questions where sought:

3 When part of the capital expenditure is assigned to sustainability, what is the effect on the financial performance of firms in the Nordics?
4 When part of the capital expenditure is assigned to sustainability, what is the effect on the share price of firms in the Nordics?

These research questions follow from the prior research wherein investments into R&D and green investments are utilized to review the effect on companies, or regions' financial returns, or corporate growth. Thus, turning to the knowledge gap concerning the impact on oil and gas companies operating in the Nordic region, it follows that research questions 3 and 4 are a natural avenue for this research to further add to, and attempt to fill upon, the knowledge gaps found and isolated in section 3.

3. Previous research

This chapter reviews relevant previous works by assessing the literature within the field of green investments and their impact on profitability.

The first section is dedicated to looking at relevant research, discussing and evaluating the impact of investments and their impact on profits. A second section briefly discusses relevant research concerning the effect of policy on renewable investments.

3.1. Literature review

3.1.1. Green investments and impact on companies' financials

Before presenting in detail the reviewed literature, Table 1 presents a summary of the reviewed papers and the aimed target for the current study.

Table 1. Summary of related studies and the target study, divided by market study type and analyzed variables

Paper	Market	Study type	Independent variables	Dependent variables
(Vithessonthi & Racela, 2016)	USA	Linear regression	R&D investments	Operating performance
(Morina et al., 2025)	Global - Tech firms	Semiparametric quantile	R&D investments	Corporate growth
(Song et al., 2023)	China	Multi-layer own model	Green R&D investments	Corporate performance (ROA)
(Ribeiro et al., 2025)	Global	PRISMA model	Green investments	Geographical region
(Hazarika, 2021)	Global – Energy companies	Linear regression	R&D investments	Market value to book value, ROA, ROE, ROS, NPM, EPS
(Cheng et al., 2023)	China – Energy companies	Logarithmic regression	Green investments	Share price
(Mo et al., 2022)	Global – Energy companies	Quantile-on-quantile model	Carbon price	Stock returns
(Xu & Lin, 2024)	China	Spatial quantile regression model	Green investments	Wind power developments
(Chen & Ma, 2021)	China – Energy companies	Linear regression	Green investments	Net profit, ROE, Tobin'Q
(Bostian et al., 2016)	Sweden – Pulp and paper	DEA model	Green investments	Energy efficiency, environmental performance, firm productivity
(Pham et al., 2021)	Sweden	Linear regression	Firm sustainability framework	Earning yield, ROA, ROE, ROC
(Abakah et al., 2022)	USA	Quantile-based time-varying connectedness framework	Green bonds	Conventional assets

(Taghizadeh-Hesary & Naoyuki Yoshino, 2019)	General	Multi-variable own model	Green investment framework	Return rate – Green projects
Target study in this work	Nordic – Energy companies	Linear regression	Green investment analysis: Oil Price, Environmental Policies Net profit and Share price analysis: Green investments, Oil Price, Environmental Policies	Green Investment analysis: Green Investments Net profit and Share price analysis: Percentage net profit and share price

Even if there are in the literature examples of studies relevant for the current investigation, Table 1 highlights a clear research gap. Focusing on the Nordic market and aiming at analyzing the financial impacts of green investments, the reviewed papers differ slightly. While still relevant, they may cover different markets or analyze different dependent/independent variables. More details about the reviewed works are available below in this section.

Green technology investment is critical to the continued energy transition for countries around the world. These investments depend upon the ability of corporations being enabled to expect a return on investments, alongside a prediction of enabling change to ensure the longevity of the companies. Companies can foresee that there will be a need and political pressure to continue investing in green technologies. Thus, there have been multiple studies on the relationship between green technology investments and firm performances, as well as the effectiveness of green technology investments into the reduction of CO_2 emissions. Literature presents several studies addressing these issues, but still this area is yet to be explored, as the current studies are limited to certain geographies or do not analyze the entire whole financial impact of green investments, focusing either on the technological or financial aspects.

There have been multiple studies investigating the effects of research and development (R&D) on firm performance such as Chaiporn Vithessonthi and Olimpia C. Racela (2016) and Morina et al. (2025) who analyzed the **short- and long-run** effects of **internationalization and R&D intensity** on **firm performance**. Vithessonthi and Racela analyzed all non-financial firms listed on the US stock exchange during the period 1990-2013 utilizing an **ordinary least squares linear regression model,** finding that the level of R&D intensity is negatively associated with operating performance, possibly indicating that R&D expenditure may decrease profitability in the short term. However, R&D investments were positively correlated with firm value, indicating an improvement to a firm's competitive advantage in the long run. It should be noted that Vithessonthi and Racela reviewed R&D and not particularly green investments, as well as the impact of internationalization, in comparison to the impact of regional policy effects, thereby indicating that a least squares linear regression model is a suitable measure for the considered analysis. Morina et al. examined the intensity- and speed-based differences in the short-term relationship between **R&D investment** and **corporate growth** of 2,000 tech firms from 2000 to 2020 using **semiparametric quantile models**. They concluded that the effect of R&D investments is positive at intensities above 50% of sales for high growth firms, and for low growth firms there is a required 130% of sales into R&D investments to generate positive sales growth.

However, there are multiple studies which have narrowed the scope and focused on the correlations between investments into renewable or green technology or infrastructure utilizing a variety of methodologies.

Song et al. (2023) review the correlation between **green technology R&D investment** and **corporate performance** of 44 energy companies listed in Beijing from 2016-2021, illustrating that green technology R&D investment have a positive effect on firm performance within an appropriate green

technology R&D investment interval. The results show an **inverse W-shaped nonlinear relationship** between green technology R&D investments and firm performance. However, the result of this study also indicates that not all investments are positive investments. Taking into context that China is a developing country, there is a larger capacity for the continued decrease of greenhouse gases within China during the country's development. It is worthwhile noting that this is a very narrow geographical scope and thus motivates the use of the same method and analysis for a different geographic region. As emphasized by Ribeiro et al. (Ribeiro et al., 2025) the effects of green technology investments may be dependent upon geographical factors.

Hazarika (2021) discusses the relationship between **environmental research and development** and **corporate financial performance**. (Hazarika, 2021) Having reviewed 24 companies worldwide from 2007-2016 Hazarika illustrates that after passing an inflection point, investment in **R&D reaps financial benefits that eventually offsets that cost of the initial investment,** presenting an argument for the **curvilinear relationship of R&D intensity** on return on sales and net profit margin. However, Natasha Hazarika reviews companies across the world, thus enabling a further venue of research into the effects of regional or national policies impacting the relationship between environmental research and development and corporate financial performance. More nuanced research would therefore be enabled by narrowing down the scope of geography within the same model, thus enabling a control of geographic factors. Alternatively, further research, including multiple companies in different regions and a comparison of such results against each other, would further contribute to the field of research.

Cheng, Chen and Yuxin Su (2023) investigates **green innovation in oil and gas exploration** and production for meeting **sustainability goals**, analyzing 100 publicly listed companies from 2010-2020 utilizing a **Cross-Sectionally Augmented Autoregressive Distributed lag technique** concluding that there is a relationship between the increase in technology expenditure (1%) has a **positive effect on energy efficiency** (Cheng et al., 2023), thereby providing an argument to the value of investing in advanced technology for improving energy efficiencies in both the short and long run. Additionally, the study identified **stock price as an indicator of energy efficiency**, wherein a 1% increase in stock price was associated with approximately 0.27% and 0.31% enhancements in energy efficiency in the short and long term, respectively, suggesting that a robust stock performance signals investors' confidence and a commitment to sustainability. However, the research leaves the door open to utilizing alternative models beyond the Sectionally Augmented Autoregressive Distributed lag technique, affecting stock price such as those of Mo et al., (2022) that analyzes the correlation between **carbon price** and **stock return of green energy companies**, utilizing a **quantile on-quantile regression model**. Mo et al. (2022) conclude that carbon price changes over time and is vulnerable to impulse changes e.g., COVID-19, so investors may benefit in the short term with high-frequency trading (Mo et al., 2022). Following this study, it can be observed that the price of a green energy is related to more than just a company's investments into R&D but also in the environment that it operates within, e.g., the carbon price enabling a spillover effect on the value of green energy companies stock price as an increase in the carbon price may tend to raise the price of electricity. Thus, the authors indicated a variety of factors that may impact the stock price of energy companies, suggesting that a further analysis into their relationship to the stock price could be future venues of research.

Bin Xu and Boqiang Lin investigates the impact of **green finance** on **wind power developments in China** utilizing a **spatial quantile regression model**, showing that green finance has a driving effect on provinces with low- and middle-wind power production, and that the impact of wind power prices on the wind power in all Chinese provinces is negative as at the time of the research the wind prices are still high (Xu & Lin, 2024). Thus, there is an effort to correlate financial investments in green technology with a particular type of energy development, wind power, but it should be considered that most oil and gas companies need to stay profitable while the energy transition takes hold. Thus, it may be pertinent to view the overall effect of investments into green technology in general, beyond the scope of just a singular type of green energy.

Several additional studies have tried to investigate relations between green investments and various aspects of firms' financial performance. One example is the work of Chen and Ma, who analyzed the impacts in the energy industry in China. They underlined the importance of having a government strengthening the enforcement of environmental taxes, proportionally to the firms' environmental emissions. They also argued that financial performance was significantly improved in the third year after green investment. (Chen & Ma, 2021)

The work of Bostian et al. (2016) takes this analysis to the Nordic region, as they analyzed firms in the pulp and paper industry in Sweden. Similarly to Chen and Ma (2021), Bostian et al. also found positive relationships between energy efficiency, environmental performance and firm productivity, considering both short-term environmental management practices and long-term environmental investments. (Bostian et al., 2016)

Pham et al. also studied the Swedish market, studying several firms for the year 2019. Their research indicated a positive relationship between corporate sustainability and financial performance, especially when measured by earnings yield, return on asset, return on equity and return on capital employed. In addition, the authors suggested a series of KPIs to be included in the sustainability reports, aimed at improving performance even further. (Pham et al., 2021)

When considering alternative investments in sustainability, Abakah et al. (2022) examined the relatedness between green and conventional assets, in particular during periods of economic downturn. They examined quantile-based time-varying connectedness between the green bond market and other financial assets using quantile vector autoregression from March 2018 to March 2021 of the US market. These results show that green bonds are strongly connected with treasure bonds, aggregate bonds and bond index, and have a weak connectedness to the energy bond index, the price of which does not appear to have substantial influence on the green bond market. Herein, the research illustrates how the utilization of green bonds can be viewed as investments for portfolio managers, policy makers and researchers. (Abakah et al., 2022)

Taghizadeh-Hesary and Yoshino (2019) discuss the way to induce private participation in green finance and investment, exploring how green credit guarantee schemes and the returning of a portion of the tax revenue originally generated from spillover effects of green energy supply to investors, with the objective to induce the private participation in green finance and investments. In their study, they explored factors that may be considered to impact the share price of companies working within the green energy sector in the long run. However, their analysis covers the financial aspects, without presenting an individual corporate perspective, thus lacking the corporate's interest and risk analysis of investing in green technology. (Taghizadeh-Hesary & Naoyuki Yoshino, 2019)

In summary, the literature provides arguments for the positive relationship between a firm's performance and green investments. The literature further indicates a generally positive correlation between sustainability investments and the reduction of CO_2 emissions, with potential for improving the firm's financial performance.

Even though various of the reviewed studies have attempted to correlate green investments with firms' financials and profitability, there is still potential to be explored, as in most studies there are inherent biases within the selection of the studied context. As this is a weakness, it should be kept in mind throughout the rest of this study. This thesis focuses on energy companies in the Nordics, as this sector has been directly associated with fossil fuels. We observed that other studies in the same region focus on the industry as a whole such as Pham et al.., (2021) or they select a different type of industry, see Bostian et al. (2016) We believe that it is crucial to focus on the energy sector, due to its correlation to fossil fuels. Finally, previous studies focusing mainly on the energy sector, such as Chen and Ma, looked at different markets, such as China. We believe that the regulatory landscape is widely different between the Nordics and other regions outside the EU, due to the fundamental differences in these markets.

Therefore, while having more data from markets outside the EU provides a relevant benchmark, there is still a need for an EU-centered study to evaluate the situation in this geographical context.

There are alternative views as well, with multiple studies indicating that intensive investments into green R&D technology may have negative impacts on profitability, for example Vithessonthi and Racela (2016), however, these studies have not been performed on an narrow concept focused on the energy industry wherein there are both internal and external incentives for the development of green technology.

3.1.2. Effects of policies on renewable investments

There are multiple studies illustrating the effects of policy on renewable investments, generally analyzing the impact of policies on the reduction of carbon emissions, or alternative indicators.

Reuter et al. (2012) investigate the policy and market impacts on renewable energy investments (Reuter et al., 2012). They used a real options model in discrete time with lumpy multiple investments to analyze the decisions of an electricity producer in Germany to invest into new power generating capacity, to select the type of technology and to optimize its operation under price uncertainty and with market effects. Even if they analyzed energy policies, and not the return on sustainability investments, their results indicated that feed-in tariffs appear to be effective means of promoting renewable investments.

Zhang and Xie (2023) discuss how global economies implement rigorous environmental rules to limit climate change and to stimulate the shift to renewable energy by promoting green investments and analyses 27,042 observations from China's Shanghai and Shenzhen stock exchange between 1990 and 2019. Their findings show that enforcing strict environmental standards is one of the more effective strategies for Chinese companies to reduce carbon emissions using green financing. They show that there is a correlation between policies and total factor productivity. (Zhang & Xie, 2023)

Shah et al (2018) investigate how oil prices, macroeconomic factors and policies affect the market for renewable energy in the USA, UK and Norway. They use an unrestricted VAR model for the analysis of the response to Renewable investments to the real oil price, real gross Domestic Product, and interest rate shocks covering a period between 1960 and 2015. They show that Norway and the USA have a strong relationship between oil and renewable and that the UK has no relationship, arguing that a factor for the no relationship may be government intervention. They argue that the relationship depends upon a counties status as net oil importer or exporter.

Thus, there is a clear gap in the literature for understanding how policies impact investments into renewable energy, and whether such investments generate either a short- or long-term profit for the firms.

3.1.3. Summary of literature

In summary, the previous literature frequently utilizes linear regression models to correlate R&D investments and green investment with operational performance, however, there has been little to no prior focus on Europe, and particularly the Nordics, as a region, though individual studies have been performed e.g., for Norway and Sweden. Alternative study types have also been performed to correlate R&D investments and corporate performances, such as semi-parametric, PRISMA, Logarithmic, and multiple Quantile models. Nevertheless, a true and tried solution appears to be linear regression to enable the forming of a basic opinion and a ground for further analysis and research to progress on. When considering the prior work of policies on renewable investments there are multiple studies available, however, there appears to be a continued need to further review the affect of policy on a larger geographical region and their impacts on renewable investments, as well as providing a basis for how to continue to perform analysis of policies in new regions, and with similar metrics and rigorous as previous research.

The authors identified a knowledge gap in understanding the correlation between investments into renewable energy and its effect on share-price, and firms performance; in particular when looking at a larger, yet isolated geographic region which follows similar policies, but have different geographical advantages / disadvantages towards renewable energy sources, such a region is suitably the Nordics or Western Europe, e.g., the members of the Western European Union. Furthermore, there is a gap in the literature for understanding how policies impact investments into renewable energy, and whether such investments generate either a short- or long-term profit for the firms.

4. Research Methodology

4.1. Theoretical Framework

As this thesis aims at presenting correlations affecting firm profitability, the Stakeholder Theory was used as theoretical foundation for the presented arguments. Traditionally, it was believed that the primary objective of corporations was the profit maximizations independently from other factors. This idea prioritized financial figures such as revenue and profits, which ultimately defined the firm's value and share price. The Stakeholder Theory modified this approach, adding additional variables. Firstly introduced in 1984 (Freeman, 1984), this theory argues that a firm's success over time depends on its ability to create values for a broad range of stakeholders, not just its shareholders (Donaldson & Preston, 1995; Clarkson, 1995). The Theory challenges the traditional approach, proposing that managers must consider and balance the interests of all groups who can affect or are affected by the firm's action (Mitchell & Wood, 1997; Jensen, 2001). Examples of these groups are firm's employees, customers, suppliers, local communities and the environment.

We believe that the Stakeholder Theory is particularly relevant for the current study, due to its focus on sustainability. When investing in sustainability, the focus is shifted from maximizing the return of investment into other dimensions. One of these new areas could simply be the compliance towards new regulations enforced recently. However, the behavior towards sustainability may affect the overall firm value, as this concept – while still anchored to financial figures – is greatly affected by other factors. One example could be the relation with local communities which can be impacted by investments within sustainability. For example, a firm may decide to upgrade its treatment system for environmental emissions in air and wastewater. Such an investment is clearly not generating profit and may also not be strictly required by the current regulations. However, the local communities will surely appreciate the investment, as it leads to cleaner air and water in the region. Even if it may not seem obvious at first, there is a link between community perception and firm value. Academic literature presents various examples (Fombrun & Shanley, 1990; Luo & Bhattacharya, 2006) arguing that corporate social responsibility (CSR) initiatives may have an indirect yet significant impact on the financial returns of the firm, as these activities lead to a positive perceptions of key stakeholders like customers, who may even be members of these local communities. We believe that similar links are relevant to the research questions investigated in this work. Following the previous examples, investments within sustainability aim at reducing the environmental impact of energy companies, thus may promote the firm's reputation.

Analyzing the variables chosen in the current study, the first part focuses on the sustainability investments as dependent variables, having the oil price as independent variable. We believe that there may be a correlation between these two variables because high oil prices may increase the overall market value of fuels, including renewable fuels. Similar works already showed such a correlation in the American market, where a decline in oil price was linked to a decline in sustainability investments (Özdurak, 2021). Additionally, the number of cumulative policies was added to the investigation, evaluating whether the sustainability investments were related to such political decisions. The second part of this work focuses on the firm's profitability as dependent variable, with the share of sustainability investments as independent variable. Based on the Stakeholder Theory, we believe that it is reasonable to expect a certain correlation between these two variables, due to the expected impact on the environment of such investments. Such a correlation has also been observed in Literature, where mixed correlations have been presented. A strong portion argues for a positive correlation, showing a significant positive correlation between corporate financial performance (CFP) and corporate social performance (CSP) (Orlitzky et al., 2003) or key ESG factors (Friede et al., 2015). However, other studies argue that such correlations may be complex and context-dependent (Carroll & Shabana, 2010). The oil price and the cumulative number of environmental policies were also added in the regression as control variables, evaluating whether profitability is merely linked to the market price of energy firms' products or alternatively to the policy enforcement. In this respect, we argue that the oil price may be

strongly correlated with increased firm's profit, as a higher market price results in a higher revenue from selling crude oil, thus leading to higher profits, as the operational expenses may not have been significantly affected.

4.2. Methodology – Linear regression

The theory for this study focuses on utilizing linear regression models to evaluate the effect on profitability and share price of energy firms in relation to their investments within sustainability. Previous works e.g., Muyiwa *et al.* (2024) and Zhifei Wu (2022) proved that this approach is an effective tool to investigate potential correlation between investments and financial impacts. In particular, it has been widely used within the fields of ESG and sustainability, so it was the chosen approach for the selected study.

The overall approach adopted in this study was similar to that of Vithessonthi and Racela (2016) who analyze the intensity of overall investments on firm performance for a relatively wide market. The annual firm-level profits, capital expenditures and investments were obtained for the last 10 years, 2014 - 2023, with particular attention to green investments and other control variables such as the crude oil price and the number of environmental policies. To enable a proper evaluation of energy companies competing on similar legislative terms, the firms selected for the study are active in the Nordic region according to Section 4.3.1.

When performing linear regressions, it is crucial to make multiple assumptions regarding the types of data and their relationship. One example is that the predictor variables are assumed to be error-free, and not contaminated data. Another example is that the dependent variable is a linear combination of regression coefficients and the predictor variables. Finally, other examples of assumptions are assuming a constant variance and the independence of errors (Decoding Data Science, 2025), (Bobbitt, 2020).

4.3. Research Design

Our method utilized linear regression to evaluate financial performance and share price of energy companies investing within sustainability. The overall approach adopted in this study was similar to that of Vithessonthi and Racela (2016), of short- and long run R&D intensity on firm performance. The choice for this approach is one of the main assumptions and possibly limitations with the current work. While linear regression has been proven to be a solid and accurate way to establish correlation models, other methods have been presented with approaches having similar accuracy. One example is the work of Pham et al. (2021) who developed their own model to predict the financial performance of a firm, based on a relatively long series of financial KPIs which are also used as variables in five additional sub-models developed to calculate additional financial variables. Ultimately, the linear regression was chosen due to its robustness and relatively overall accuracy.

It is worth noting that the linear regression may have several cons, such as an overfitting to all available data instead of considering only relevant values. This is the case of multiple outliers or multiple variances within the data. Therefore, various checks and control functions need to be implemented to ensure the robustness of the generated models and final results.

While more complex models could have led to more accurate predictions, we believe that the relationship between investments and financial performance is complex, so an increased accuracy could be reached with a detailed approach which goes beyond the scope of this work. That is, the scope of this study is to determine if there is a relationship and give an indication to what degree this might be, which can serve as a basis for further research. The main objective of this work is to evaluate any potential overall trend of the potential relationship (e.g. positive vs. negative), not to establish an accurate performance predictor.

When using this approach, we assumed that there could be potential for a positive relationship, meaning that the greater the investments into renewable energy, the higher the financial performance. Again, this is of course an assumption with some caveats. It is well known that companies do not have unlimited resources, and that they operate in a finite market. However, regarding the size and market of the companies viewed, we proceed with the assumption that a linear relationship is at least a reasonable relationship for the size of investments, the size of the market, and the size of the companies.

It should further be noted that another underlying assumption is that investments into renewable energy perform at or better than investments into non-renewable energy when the same amount is invested. However, this may not be the case and is a glaring weakness of the analysis as it was not possible to perform a complete portfolio analysis of each company's investments, differentiating between green and traditional. This is readily acknowledged by the authors, however, when considering the basis for the data of the research such a granular investigation would require resources beyond the scope of this research, and it is thus a possible further avenue for other scholars wishing to investigate more thoroughly the impact of green investments.

4.3.1. Selection of companies in the Nordic Energy Sector

Several criteria were utilized for the selection of the companies analyzed. As this work is focused on the Nordic market, companies were chosen that had a large impact on the energy sector within the region in which they operate, thus naturally the largest company in this region were considered based on size of operations, which in turn generally focus on companies with greater revenues. Additionally, the company's business model needed to include efforts towards the production of renewable energy, as we aim at evaluating the outcome of these investments. When using this criterion, companies active in the exploration of oil fields were excluded, because – while they may invest in sustainability – these investments are mainly aimed at reducing the carbon footprint of crude oil extraction. This study wants to have a focus on companies aiming at developing renewable energy as main way to invest in sustainability.

Further selection was made in that the companies' financial date was readily available, that is, the companies were required to publish their financial results. Generally, this leads the companies to be publicly traded companies, however an effort was made to include companies beyond such limitations. Notably, to adequately compare green investments, it was a further requirement that such information regarding green investments was readily available in addition to the traditional financial figures. Lastly, an effort was made to reduce the number of companies available down to a sample appropriate within the scope of this thesis, therefore it was concluded to include 5 companies within this study's scope. Do note that the low number of companies is indeed a limitation, and weakness of the study, and we strongly encourage future research encompassing a greater number of companies within the Nordics to further verify or refute the premise of this study.

When all selection criteria are considered, five companies were selected: Shell, Preem, Equinor, St1 and Neste. For a full list of references to the selected financial reports, we refer to Appendix D.

While we predominantly focused on the Nordic market, Shell is an exception in this category, as it is based in the Netherlands / UK. This firm was included in the study as a benchmark for the other firms, aiming at identifying potential deviations of the Nordic market compared to a global average.

When considering all the selection criteria, a large number of energy companies are excluded, so it is important to note how this factor may be seen as a limitation in the study. When considering a relatively small part of the total market, there is a higher risk for information bias, which may result in uncertainty whether the results truly reflect the energy companies in the Nordics. For instance, the current selection process may be a cause of error in terms of the survivorship bias fallacy where companies that have

invested heavily in sustainability, yet performed poorly, have been eradicated from the market and thus were not available for review for the selected period of time. Further research would benefit from reviewing the investment patterns of companies that failed over the same time period as no such companies were included in the analysis. Additionally, even if the companies considered represent a large part of the market capitalization for energy companies in the Nordics, this sample may not be entirely representative of the total market, so this factor represents another limitation of the current study.

Finally, it is also important to underline another limitation regarding the data for the chosen firms. Even if companies with an open reporting policy were selected, some data is still missing. Even if it was possible to collect annual and sustainability reports for all the selected companies, some of them - Preem and St1 - are not publicly listed, so their capitalization is currently not known, meaning that it was not possible to evaluate the effect of green investments on the shareholders' value.

4.3.2. Analysis of the firms' green investment portfolios

A portfolio investigation was carried out in order to identify any potential sector where Equinor successfully invested, unlike the other companies analyzed. After analyzing the Sustainability reports for each company, a summary is presented in Table 2.

Table 2. Summary of the main investment sectors within sustainability, with the main companies investing in each sector.

Sector	**Investing company**
Renewable fuels (HVO and SAF)	- Neste (market leader) - Preem (significant investments) - Shell and St1 (minor investors)
Offshore power – wind	- Equinor (market leader)
Onshore power – wind and solar	- Equinor and Shell
Carbon Capture and Storage	- Equinor and Shell
Infrastructures (e.g. EV charging points)	- Preem (slightly major) - Shell (slightly minor)
Innovative feedstocks (recycling)	- Neste and St1
Geothermal energy	- St1

A significant difference between Equinor and the other firms can be observed as Equinor has not invested into traditional renewable fuels – such as HVO and SAF, unlike all others. On the contrary, this firm leveraged its already dominant position within the offshore business to establish itself as a market leader within offshore power generation via wind power.

When looking at the other sectors beyond the ones mentioned, we believe that it is difficult to have a similar differentiation. Either the other sustainability sectors are minor, with few interested companies, such as geothermal energy, or Equinor and the other Nordic energy companies may be investing in the same sector (e.g. Carbon Capture and Storage), so it is not possible to draw conclusions about the investing sectors.

Finally, the portfolio diversity was also briefly assessed, observing a difference between Shell and the other firms. The former firm has a broad investment strategy covering different sectors. This behavior can be due to the overall size of Shell, which is significantly larger than the other firms and with operations located globally. The broad activity of Shell might be a consequence of this widespread reach, while the other firms are more focused on specific markets / sectors, so they adjusted their investments accordingly.

4.3.3. Data Collection

Data from the past ten years were analyzed: 2014 - 2023. Even if the amount of data points was limited, taking into consideration the rule of thumb for 10 data points per independent variable, see for example regression modelling strategies for improved prognostic prediction by Frank E. Harrell et al. (Harrell Jr. et al., 1984). Therefore, the authors decided to aggregate the collection of data points into an individual regression to thus fulfill the rule of thumb for 10 data points. However, as will be noticed further down some brief comments are made on an individual basis as well. The authors of this study believe that this process will therefore be representative of the Nordic energy sector at large, and thus sufficient to at least establish an overall trend without the expectations of providing a model with extreme accuracy. In addition, it was not possible to add more data to the study, as most firms (with some exceptions) provide information about sustainability starting from the years following 2015. All data was converted into USD to have a consistent measuring rate, at a conversion rate of 0.094 USD per SEK.

In a simplified step by step manner the process is as follows:

The scope of the thesis is to assess if there is a relationship between the effect of low-carbon investment on net profits and share price. However, the authors decided since profits and share prices for companies in the energy sector may be heavily dependent upon the price of oil, there was a need to understand as a starting point if there is a relation between the price of oil and low-carbon investments. Thus, an initial analysis was performed using a regression to examine the relationship between low-carbon investments as a dependent variable and the average oil price of as the independent variable. Furthermore, the same analysis using the number of environmental policies in Europe as independent variable was also performed.

a) Gather relevant net profit data for the selected companies from their annual reports.
b) Gather relevant data for green investments for the selected companies from their annual reports and/or sustainability reports
c) Gather the Share price for the companies on the stock market
d) Gather the oil price and the number of cumulative environmental policies
e) Aggregate the data into an Excel spreadsheet and import the data into STATA
f) Perform the regression analyses, in the following order:
    a. Green investment analysis
    b. Net profit analysis
    c. Share price analysis

The first part of the study was focused on the financial performance of the firms analyzed. The annual reports, referred to in appendix D, were used to gather data related to the KPIs such as revenue, operating expenses and net profit. As the firms considered vary significantly in terms of size, one important key performance indicator (KPI) is the net profit as percentage of the revenue. This value is used to normalize the profits between different firms, showing profitability regardless of the firm's size. After considering different options, this value was chosen as one of the main indicators measuring the firm's financial performance, so it was one of the dependent variables in the linear regression. The share price for the investigated firms was the other indicator used to measure financial performance, as this variable shows the current market capitalization and shareholders' value. The choice for these two indicators is

another important assumption and possibly limitation for the current study. Even if these indicators provide great insight into the current situation, they lack a deeper perspective on the long term, which may indicate a longer-term effect of these investments. Typical indicators of this type used in similar works are ROE (Return on Equity) and ROA (Return on Assets) as presented by (Pham et al., 2021). Nevertheless, the percentage net profit was chosen as an indicator due to its direct correlation with how efficiently a firm is managing its operations and controlling costs, having an immediate result on the firm's value. Similarly, the share price was also selected as it indicates the firm's value, but from a different perspective, as it represents the perception of investors outside the firm.

The value of net profit was taken at the year's end, as this moment is when all the selected firms presented the financial figures in the annual report. Similarly to the net profit, the share price for each firm was also considered at the end of each year, as it is believed to be the most representative value for the developments during the year and the expectations for the future. A further reason for this dependent variable being picked at the end of the year is that it would then follow the same period as for the investment cycles displayed in annual reports. An important remark needs to be noted for Preem and St1. As these firms are private companies, their share price is not publicly traded, so these two firms were excluded from the share price analysis.

After gathering general financial data, the study focused on data related to investments. These values are typically found in the sustainability reports. The study focused on gathering information on total investments and investments within sustainability. This latter variable may be different from one company to the other, depending on their business model. Sometimes it is called "low-carbon", "renewable" or "sustainability" expenditure. For the linear regression, this value was normalized dividing it by the total investments value, thereby establishing the share of investments within sustainability. As has been indicated in literature, it is known that there may be a time-lagging effect between investments within R&D and corporate performance. (Lee & Choi, 2015) (Xie et al., 2020). Thus, multiple independent variables were incorporated from previous years, possibly impacting a certain year. In particular, green investments from the previous year and from two years before were considered. We would like to point out a limitation of this study, related to the source of data. As the firms are not obliged to present all data within sustainability with the same rigor as the financial figures, there may be slight ambiguity in the amount invested. For example, it is not possible to be sure that all investments called "renewable" from one firm and "low-carbon" from another firm are entirely connected to sustainability, as "low-carbon" may also indicate investments aiming at increasing the energy efficiency while keeping fossil oil as feedstock. Nevertheless, it was not possible to have more details about the exact investments, as these are normally kept confidential. Even if we believe that we reached the maximum level of detail in this aspect, we still would like to point out this possible ambiguity.

The use of oil price as control variable is the next parameter analyzed. We believe that there are always multiple variables affecting profitability, so we decided to investigate the crude oil price as a control variable. The assumption behind this choice is that the oil price across the year would readily impact on the firms' profitability. As the financial data was gathered on a yearly basis, the crude oil price was considered as the average value for each year. The price for Brent crude oil in USD per barrel was considered (Statista Research Department, 2025). A weakness of utilizing the average oil price is that the consumption rate differs across the various seasons, as the consumption of energy in the Nordics generally is effect by the climate. However, the authors assume that such seasonal impact is averaged out across the year. In addition, the financial figures are presented on a yearly basis, inviting for an equivalent time interval in terms of oil price. In this perspective, an annual average is the value that represents the most the historical trend during the year considered. Finally, it was also assumed that the volatility of the oil price within one year should be directly connected to the investment decision of large firms such as the ones analyzed in the current study, as the investment decisions consider multi-year trends. It should be noted that we have not weighed outliers towards an average expected norm, for example due to impulse changes to the price of oil based on e.g., geopolitical turmoil, or international

crises. Such incidents are included with their full effect on the price of oil, and in fact assuming that the average price dilutes any extraordinary effects triggered by such impulse changes. Nevertheless, the authors readily invite further research reviewing the performance of yearly net profit based upon the seasonal, weekly, or monthly oil price averages as a venue for further study.

The last variable included in the study was the number of environmental policies. This value represents the cumulative number of major policies enforced in the country where each energy company is based. Even if each Nordic country mostly follows EU directives, minor variations were observed among the different countries, so it was decided to consider the policies for each single country. The policies were enumerated, and the strength of each policy was not considered in this research. Thus, it is assumed that each policy carries the same weight and effect, which is a limitation within this report, as this cannot be the truth. However, such an endeavor to weigh and analysis the strength/weakness of each policy enacted within the region is also beyond the scope of this research, but it is however an endeavor to which the authors encourage further research.

All the mentioned variables were inserted into the STATA code performing the desired linear regressions. Some variables were just general variables, used to calculate other variables, while the remaining variables were actively used in the STATA regression, either as dependent or independent variables. Taking into consideration the prior research on the topic, it is worthwhile noticing that multiple models have been utilized to analyze the relationship between dependent variables concerning green investments and corporate performance, (Song et al., 2023) (Hazarika, 2021) (Cheng et al., 2023), however, looking at the broader literature it appears that a linear regression may also be suitable for an analysis of the relationship between green investments and corporate performance, (Vithessonthi & Racela, 2016).

A summary of each variable, including description and type is presented in Table 3.

Table 3: Abbreviations used with description and type.

Variable name	**Description**	**Type**
Company	Company name	General
Year	Year	General
REV	Company revenue	General
NET_PRO	Company net profit	General
OIL_PRI_CHANGE	Oil price change as % of previous year	General
CAP_EXP	Total investments (CAPEX)	General
LOWC_INV	Total green investments	General
PERC_NET_PRO	Net profit as % of revenue	Dependent
SHARE_PRI	Company share price at the end of the year	Dependent
PERC_LOWC_INV	Share of green investments	Both in- and dependent
PERC_LOWC_INV_1	Share of green investments from previous year	Independent
PERC_LOWC_INV_2	Share of green investments from two years before	Independent

OIL_PRI	Average annual oil price	Independent
ENV_POL	Cumulative number of environmental policies in region where Company's headquarters are located	Independent

4.3.4. Criterion for environmental policy selection

If the totality of environmental actions were considered, the number of enforced policies is remarkably high, but not all of these should be applicable for this study. Some policies may be applicable to other sectors, not directly connected to climate change – such as ocean or air pollution. Other policies may have only a minor impact, as they are related to a limited sector. In order to identify which policies should be included in the current study, a certain selection criterion had to be established, following the idea of including only relevant policies with expected major impacts, as we believe that these policies may affect the energy sector. The first step in the policy selection is identifying the most relevant sectors, which were identified based on the latest IPCC's Sixth Assessment Report (AR6). In this report, Working Group III presents relevant actions for mitigating climate change, with different chapters covering various sectors (IPCC, 2022). In particular, we believe that the most relevant chapters are:

- Chapter 6: Energy Systems
- Chapter 9: Buildings
- Chapter 10: Transport
- Chapter 13: National and Subnational Policies and Institutions

These chapters present relevant considerations about e.g. fossil fuel heating, ban on gasoline-powered cars and incentives for electric cars. The content of these chapters was used to identify the most relevant sectors within energy transition, e.g. energy networks as well as fuels for automotive and heating.

Once the relevant sectors are identified, single policies tackling these sectors were identified in these sectors. The Climate Policy Council reports (Climate Policy Council, 2025) from Sweden were used to list the policies which were then matched with the previously identified sectors. Once the policies for Sweden were shortlisted, equivalent policies were identified for the other investigated countries (Norway, Finland and the Netherlands).

A summary of the environmental policies is presented in Appendix B. It should be noted that the environmental policies were simply counted herein. Thus, this thesis assumes that there is no difference of impact between the varying policies. It is beyond the scope of this research to generate weighted impacts for the study to consider the perceived effects or impact of each policy. Such an analysis would be well suited to attempt to determine e.g. factors impacting the strength of a policy, or in which political climate a policy was enacted, each leading to multiple studies which could be considerably larger than the author's capacity at this time.

4.4. Procedure

All the analyzed variables were cataloged in a Microsoft Excel spreadsheet. The software Stata, version 18.5, was used for identifying statistical relevance and performing linear regressions. Appendix C presents the code utilized. As these variables were previously reported in Excel, they were imported into Stata using the import function. As some data – especially before the year 2014 – was not available, the drop function was used to remove all lines containing incomplete information, such as missing or null firm's revenue or net profit. Finally, all linear regressions were performed in Stata, according to Table 4

Table 4. Dependent, independent and control variables in the different models.

No.	Type	Dependent variable	Independent variables	Control variables	
1	Green investment analysis	Sustainability investments share	Oil price Env. policies number	- -	- -
2	% net profit – same year	% net profit	Sustainability investments share – same year	Oil price	Env. policies number
3	% net profit – year before	% net profit	Sustainability investments share – year before	Oil price	Env. policies number
4	% net profit – 2 years before	% net profit	Sustainability investments share – two years before	Oil price	Env. policies number
5	Share price – same year	Share price	Sustainability investments share – same year	Oil price	Env. policies number
6	Share price – year before	Share price	Sustainability investments share – year before	Oil price	Env. policies number
7	Share price – 2 years before	Share price	Sustainability investments share – two years before	Oil price	Env. policies number

Despite the data arising from companies each utilizing their own reporting style, due to the strict regulation regarding the presentation of financial values in annual reports, the authors assume that the figures are equal even though there is an allowance for self-interpretation. Thus, such differences were assumed to be insignificant for the scope of this study. This is a necessary assumption as without having access to the direct figures utilized for generating said financial reports such granularity is impractically burdensome to acquire.

This statistical analysis was performed for all individual companies as well as the complete dataset, meaning using data from all companies in the same regression. This latter approach was used to evaluate any potential trend or behavior in common for the entire sector.

The goal of the analysis was to identify the correlation coefficients between the different variables. However, it may be that a certain correlation may be too weak to be statistically representative, so several checks were performed on the regression result, as per Table 5.

Table 5: Summary of the checks on the regression results aimed at eliminating variables which are not statistically significant.

Check	Applicable data	Desired range	Description
Prob > F	Entire regression	< 0.05	Check that at least one of the predictors in the model has a non-zero coefficient. If < 0.05, the null hypothesis is rejected, and the model is statistically significant
R-Squared	Entire regression	> 0.5	Measure that represents the proportion of the variance in the dependent variable that is explained by the independent variables in the model, providing an indication of the goodness-of-fit of the model.
T-test	Individual coefficient	< -2 or > +2	Test that measures the size of the difference relative to the variation in the sample data, used to test the null hypothesis that a particular coefficient is equal to zero (i.e., that the predictor has no effect). The desired values correspond to the 95% confidence level.
P-value analysis	Individual coefficient	< 0.05	Check associated with the t-statistic, still testing the null hypothesis that the coefficient is equal to zero.

After performing these checks, the irrelevant regressions and coefficients were removed, presenting the remaining models which were statistically sound.

An example of model via linear regression is presented in Equation 1 below

Equation 1: $Dependent\ var. = \alpha * (var.1) + \beta * (var.2) + \gamma * (var.3)$

Where α, β and γ are the coefficients obtained in the Stata regression. Finally, as this regression is linear, no power functions are present, and the effect of each independent variable is summed to the effect of the others.

4.5. Statistical robustness

To further evaluate the results of the data we performed several tests. These include the STATA's SK-test (sktest), where we test for skewness and kurtosis and an aggregated test result for the both of them. These are graphs tests, and they assess if the data set is symmetrical or skewed. It also enables a test if there one or more peaks to the data sets. (Brown, 2022). For the sktest, the following transformations of the data set were performed and analyzed; Ln, Log, Square root, Cubit root, inverse hyperbolic sine, and box-cox test.

Following each regression further tests were performed, these are STATA's Hettest, testing for the heteroskedasticity of the data. That is, what is tested for is actually if there is too much heteroskedasticity to raise a concern with regard to the data. A further test was STATA's ovtest, which test for potential omitted variables. It performs a regression specification-error test assessing if omitted variables are causing model misspecification. A final test was STATA's vif test. The variance inflation factor (VIF) tests multicollinearity in regression analysis within the variables.

It is further worthwhile noting that, when heteroskedasticity was observed, a robust regression was performed instead of the regular regression.

The results of the aforementioned tests are displayed in Appendix A.

4.6. Potential biases and limitations

While striving for data accuracy and completeness, the presence of biases and limitations is unavoidable in most research works. Even if these factors were already presented in Section 4, they are summarized in Table 6 for better clarity.

Table 6. Summary of potential biases and limitations affecting the results and conclusions, with possible consequences.

Potential bias/limitation	**Reason**	**Possible consequence**
Use of linear regression	Proven robust method for statistical analysis	Developed model with lower accuracy
Survivor fallacy bias	Only the active firms could be analyzed	The results may be prone to suggests that green investments are profitable because firms that were not profitable failed
Only five firms included in the study	To carry out the required analysis, we needed firms that are already active in renewable energy, publishing their financial figures and based in the Nordics	The selected sample may not be entirely representative of the total energy market in the Nordics
Missing share price data for Preem and St1	Firms not publicly traded	Effect of green investments on the shareholders' value not evaluated for these firms
Choice of percentage net profit and share price as financial indicators	Clear KPI indicating financial performance	Additional KPI such as ROE or ROA may add additional insights
Unregulated nomenclature for green/sustainable investments	No current regulation governing this aspect – firms may choose	Green investments may be under- or overestimated
Equal weight for each environmental policy	The evaluation of policies' impact is beyond the scope of this work	Lower model accuracy due to effects on independent variables

4.7. Ethical considerations

In all research it is vital to take into consideration the ethical principles of research that guide researchers to produce results with ethical results. The research produced herein follows the ethical principles and guidelines set forth by the Swedish Research Council (2017) Transparency has been upheld with the disclosure and detailing of the methodologies, procedures, and data sources used to produce this study. Accountability for the results produced herewith lies solely with the authors, with the authors taking full responsibility for the integrity and accuracy of the findings.

To ensure that this research project follows ethical guidelines no information utilized in this study was obtained from non-public sources, this aims to follow ethical guidelines and aims to avoid the likelihood of publishing unpublished materials. It should be noted that one author has an employment in a relevant field, however, no data was used that they were privileged to. It should be noted that this research is the first collaborative research that the authors have performed on this topic. The data used in this research was gathered from publicly available sources. More specifically, the data was obtained from historical information on publicly traded companies share price, from governmental websites, corporations' annual reports, and environmental and/or sustainability reports published by the companies herein. The use of publicly available sources furthermore increases accessibility and neutrality, enabling further reproducibility of the results. However, these sources provided a clear and readily source of error.

Though similar, the annual reports of the different companies may classify various activities differently within their organization, leading to a non-traceable source of error.

No sensitive personal data was collected or utilized in the scope of this study. The scope of this research was limited to the publicly available data as previously mentioned.

The authors have not received any grants to perform the research disclosed herein. The authors have taken all reasonable measures to ensure that the research was conducted independently and free from external influences that might compromise its impartiality. To repeat, the authors have not received funding or support from private companies or organizations enabling a more readily unbiased research bar the authors own unconscious biases.

5. Analysis and discussion

5.1. Green investment analysis

The main part of this report presents the effect of low-carbon investments (independent variable) on net profits and share price (dependent variables). Before going into the main analysis, a regression considering low-carbon investments as dependent variable was carried out. The aim of this analysis was to evaluate the underlying reason triggering investments in sustainability, considering the crude oil price and number of environmental policies as independent variables, answering the research questions and testing the null hypothesis as presented in Chapter 2.

First, an overall trend of the investments within sustainability is analyzed. These companies are normally smaller players in the global market, such as Preem, St1 and Neste, which were already scarce of natural reserves, so they decided to anticipate their transition to renewable fuels, however when considering the Nordic energy sector they are still significant players. On the contrary, conservatives stayed below 30% of total investments within sustainability, still having significant efforts into traditional lines of business. This is the case with larger, global companies, such as Shell and Equinor, which have a strong base within traditional business, owning large reserves. In addition, the total investments of these companies are significantly higher than the forerunners in absolute numbers, so a lower percentage of investments in new areas is expected to reduce risks. Nevertheless, a clear trend can be observed also for the conservatives, with gradual but consistently increasing efforts towards sustainability.

One of the reasons behind this trend could be the sudden oil price drop experienced starting from 2014. This sharp decrease is due to a series of factors, which are mainly due to technological advancements and geopolitical considerations. At first, during these years there were significant advancements in oil extraction technologies, in particular with hydraulic fracturing ("fracking") and horizontal drilling in the US, leading to a sudden production increase (Jackson et al., 2014). In addition, the Organization of the Petroleum Exporting Countries (OPEC) decided not to cut the global oil production, as previously anticipated. This strategy is normally implemented to stabilize the oil prices, but in 2014 Saudi Arabia decided to not cut production, aiming at maintaining market share and putting pressure on higher-cost producers, particularly US shale oil companies. This sharp decrease in price made crude oil a less valuable product, possibly triggering investments in alternatives such as biofuels, especially in countries with high extraction costs.

Despite expectations, the regression analysis shows there is no correlation between the oil price and the investments within sustainability, indicating that the 2014 oil price drop did not trigger any change in direction for the analyzed companies. This consideration is also confirmed by the fact that the 2022 oil price surge did not trigger any reversed trend within sustainability. From a statistical point of view, the lack of correlation between oil price and green investment is confirmed by the t-test as performed in the pre study. In general, if t is higher than 2 and lower than -2, we can reject the null hypothesis for that specific coefficient. On the contrary, low absolute values of t indicate that this coefficient is not significantly contributing to the model, so it fails the t-test and it should not be used in the final formulation. For all the considered regressions, the value of “t” is lower than 2, thus the null hypothesis cannot be rejected.

Figure 2 presents a comparison between the average oil price and investments in sustainability as percentage of the total investments.

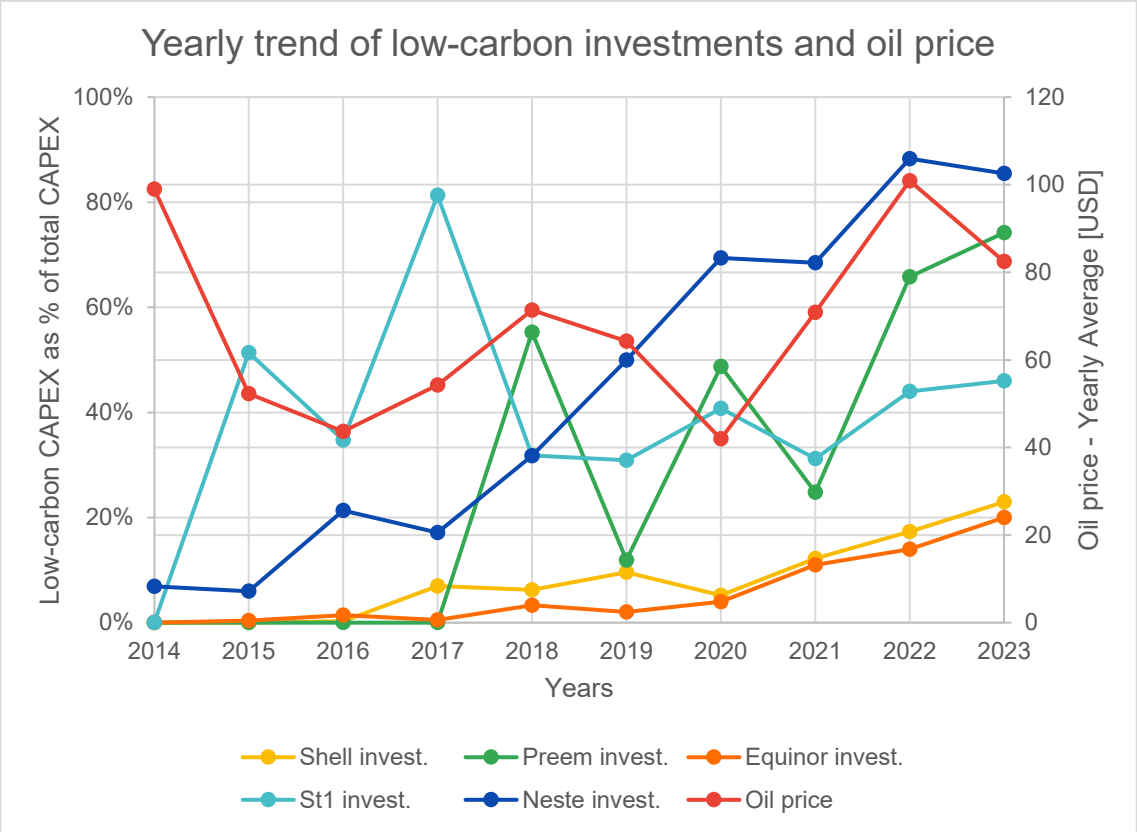

Figure 2. Comparison between the low-carbon investments (as % of the total CAPEX) and the average oil price.

Figure 3 presents a similar comparison, where the same values of investments within sustainability are plotted against the cumulative number of policies, calculated as weighted average of the number of policies where the analyzed companies are located.

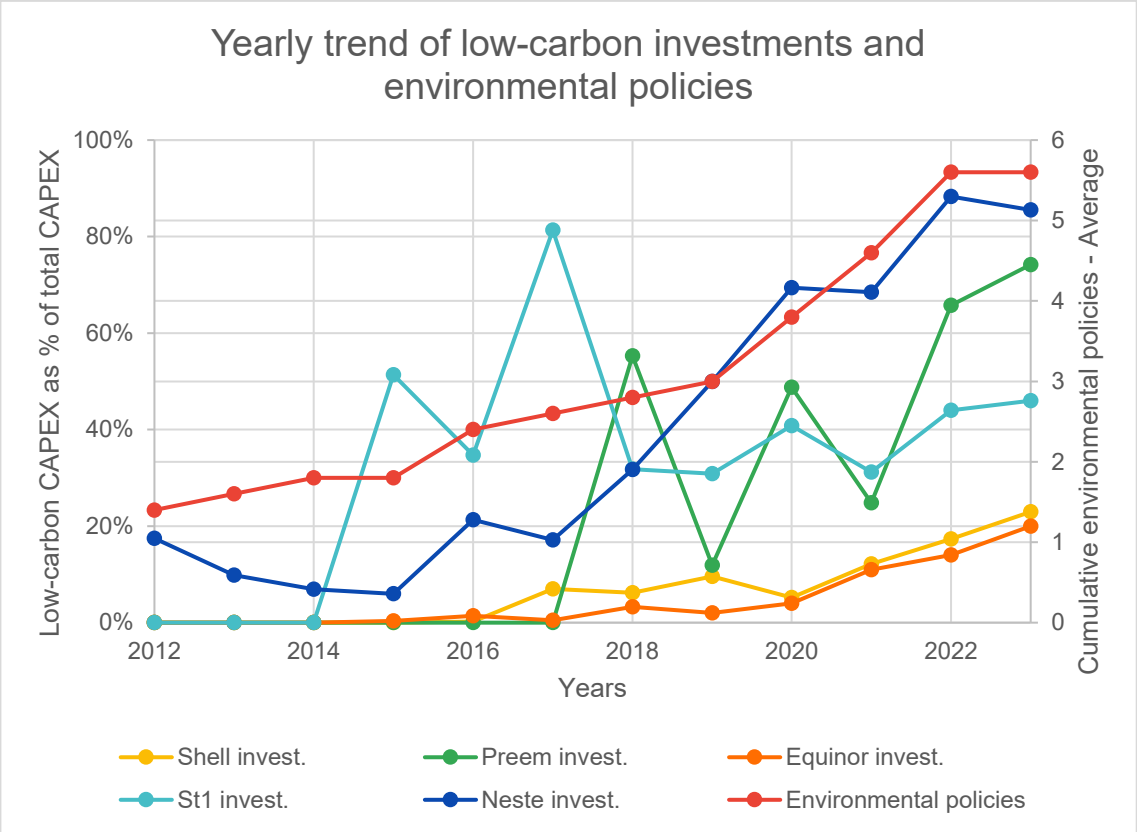

Figure 3. Comparison between the low-carbon investments (as % of the total CAPEX) and the average number of cumulative policies.

As noted during the green investment analysis there is an interest in ascertaining that there are enough data points to follow the common rule of thumb that is 10 data points per independent variable. Thus, a regression was performed comprising the data points from all the companies utilizing dummy variables for the companies. In the initial regression it was indicated that no variables passed the T-test. After further consideration, in particular when reviewing the graph illustrated in Figure 3, St1 was identified as outlier in the group considered. This firm was one of first investing heavily in green technologies, however there was a significant downturn in 2018, with a resulting investing behavior aligned with the other conservatives. The reason for this sudden change of strategy is not known, as this information is considered confidential. For this particular behavior, it was decided to exclude St1 from the regression analysis.

A summary of the regression results is presented in Table 7.

Table 7. Result summary of the regression with the share of sustainable investments as dependent variable and the number of environmental policies as independent variable.

PERC_LOWC_INV	Coefficient	Robust Std. err.	t	P > | t |	[95% conf. interval]
ENV_POL	.0509405	.020742	2.46	0.018	.00908 .09280
_cons	.0321247	.058413	0.55	0.585	-.0857 .1500
F(1, 42) = 6.03		Prob > F = 0.0183		R-squared = 0.1062	

The coefficient 0.05 means that, on average, each new policy corresponds to an increase in the share of green investments by 5%. It is worthwhile noting that currently there is no evidence confirming any causality between dependent and independent variables, as the Stata analysis can only highlight correlations. Additionally, if the situation is analyzed from a more holistic perspective, it is unlikely that each energy firm would look only at the number of environmental policies to decide their investment strategy, which is most likely defined by a multitude of factors.

It can be observed that the amount of green investment changed significantly over the last 10 years. Prior to the year 2016 these types of investments were very scarce, however, each of the analyzed companies gradually increased their efforts starting from 2016. In addition, it is possible to distinguish between two types of investment behaviors, which can be called "forerunners" and "conservatives" for the sake of simplicity. The forerunners took significant steps towards sustainability, investing more than 50% of their total investments in the last few years.

Ultimately, it can be concluded that the null hypothesis (H0) for this analysis was rejected, as it was possible to find a correlation between the share of green investments and an independent variable for all firms besides St1, which is the number of environmental policies.

When looking at previous literature, the correlations observed in this study have some differences with the majority of the literature. It was expected to observe a positive correlation between oil price and sustainability investments, due to a higher market price of the produced energy (Özdurak, 2021). However, the sustainability investments for the analyzed companies are not correlated to the oil price, so this variable does not play a major role when defining investing strategies. On the contrary, the strong correlation between sustainability investments and number of environmental policies suggests that the analyzed companies may feel the pressure to become compliant with the enforced policies. Additionally, this result may indicate that the policies are directly affecting the energy companies in the Nordics, which are forced to comply. One of the limitations of this work was the equal consideration of environmental policies, having the same weight. This limitation was required due to the complexity of the analysis when assessing the impact of each policy. However, we suggest that this work could be part of future research. Such research could start with the correlations presented in this study, analyzing if there is direct causality between the correlated variables, meaning that the enforced policies are designed to directly target the energy firms in the EU area. Additionally, a breakdown in the overall impacts of each policy could also be added to this future research.

5.2. Net profit analysis

The main part of this study was aimed at identifying any correlations between green investments and percentage net profit or share price. This Section and the following Section 5.3 aim at testing the main null hypothesis with its following research questions (Chapter 2), investigating if there is any correlation between green investments and either financial performance or share price.

Each analysis was carried out considering three possible scenarios: the investments in the same year, the year before or two years before. This approach follows the reasoning that some time is needed for any investment to generate income, so a certain delay is expected between an investment and its potential financial benefits.

Once the overall model accuracy was evaluated, the t-test and p-value analysis were performed for each independent variable. Figure 4 shows a graphical summary of the results.

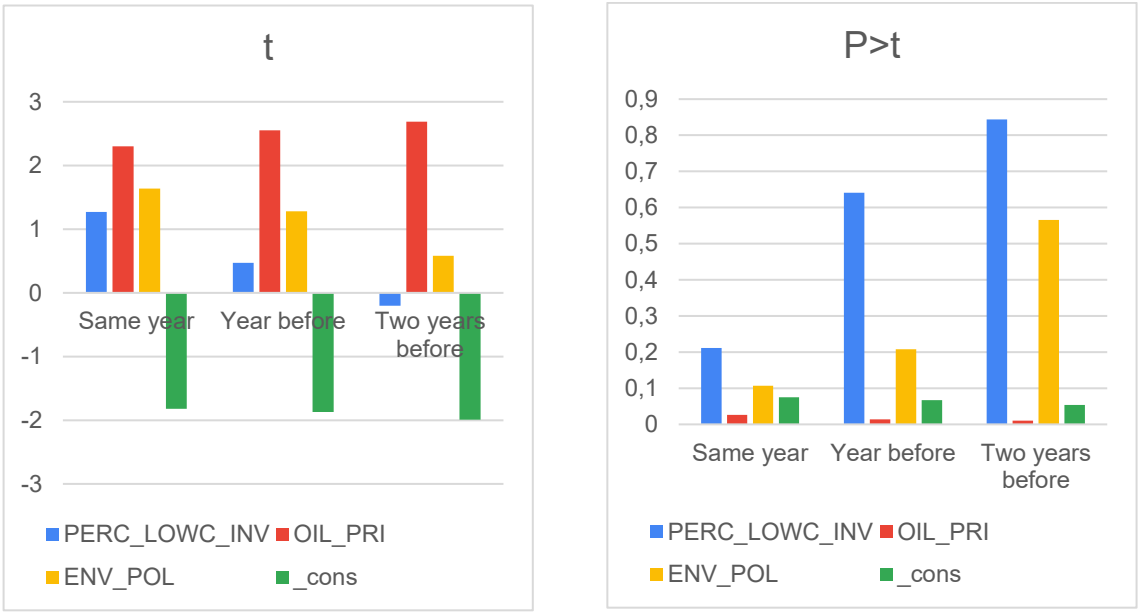

Figure 4. Results of the T-test and p-value analysis for each independent variable, divided by years of investment (net profit analysis).

The results show that only the oil price has a significant correlation with the net profit, meaning that investing within green technology does not lead to increased profits for the Nordic sector.

As can be observed, the coefficient for the oil price is positive. Thus, the higher the price of oil, the greater the increase in profits for the companies analyzed.

Table 8 summarizes the regression results for the net profit analysis, divided by the year analyzed. These results show how only the oil price is a statically significant variable due to the t-test and p-value analysis.

Table 8. Result summary of the regression having the percentage net profit as dependent variable, divided by year.

Investments from the same year					
PERC_NET_PRO	Coefficient	Std. err.	t	P > | t |	[95% conf. interval]
PERC_LOWC_INV	.0347501	.0273881	1.27	0.211	-.0202884 .0897886
OIL_PRI	.000725	.0003152	2.30	0.026	.0000915 .0013585
ENV_POL	.0072374	.0044098	1.64	0.107	-.0016244 .0160993
_cons	-.0472059	.0259591	-1.82	0.075	-.0993727 .0049609
F(3, 49) = 4.06		Prob > F = 0.0118		R-squared = 0.1992	

Investments from the year before					
PERC_NET_PRO	Coefficient	Std. err.	t	P > | t |	[95% conf. interval]

PERC_LOWC_INV_1	.0144055	.0306998	0.47	0.641	-.0474271	.0762381
OIL_PRI	.0009373	.0003669	2.55	0.014	.0001982	.0016763
ENV_POL	.0062225	.0048752	1.28	0.208	-.0035968	.0160417
_cons	-.0509077	.0271714	-1.87	0.067	-.1056336	.0038183
F(3, 45) = 3.87		Prob > F = 0.0151		R-squared = 0.2052		

Investments from two years before						
PERC_NET_PRO	Coefficient	Std. err.	t	P > | t |	[95% conf.	interval]
PERC_LOWC_INV_2	-.0074674	.0376201	-0.20	0.844	-.0835005	.0685656
OIL_PRI	.0013094	.0004868	2.69	0.010	.0003255	.0022933
ENV_POL	.0034191	.0059141	0.58	0.566	-.0085338	.0153719
_cons	-.0600816	.0302528	-1.99	0.054	-.1212248	.0010615
F(3, 40) = 3.88		Prob > F = 0.0159		R-squared = 0.2253		

The regression coefficients for the oil price show an increasing trend when investments from older years are considered. This trend may be due to potential influences that investments may have in the overall model, even if this independent variable is not statistically significant. This idea may be supported by the gradual lower absolute value for the “t-test”, indicating that older investments may lose any effect on the model (albeit already not statically relevant from the first year), so the oil price has a higher importance.

Additionally, regressions on a company-by-company basis were performed to assess whether there are indications for alternative interpretations based on a company’s business level.

When analyzing Equinor with the percentage of green investments as an independent variable, the numbers of data points are above the rule of thumb for 10 with only one independent variable. Thus, this regression is considered within the scope of the thesis. The regression results are presented in Table 9

Table 9. Result summary of the regression for Equinor having the percentage net profit as dependent variable and the share of sustainable investments as independent variable, divided by year.

Investments from the same year					
PERC_NET_PRO	Coefficient	Std. err.	t	P > | t |	[95% conf. interval]
PERC_LOWC_INV	.8548103	.4028588	2.12	0.067	-.0741838 1.783804
_cons	-.0120081	.0348957	-0.34	0.740	-.0924777 .0684614
F(1, 8) = 4.5	Prob > F = 0.0666			R-squared = 0.3601	

Investments from the year before					
PERC_NET_PRO	Coefficient	Std. err.	t	P > | t |	[95% conf. interval]
PERC_LOWC_INV_1	1.238716	.5588436	2.22	0.057	-.0499799 2.527411
_cons	-.0089694	.033076	-0.27	0.793	-.0852428 .067304
F(1, 8) = 4.91	Prob > F = 0.0575			R-squared = 0.3805	

Investments from two years before					
PERC_NET_PRO	Coefficient	Std. err.	t	P > | t |	[95% conf. interval]
PERC_LOWC_INV_2	1.170843	1.040249	1.13	0.297	-1.288954 3.63064
_cons	.0066576	.043073	0.15	0.882	-.0951937 .108509
F(1, 7) = 1.27	Prob > F = 0.2975			R-squared = 0.1532	

Green investments performed in the same year and the year before pass the T-test, but they have a value for "Prob > F" higher than the define threshold of 0.05. Nevertheless, it was decided to still present these results, as the sample size is known to affect the model power. When the sample size decreases, the F-statistic is known to have a lower probability to be large enough to be considered statistically significant. Therefore, several studies (Serdar et al., 2020) (Kiselova et al., 2025) suggest that a threshold of 0.1 may be acceptable, especially for pilot studies or when not much data is available. In addition, the values of the F-statistic are close to the 0.05 threshold, so we believe that it is worthwhile to present them, while considering that further confirmation of this correlation would be beneficial.

When reviewing the green investments from two years before, the sample size became even smaller and the results failed the T-test, indicating that there is no further statistically significant influence from the earlier investments.

In general, these results show that a 1% higher share of sustainable investments from Equinor correlates with an increase in net profits by an average of 0.85% and 1.24% for the same year and the year before, respectively.

Taking into consideration that the investments for the current year are an aggregated amount for the entire year, the total time for an impact should be less than one year. As the data indicates, it is therefore more reasonable to expect that the investments would at least being to have a greater impact on the following year, in particular when considering the theory of time lag for investments which indicates that investments are not presented online once the investment is made. (Bar-Ilan & Strange, 1996).

Based on these regression results and the unique Equinor's investment behavior – as presented in Section 4.3.2 – it can be argued that the offshore wind sector is probably the driver for Equinor's financial performance, and more investments could be encouraged into this sector, as potential financial benefits may be expected. On the contrary, considering the lack of regression between green investments and profitability for the remaining companies, investments within HVO and SAF are not advisable from a purely financial point of view, because all other companies invested significantly, without showing financial benefits.

Ultimately, these results argue that – while it is not an obvious outcome – it is possible to receive financial benefits from investments within sustainability. This result should be carefully assessed as it indicates that environmental policies do not necessarily mean a financial burden for energy companies, but they represent an investment opportunity which may lead to a better position – if harvested properly.

When comparing these results with the previous literature, we believe that our work aligns with the work of (Carroll & Shabana, 2010), describing the relation between sustainability investments and financial profits as complex and multifaceted. Our work aligns with this idea because only Equinor showed a positive correlation, while all other companies did not exhibit a statically significant correlation. A positive correlation between oil price and net profit was expected, as crude oil is still the major product sold by these companies, leading to higher revenue. Additionally, the operational expenses are not expected to be strongly correlated with the oil price, as the cost of raw materials is typically independent of the oil price, as it is regulated at a higher level when deciding the ownership of the various oil fields.

The peculiar portfolio of Equinor's sustainability investments is particularly suitable to be explored in future research. As presented in Section 4.3.2, significant differences were observed between Equinor and the other companies when investing in sustainability, as Equinor invested significantly more in offshore wind. However, based on the current data, it is not possible to assess whether this difference may be the reason why only Equinor increases its net profits when investing in sustainability. Future research could aim at delving into this topic, evaluating the market potential of offshore wind against traditional biofuels. Finally, future research could also aim at analyzing the differences between Equinor and the other companies, as Equinor has a strong background in offshore operations, which may have facilitated its transition towards offshore wind.

5.3. Share price analysis

The effect of investments within sustainability on the companies' share price was analyzed similarly to the net profit. As Preem and St1 are private companies, they do not have a share price readily available, so they were excluded from this study, which considers Shell, Equinor and Preem. The analysis considers the effects of investments in the same year, the year before and two years before. The values of share price were extracted from the last day of each considered year.

Figure 5 summarizes the results of the T-test and P-value analysis for the regressions.

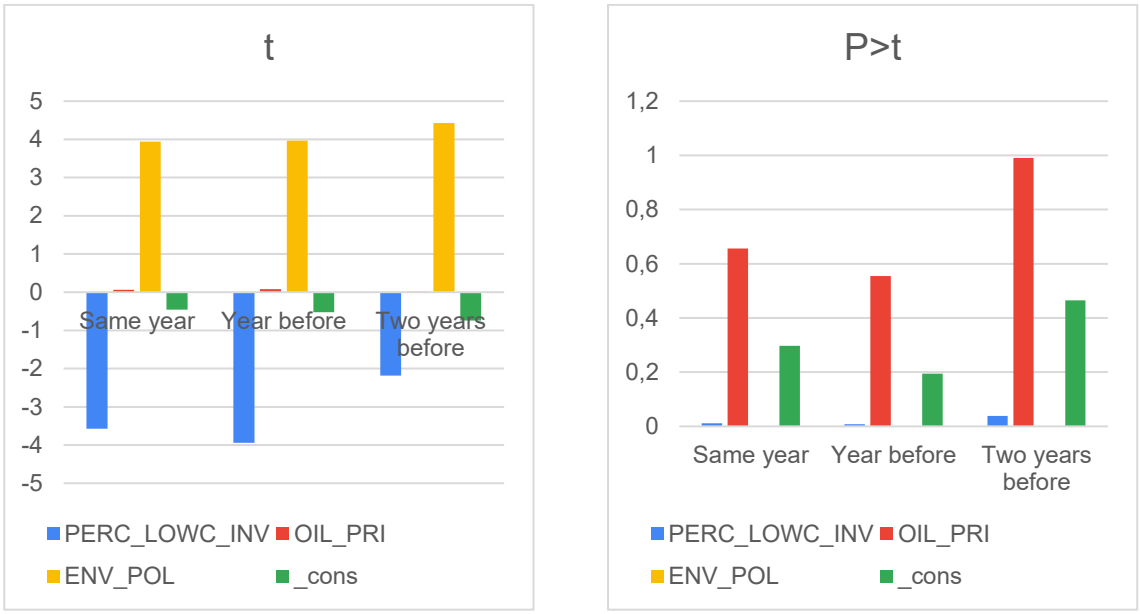

Figure 5. Results of the t-test and P-value analysis for dependent variables, divided by years of investment (share price analysis).

When reviewing the data, we observed that the oil price does not greatly affect the share price of the Nordic energy sector. This is surprising, especially when considering that the green investment analysis indicated that the price of oil was readily affecting the Nordic energy sector's profitability. The net profit translates into earnings per share (EPS), which normally has a positive correlation with share price. (Nalurita, 2019), so a similar correlation was expected in this case as well. On the authors' side, only speculations can be made as to the reasons for this resistance to impact from a fluctuating EPS, one consideration is that the energy sector market may be driven by an acceptance for year-by-year fluctuations and more concerned with long term growth. Nevertheless, it should be appreciated that the share price is indeed correlated with both green investments and the number of environmental policies.

There is a negative correlation when viewing the relationship between green investments and share price, so investors may be inclined to see green investments as non-profitable investments. Therefore, when Nordic energy companies invest in green investments, they may be seen as forgoing dividends to the investors, or alternative investments, e.g., into traditional investments in oil and gas. One interpretation is that, despite these investments negatively affecting the profitability on a face value, the investors may not be positive concerning the lack of positive impact on investments, an alternative interpretation may be that investors are too risk averse and underestimating the positive impact. Finally, investors may falsely assume a negative impact by the green investments despite this not being shown in the data. Also, for this analysis, the previous year's investments have had the greatest impact on the share price.

When viewing the relationship between share price and environmental policies there is a stronger correlation than with green investments. Herein the regression coefficient is positive, indicating a positive correlation between the number of environmental policies and the share price. An interpretation of this result could be that an increasing regulation in the Nordic market positively impacts the selected companies. Herein lies a further source of bias in the data, in that small and medium enterprises are generally excluded from the selected set of companies. These are companies which may have an alternative impact, or in fact greater detrimental impact, by the regulations enforced by the policies. This may be a response as to why there is a positive correlation between the regulation of the Nordic energy market and the share price of the selected companies, simply because they may be considered market leaders, and more enabled to deal with and manage the regulation of the market. That is, the increase in

regulation provides an advantage for these companies compared to smaller counterparts, thereby providing an increase in share price as the market becomes more regulated. Table 10 summarizes the regression results for the share price analysis, divided by the year analyzed.

Table 10. Result summary of the regression having the share price as dependent variable, divided by year.

Investments from the same year					
SHARE_PRI	Coefficient	Robust Std. err.	t	P > | t |	[95% conf. interval]
PERC_LOWC_INV	-113.12	31.642	-3.57	0.001	-177.7 -48.5
OIL_PRI	.028239	.43629	0.06	0.949	-.863 .919
ENV_POL	34.2394	8.6993	3.94	0.000	16.47 52.01
_cons	-22.0723	48.066	-0.46	0.649	-120.2 76.1
F(3, 30) = 8.42		Prob > F = 0.0003		R-squared = 0.4987	

Investments from the year before					
SHARE_PRI	Coefficient	Robust Std. err.	t	P > | t |	[95% conf. interval]
PERC_LOWC_INV_1	-129.54	32.843	-3.94	0.000	-196.8 -62.3
OIL_PRI	.38	.487297	0.08	0.938	-.96 1.04
ENV_POL	34.41	8.673467	3.97	0.000	16.64 52.18
_cons	-25.42	49.07889	-0.52	0.609	-125.9 75.1
F(3, 28) = 8.24		Prob > F = 0.0004		R-squared = 0.4884	

Investments from two years before					
SHARE_PRI	Coefficient	Std. err.	t	P > | t |	[95% conf. interval]
PERC_LOWC_INV_2	-163.49	75.07274	-2.18	0.039	-318.1 -8.9
OIL_PRI	.00961	.7793285	0.01	0.990	-1.60 1.61
ENV_POL	38.498	8.698397	4.43	0.000	20.58 56.41
_cons	-37.067	49.97344	-0.74	0.465	-140.1 65.9
F(3, 25) = 8.46		Prob > F = 0.0005			

Following these results, we decided to perform additional regressions on a company-by-company basis to assess if there are indications for alternative interpretations based on a company business level.

When viewing Equinor with the percentage of green investments as the independent variable, the number of data points is above the rule of thumb for 10 with only one independent variable. Thus, this regression is considered within the scope of the thesis. The regression results are presented in Table 11.

Table 11. Result summary of the regression for Equinor having the share price as dependent variable and the share of sustainable investments as independent variable, divided by year.

Investments from the same year					
SHARE_PRI	Coefficient	Std. err.	t	P > | t |	[95% conf. interval]
PERC_LOWC_INV	1110.7	178.12	6.24	0.000	689.47 1531.8
_cons	136.89	11.112	12.32	0.000	110.61 163.16
F(1, 7) = 38.88			Prob > F = 0.0004		

Investments from the year before					
SHARE_PRI	Coefficient	Std. err.	t	P > | t |	[95% conf. interval]
PERC_LOWC_INV_1	1254.7	240.03	5.23	0.001	701.17 1808.2
_cons	146.95	14.207	10.34	0.000	114.19 179.71
F(1, 8) = 27.32			Prob > F = 0.0008		

Investments from two years before					
SHARE_PRI	Coefficient	Robust std. err.	t	P > | t |	[95% conf. interval]
PERC_LOWC_INV_2	1442.0	300.14	4.80	0.002	732.3 2151.8
_cons	165.81	15.438	10.74	0.000	129.3 202.3
F(1, 7) = 23.08		Prob > F = 0.0020		R-squared = 0.5682	

The results show that green investments performed in the same year and the year before pass the T-test and the P-value analysis, with values indicating a strong correlation. When investments from two years before are considered, it was decided to consider them not statistically significant due to the low number of observations which does not pass the rule of thumb of ten observation per variable (Harrell Jr. o.a., 1984).

These results can be interpreted as Equinor's investors viewing green investments positively and expecting a positive return on these investments, with an increasing share price based upon the amount of green investments made.

Ultimately, some conclusions can be drawn related to the original research questions. When considering the net profit analysis for the entire energy sector, the null hypothesis cannot be rejected, because no correlation was found with green investments. The null hypothesis can be rejected when analyzing the

share price, as it exhibits a negative correlation with green investments. As previously mentioned in Section 5.2 and 5.3, when considering Equinor separately from the rest of the sector, this firm stands out as a significant exception, as there is a positive correlation, so the null hypothesis is rejected for both the net profit and share price analysis.

When comparing these results to the previous literature, we observe some level of disagreement. Even if previous works (Carroll & Shabana, 2010) highlight the complexity between financial gains and sustainability investments, there is a significant part of literature (Orlitzky et al., 2003; Friede et al., 2015) arguing for a positive correlation, meaning higher firm values for higher sustainability investment shares. This principle is consistent with the Stakeholder theory, as the environment may be considered as a relevant stakeholder and it has clear benefits from sustainability investments. However, for every sustainability investment, the potential gains from profit-oriented investments are foregone. It is possible that the shareholders value these foregone profits more than the environmental gains from investing within sustainability, thus the firms' value decreases. This situation may be a good starting point for future research aimed at expanding the discourse on this topic. Such research could be an explorative, qualitative analysis of the viewpoints from the investors in Nordic energy companies, focusing especially on the perception of sustainability investments. Additionally, such a study could be expanded covering also the perception of newly enforced environmental policies. The present study presents a positive correlation between the number of policies and share price, even without showing significant financial gains. As the previous part of the study showed a positive correlation between policy number and share of sustainability investment, the fact that there is a positive correlation policies-share price contradicts the negative correlation investments-share price. Following the idea that the investors are risk averse when investing in sustainability, there should be a negative correlation between share price and number of environmental policies, as these may come with additional investments, thus foregoing profits. However, the present study shows a positive correlation, which should be further explored. Even if it can be argued that investors may appreciate a more regulated market when investing in the energy market leaders, such an idea is still not proven, so future research could be aimed at addressing this gap.

6. Conclusion

This report analyzes the financial performance of energy companies predominantly located in the Nordic region, focusing on their investments within sustainability and the effects on financial performance. This study begins by analyzing the underlying variables possibly triggering green investments, selecting crude oil price and number of environmental policies as independent variables. All the analyzed companies began to invest significantly within sustainability starting from the years 2014 – 2016. Two investment behaviors are observed: forerunners investing more than 50% within sustainability and conservatives, investing less than 30%. St1 seems to be an outlier in this analysis, as it started earlier than others to aggressively invest in green solutions. This trend was abrupted in 2018, when it resembled a behavior that is typical of a conservative. The reasons behind this sudden shift are not publicly known and are considered confidential within St1.

Answering the research question related to the "Green investment analysis", it was observed that the oil price did not affect investments within sustainability, while there is a correlation between the number of enforced environmental policies and green investments, when St1 is removed from the study group. As previously mentioned, this company had a sudden strategy shift, which is believed to be specific for this firm. However, the energy sector as a whole shows a correlation with green investments / number of policies. It can therefore be concluded that policies trigger investments within sustainability, with the share of green investments increasing by 5% for each new environmental policy enforced. Ultimately, it can be concluded that the null hypothesis (H0) was rejected, as it was possible to find a correlation between the share of green investments and an independent variable for all firms besides St1.

After analyzing green investments as a dependent variable, this value becomes one of the independent variables aiming to explain variations of net profit in percentage and share price. This second part of the study answers the research questions for the "Net profit-" and "Share price analysis". When analyzing the net profit, the oil price is the only variable affecting the entire energy sector. As expected, the correlation coefficient is positive, meaning that the net profit increases with the oil price. Equinor is an exception to the category, as there is a correlation between green investments and net profit. The correlation is stronger for investments coming from the year before, meaning that – on average – there is a one-year delay between investment decision and benefits in the net profit. The correlation shows that if Equinor increases the share of green investment by 1%, the net profit should increase approximately also by 1%.

Equinor's sustainability portfolio was then analyzed aiming at identifying the unique sectors which possibly make this company profitable. Coming from an offshore heritage, Equinor leveraged this expertise and became a pioneer in offshore power generation by wind, establishing a position of market leader. In addition, it is the only company that did not invest in more traditional forms of green fuels such as biodiesel, HVO and SAF.

The next step in the analysis is evaluating potential effects of green investments, oil price and number of environmental policies on the share price. Surprisingly, there is no correlation between the oil price and the share price of energy companies, despite having an influence on the net profit, meaning that the market is probably looking at other indicators. The share price is correlated with the green investments, with a negative coefficient, indicating that investors may see these investments as a risk, despite not showing any negative consequence on profitability. The strongest correlation is given for investments from the previous year, further confirming the one-year cycle. The number of environmental policies has an even stronger correlation with the share price compared to green investments, indicating that shareholders may have financial KPIs linked to this variable. The correlation is positive, indicating that the share price is likely to increase when new policies are enforced.

As observed by the net profit analysis, Equinor is an exception in this sector, as the correlation between green investments and share price is positive, indicating that shareholders probably value these investments, as they probably see the increase in profitability.

Similarly to the green investment analysis, some considerations can be drawn regarding the null hypothesis and research question related to the net profit and share price analysis. When considering the net profit analysis for the energy sector as a whole, the null hypothesis (H0) cannot be rejected, as no correlation as found with green investments. A negative correlation was found when analyzing the share price, so the null hypothesis can be rejected for this case. Equinor represents an exception in this category, as their green investments exhibit a positive correlation with both the percentage net profit and the share price, thus the null hypothesis can be rejected when considering specifically this firm.

References

Abakah, E. J., Tiwari, A. K., Sharma, A., & Mwamtambulo, D. J. (2022). Extreme Connectedness between Green Bonds, Government Bonds, Corporate Bonds and Other Asset Classes: Insights for Portfolio Investors. *Risk and financial management, 15*(10), 477. https://doi.org/https://doi.org/10.3390/jrfm15100477

Abbasi, K. R., Shahbaz, M., Zhang, J., Irfan, M., & Alvardo, R. (2022). Analyze the environmental sustainability factors of China: The role of fossil fuel energy and renewable energy. *Renewable Energy, 187*, 390-402.

Abbass, K., Qasim, M. Z., Song, H., Murshed, M., Mahmood, H., & Younis, I. (2022). A review of the global climate change impacts, adaptation, and sustainable mitigation measures. *Environmental Science and Pollution Research, 29*, 42539–42559. https://doi.org/https://doi.org/10.1007/s11356-022-19718-6

Bar-Ilan, A., & Strange, W. C. (1996). Investment Lags. *The American Economic Review, 86*(3), 610-622. Retrieved from http://www.jstor.org/stable/2118214

Bataille, C., Waisman, H., Rahbar, S., Sampedro, J., Eyre, N., Pye, S., . . . George Kamiya, S. S. (2018). A review of energy-economy modelling paradigms for deep decarbonization policy analysis. *Energy Economics, 73*, 204-215. https://doi.org/10.1016/j.eneco.208.05.004

Block, S., Emerson, W., J., Esty, D. C., de Sherbinin, A., & Wendling, Z. A. (2024). *2024 Environmental Performance Index.* New Haven: CT: Yale Center for Environmental Law & Policy. Retrieved from epi.yale.edu

BloombergNEF. (2025). *Energy Transition Investment Trends 2025.*

Bobbitt, Z. (2020, January 8). *Linear Regression Assumptions*. Retrieved from Statology: https://www.statology.org/linear-regression-assumptions/

Bogmans, C., Pescatori, A., & Prifti, E. (2024). The impact of climate policy on oil and gas investment: Evidence from firm-level data. *European Economic Review*(165), 104750. https://doi.org/https://doi.org/10.1016/j.euroecorev.2024.104750

Bostian, M., Färe, R., Grosskopf, S., & Lundgren, T. (2016). Environmental investment and firm performance: A network approach. *Energy Economics, 57*, 243-255. https://doi.org/https://doi.org/10.1016/j.eneco.2016.05.013

Brown, S. (2022, March 17). *Skewness*. Retrieved from Brownmaths.com: https://brownmath.com/stat/shape.htm#Skewness

Carroll, A. B., & Shabana, K. M. (2010). The Business Case for Corporate Social Responsibility: A Review of Concepts, Research and Practice. *International Journal of Management Reviews, 12*(1), 85-105. https://doi.org/10.1111/j.1468-2370.2009.00275.x

Chen, Y., & Ma, Y. (2021). Does green investment improve energy firm performance? *Energy Policy, 153*, 112252. https://doi.org/https://doi.org/10.1016/j.enpol.2021.112252

Cheng, X., Chen, K., & Yuxin Su. (2023). Green innovation in oil and gas exploration and production for meeting the sustainability goals. *Resources Policy, 87, Part A*, 104315. https://doi.org/https://doi.org/10.1016/j.resourpol.2023.104315.

Clarkson, M. B. (1995). A Stakeholder Framework for Analyzing and Evaluating Corporate Social Performance. *Academy of Management Review, 20*(1), 92-117. https://doi.org/https://doi.org/10.2307/258888

Climate Policy Council. (2025). *2025 Climate Policy Council report.* Stockholm: Climate Policy Council.

Decoding Data Science. (2025). *Linear Regression: A complete Guide with Exampels*. Retrieved from Decodingdatasceince: https://decodingdatascience.com/linear-regression-a-complete-guide-with-examples/

Donaldson, T., & Preston, L. E. (1995). The Stakeholder Theory of the Corporation: Concepts, Evidence, and Implications. *Academy of Management Review, 20*(1), 65-91. https://doi.org/https://doi.org/10.2307/258887

Equinor. (2013). *Investors: Annual-reports-archive.* Retrieved from Equinot: https://cdn.equinor.com/files/h61q9gi9/global/f7148331f9bfa5ddb7b7b9851bc94e9bff66dfb0.pdf?statoil-annual-report-20-F-2013.pdf

Equinor. (2013). *Sustainability: Sustainability-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/5e41bce2e2444da7218f433dc0401c91dd5a6df5.pdf?sustainability-report-2013-equinor.pdf

Equinor. (2014). *Investors: Annual-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/b2c0248e609fa8783137514d8fd0ca09f9a1ec5e.pdf?Statoil-20-F-2014.pdf

Equinor. (2014). *Sustainability: Sustainability-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/1537545f0382cc365f87eaf3d4c564f6e005d603.pdf?sustainability-report-2014-equinor.pdf

Equinor. (2015). *Investors: Annual-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/13283f4d920be9b47a9f4af9c9c64452da40680b.pdf?statoil-2015-annual-report-on-form-20-F.pdf

Equinor. (2015). *Sustainability: Sustainability-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/3b3dfed9ee2bf168d83d7551c8257aaf2042d055.pdf?sustainability-report-2015-equinor.pdf

Equinor. (2016). *Investors: Annual-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/0e20f74dbf8e00cd8837e8eb2526c212c069860c.pdf?statoil-2016-annualreport-20-F.pdf.pdf

Equinor. (2016). *Sustainability: Sustainability-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/514d634e9d374f377762386b4d0262d0cf301989.pdf?sustainability-report-2016-equinor.pdf

Equinor. (2017). *Investors: Annual-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/677d0571372cf5e926b24090b712a0b943842dc8.pdf?statoil-annual-report-20f-2017.pdf

Equinor. (2017). *Sustainability: Sustainability-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/2741acbbc05825f22fef114c1a34f40a25536353.pdf?sustainability-report-2017-equinor.pdf

Equinor. (2018). *Investors: Annual-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/b9548e9872909e4020c84df1d1eeb9642c3ce1c6.pdf?equinor-2018-annual-report.pdf

Equinor. (2018). *Sustainability: Sustainability-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/32fcfa06667da281edd250865ccad939f6963720.pdf?sustainability-report-2018-equinor.pdf

Equinor. (2019). *Investors: Annual-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/285c51a7491a6dd19f981ee256f34b08ec83bb85.pdf?equinor-2019-annual-report-and-form-20f.pdf

Equinor. (2019). *Sustainability: Sustainability-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/dd7a7ad9cb23d5cba1243223e11353c7b83877d7.pdf?sustainability-report-2019-equinor.pdf

Equinor. (2020). *Investors: Annual-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/50088434118167232c3cd8dc335ca7d419eb272f.pdf?2020-annual-report-and-form-20-f-equinor.pdf

Equinor. (2020). *Sustainability: Sustainability-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/9c603ad28ad20b49226e5cd24d8c2eb34d8180a7.pdf?sustainability-report-2020-equinor.pdf

Equinor. (2021). *Investors: Annual-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/83ce4c64e602e203100e1ce2c5de9b2d42ff8192.pdf?equinor-2021-annual-report-and-form-20-f.pdf

Equinor. (2021). *Sustainability: Sustainability-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/d44ff2e9498e7d9cee9e88c4f01e6c4135c7a2f8.pdf?sustainaiblity-report-2021-equinor.pdf

Equinor. (2022). *Investors: Annual-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/d3b41d2d0b98906de981ded0cd454636c1ba9088.pdf?2022-annual-report-equinor.pdf

Equinor. (2022). *Sustainability: Sustainability-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/d3b41d2d0b98906de981ded0cd454636c1ba9088.pdf?2022-annual-report-equinor.pdf

Equinor. (2023). *Investors: Annual-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/76629806e2cc50eefdd89d5b8daabda39247db63.pdf?2023-annual-report-equinor.pdf

Equinor. (2023). *Sustainability: Sustainability-reports-archive.* Retrieved from Equinor: https://cdn.equinor.com/files/h61q9gi9/global/76629806e2cc50eefdd89d5b8daabda39247db63.pdf?2023-annual-report-equinor.pdf

Equinor. (2025, 05 01). *Annual reports archive*. Retrieved from Equinor: https://www.equinor.com/investors/annual-reports-archive

Equinor. (2025, 05 01). *sustainability-reports-archive*. Retrieved from Equinor: https://www.equinor.com/sustainability/sustainability-reports-archive

European Commission. (n.d.). *what-we-do: Green-transition_en*. Retrieved 05 02, 2025, from Reform-support.EC.Europea.EU: https://reform-support.ec.europa.eu/what-we-do/green-transition_en

European Environment Agency. (2024, Oct 31). *total-greenhouse-gas-emission-trends*. Retrieved from www.eea.europa.eu: https://www.eea.europa.eu/en/analysis/indicators/total-greenhouse-gas-emission-trends

Fombrun, C., & Shanley, M. (1990). What's in a name? Reputation building and corporate strategy. *Academy of Management Journal, 33*(2), 233-258. https://doi.org/https://doi.org/10.2307/256324

Freeman, R. (1984). *Strategic Management: A Stakeholder Approach.* Pitman. https://doi.org/10.1017/CBO9781139192675

Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment, 5*(4), 210-233. https://doi.org/https://doi.org/10.1080/20430795.2015.1118917

Harrell Jr., F. E., Lee, K. L., Califf, R. M., Pryor, D. B., & Rosati, R. A. (1984). Regression modelling strategies for improved prognostic prediction. *Statistics in Medicine, 3*(2), 143-152. https://doi.org/https://doi.org/10.1002/sim.4780030207

Hazarika, N. (2021). R&D Intensity and Its Curvilinear Relationship with Firm Profitability: Perspective from the Alternative Energy Sector. . *Sustainability, 13*(9), 5060. https://doi.org/https://doi.org/10.3390/su13095060

International Energy Agency. (2024). *World Energy Investment 2024 Report.* International Energy Agency.

IPCC. (2022). *Climate Change 2022 Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, UK and New York, NY, USA: IPCC.

IPCC. (2023). *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report.* Geneva Switzerland: IPCC. https://doi.org/10.59327/IPCC/AR6-9789291691647

Jackson, R. B., Vengosh, A., Carey, J. W., Davies, R. J., Darrah, T. H., O'Sullivan, F., & Petron, G. (2014). The Environmental Costs and Benefits of Fracking. *Annu. Rev. Environ. Resour.*, 327-62.

Jensen, M. C. (2001). Value Maximization, Stakeholder Theory, and the Corporate Objective Function. *Journal of Applied Corporate Finance, 14*(3), 8-21. https://doi.org/https://doi.org/10.2307/3857812

Kartal, M. T., Shahbaz, M., Taşkın, D., Depren, S. K., & Ayhan, F. (2024). How are energy transition and energy-related R&D investments effective in enabling decarbonization? Evidence from Nordic Countries by novel WLMC model. *Journal of Environmental Management, 365*, 121664. https://doi.org/https://doi.org/10.1016/j.jenvman.2024.121664

Kiselova, V. D., Ozolina, K., Zolovs, M., Nagle, E., & Reine, I. (2025). The Role of Statistical Power: A Study of Relationship Between Emotional and Conduct Problems, Sociodemographic Factors, and Smoking Behaviours in Large and Small Samples of Latvian Adolescents. *Medicina, 4*(687), 61. https://doi.org/https://doi.org/10.3390/medicina61040687

Lee, M., & Choi, M. (2015). Analysis on time-lag effect of Research and Development Investment in the Pharmaceutical Industry in Korea. *Osong Public Health and Research Perspectives, 6*(4), 241-248. https://doi.org/https://doi.org/10.1016/j.phrp.2015.07.001

Luo, X., & Bhattacharya, C. B. (2006). Corporate social responsibility, customer satisfaction, and market value. *Journal of Marketing, 70*(4), 1-18. https://doi.org/https://doi.org/10.1509/jmkg.70.4.001

Macrotrends. (2025, May 01). *Crude Oil Price History Chart*. Retrieved from Macrotrends.net: https://www.macrotrends.net/1369/crude-oil-price-history-chart

Meehl, G. A., & Tebaldi, C. (2004). More Intense, More Frequent, and Longer Lasting Heat Waves in the 21st Century. *Science, 305*, 994-997. Retrieved from http://www.jstor.org/stable/3837565

Mitchell, R. K., & Wood, D. J. (1997). Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of Who and What Really Counts. *Academy of Management Review, 22*(4), 853-886. https://doi.org/https://doi.org/10.2307/259247

Mo, B., Li, Z., & Meng, J. (2022). The dynamics of carbon on green energy equity investment: quantile-on-quantile and quantile coherency approaches. *Environmental Science and Pollution Research, 29*, 5912-5922. https://doi.org/https://doi.org/10.1007/s11356-021-15647-y

Morina, D., Lucas, H., & Heiden, S. (2025). Unraveling the impact of R&D investment on corporate growth: Empirical insights on intensity- and growth rate-based differences. *Finance Research Letters, 74*, 106722. https://doi.org/https://doi.org/10.1016/j.frl.2024.106722

Muyiwa-Ajayi, T. P., Sobowale, A., & Augoye, O. (2024). The Financial Impact of Sustainable Investments on Corporate Profitability. *International Journal of Multidisciplinary Research and Growth Evaluation, 05*(01), 1372-1377. https://doi.org/https://doi.org/10.54660/.IJMRGE.2024.5.1.1372-1377

Nalurita, F. (2019, 06). IMPACT OF EPS ON MARKET PRICES AND MARKET RATIO. *Business and Entrepreneurial Review, 15*, 111. https://doi.org/10.25105/ber.v15i2.4629.

Neste. (2013). *HostedData: AnnualReportArchive*. Retrieved from AnnualReports: https://www.annualreports.com/HostedData/AnnualReportArchive/n/neste_2013.pdf

Neste. (2014). *HostedData: AnnualReportArchive*. Retrieved from AnnualReports: https://www.annualreports.com/HostedData/AnnualReportArchive/n/neste_2014.pdf

Neste. (2015). *HostedData: AnnualReportArchive*. Retrieved from Annualreports: https://www.annualreports.com/HostedData/AnnualReportArchive/n/neste_2015.pdf

Neste. (2016). *HostedData: AnnualReportArchive*. Retrieved from Annual Reports: https://www.annualreports.com/HostedData/AnnualReportArchive/n/neste_2016.pdf

Neste. (2017). *News: Neste-annual-report-corporate-governance-statement-and-remuneration-statement-for-2017-published*. Retrieved from Neste: https://nedxstgaprodfiles.blob.core.windows.net/pdf/838372.pdf

Neste. (2018). *Media: Materials: Annual-reports*. Retrieved from Neste: https://ir-service.funkton.com/view/ahBzfmlyLXNlcnZpY2UtaHJkchsLEg5GaWxlQXR0YWNobWVudBiAgNDhr6ynCAw?language_no=0

Neste. (2019). *Media: Materials: Annual-reports*. Retrieved from Neste: https://ir-service.funkton.com/view/ahBzfmlyLXNlcnZpY2UtaHJkchsLEg5GaWxlQXR0YWNobWVudBiAgNC98cGjCQw?language_no=0

Neste. (2020). *Media: Materials: Annual-reports*. Retrieved from Neste: https://ir-service.funkton.com/view/ahBzfmlyLXNlcnZpY2UtaHJkchsLEg5GaWxlQXR0YWNobWVudBiAgLDI2MjyCww?language_no=0

Neste. (2021). *Media: Materials: Annual-reports*. Retrieved from Neste: https://ir-service.funkton.com/view/ahBzfmlyLXNlcnZpY2UtaHJkchsLEg5GaWxlQXR0YWNobWVudBiAgLC8t6_cCww?language_no=0

Neste. (2022). *Media: Materials: Annual-reports*. Retrieved from Neste: https://ir-service.funkton.com/view/ahBzfmlyLXNlcnZpY2UtaHJkchsLEg5GaWxlQXR0YWNobWVudBiAgLCx19XhCQw?language_no=0

Neste. (2023). *Media: Materials: Annual-reports*. Retrieved from Neste: https://ir-service.funkton.com/view/ahBzfmlyLXNlcnZpY2UtaHJkchsLEg5GaWxlQXR0YWNobWVudBiAgLC9qs-HCgw?language_no=0

Neste. (2025, 05 01). *Annual-reports*. Retrieved from Neste: https://www.neste.com/media/materials/annual-reports

Orlitzky, M., Schmidt, F. L., & L., R. S. (2003). Corporate Social and Financial Performance: A Meta-Analysis. *Organization Studies, 24*(3). https://doi.org/10.1177/0170840603024003910

Özdurak, C. (2021). Nexus between crude oil prices, clean energy investments, technology companies and energy democracy. *Green Finance, 3*(3), 337-350. https://doi.org/10.3934/GF.2021017

Pham, D. C., Do, T. N., Doan, T. N., Nguyen, T. X., & Pham, T. K. (2021). The impact of sustainability practices on financial performance: empirical evidence from Sweden. *Cogent Business & Management, 8*(1). https://doi.org/https://doi.org/10.1080/23311975.2021.1912526

Preem. (2013). *Om-preem: Finansiell-info: arsredovisningar.* Retrieved from Preem: https://www.preem.se/globalassets/om-preem/finansiell-info/arsredovisningar/2013/preem-annualrep-eng-2013-framvagn_-140610.pdf

Preem. (2014). *Om-preem: Finansiell-info: arsredovisningar.* Retrieved from Preem: https://www.preem.se/globalassets/om-preem/finansiell-info/arsredovisningar/2014/preem---annual-report-2014---presentation.pdf

Preem. (2015). *Om-preem: Finansiell-info: arsredovisningar.* Retrieved from Preem: https://www.preem.se/globalassets/om-preem/finansiell-info/arsredovisningar/2015/preem_annual-report_2015_presentation.pdf

Preem. (2016). *Om-preem: Finansiell-info: arsredovisningar.* Retrieved from Preem: https://www.preem.se/globalassets/om-preem/finansiell-info/arsredovisningar/2016/preem_annual-report_2016_financial-report.pdf

Preem. (2017). *Om-preem: Finansiell-info: arsredovisningar.* Retrieved from Preem: https://www.preem.se/globalassets/om-preem/finansiell-info/arsredovisningar/preem-annual-report-2017.pdf

Preem. (2018). *Annual and Sustainability: Annual-report.* Retrieved from Preem: https://cms.preem.com/Content/preem.com/bilder--documents/hallbarhet/redovisningar/2018/preem_annual-report-2018_eng.pdf

Preem. (2018). *Annual and Sustainability: Sustainability-report.* Retrieved from Preem: https://cms.preem.com/Content/preem.com/bilder--documents/hallbarhet/redovisningar/2018/preem_progressbook2018_sve.pdf

Preem. (2019). *Annual and Sustainability: Annual-report.* Retrieved from Preem: https://cms.preem.com/Content/preem.com/bilder--documents/hallbarhet/redovisningar/2019/preem_annual_report_2019_eng.pdf

Preem. (2019). *Annual and Sustainability: Sustainability-report.* Retrieved from Preem: https://cms.preem.com/Content/preem.com/bilder--documents/hallbarhet/redovisningar/2019/preem_sustainability_report_2019_eng.pdf

Preem. (2020). *Annual and Sustainability: Annual-report.* Retrieved from Preem: https://cms.preem.com/Content/documents/rapporter/arsredovisningar/2020/preem_annual-report-2020.pdf

Preem. (2020). *Annual and Sustainability: Sustainability-report.* Retrieved from Preem: https://cms.preem.com/Content/documents/rapporter/hallbarhetsredovisningar/2020/preem_sustainabilityreport_2020_eng.pdf

Preem. (2021). *Annual and Sustainability: Annual-report.* Retrieved from Preem: https://cms.preem.com/Content/documents/rapporter/arsredovisningar/2021/preem_annual_report_2021.pdf

Preem. (2021). *Annual and Sustainability: Sustainability-report.* Retrieved from Preem: https://cms.preem.com/Content/documents/rapporter/hallbarhetsredovisningar/2021/preem_sustainability-report-2021_01_juni.pdf

Preem. (2022). *Annual and Sustainability: Annual-report.* Retrieved from Preem: https://cms.preem.com/Content/documents/rapporter/arsredovisningar/2022/preem_annual_report_2022.pdf

Preem. (2022). *Annual and Sustainability: Sustainability-report.* Retrieved from Preem: https://cms.preem.com/Content/documents/rapporter/hallbarhetsredovisningar/2022/preem_sustainability-report-2022.pdf

Preem. (2023). *Annual and Sustainability: Sustainability-report.* Retrieved from Preem: https://cms.preem.com/Content/preem.com/bilder--documents/hallbarhet/redovisningar/2023/preem-annual-sustainability-report-2023.pdf

Preem. (2025, 05 01). *Annual and Sustainability Report*. Retrieved from Preem: https://www.preem.com/en/sustainability/sustainability-report/

Renewable Energy Policy Network for the 21st Century. (2025). *Renewables 2025 Global Status Report.* Retrieved from https://www.ren21.net/reports/global-status-report/

Reuter, W. H., Szolgayová, J., Fuss, S., & Obersteiner, M. (2012). Renewable energy investment: Policy and market impacts. *Applied Energy, 97*, 249-254. https://doi.org/https://doi.org/10.1016/j.apenergy.2012.01.021

Ribeiro, I. P., Lopes, H. S., Dinis, M. A., & Remoaldo, P. C. (2025). Geography of Sustainability Transitions: Mapping Spatial Dynamics and Research Trends Between 1995 and 2024. *Environments, 12*(5), 148. https://doi.org/https://doi.org/10.3390/environments12050148

SEI, Climate Analytics, E3G, IISD, and UNEP. (2023). *The Production Gap: Phasing down or phasing up? Top fossil fuel producers plan even more extraction despite climate promises.* Stockholm Environment Institute, Climate Analytics, E3G, International Institute for Sustainable Development and United Nations Environment Programme. https://doi.org/https://doi.org/10.51414/sei2023.050

Serdar, C. C., Cihan, M., Yücel, D., & Serdar, M. (2020). Sample size, power and effect size revisited: simplified and practical approaches in pre-clinical, clinical and laboratory studies. *Biochem Med (Zagreb), 1*(010502), 31. https://doi.org/10.11613/BM.2021.010502

Shah, I. H., Hiles, C., & Morley, B., (2018). How do oil prices, macroeconomic factors and policies affect the market for renewable energy?. *Applied Energy*. 215, 87-89. https://doi.org/10.1016/j.apenergy.2018.01.084.

Shell. (2013, Dec 31). *Results-and-reporting: Annual-report-archive.* Retrieved from Shell: https://www.shell.com/investors/results-and-reporting/annual-report-archive/_jcr_content/root/main/section_812377294/tabs/tab_55706488_copy/text_copy.multi.stream/1742905707925/973768aeda60d90ad2e20728f27170d1222208b5/shell-annual-report-2013.pdf

Shell. (2013). *Sustainability: Reporting-centre: Reporting-centre-archive.* Retrieved from Shell: /reporting-centre-archive/_jcr_content/root/main/section_2106585602/tabs/tab_1645439879_copy__585651022/text_copy_copy_copy__1589128498/links/item0.stream/1742906400889/e9efb40bfbbe70c97f6077c69dc553043a27822f/shell-sustainability-report-2013.pdf

Shell. (2014, Dec 31). *Results-and-reporting: Annual-report-archive.* Retrieved from Shell: https://www.shell.com/investors/results-and-reporting/annual-report-archive/_jcr_content/root/main/section_812377294/tabs/tab_55706488/text_copy.multi.stream/1742905708495/23c7ba36f2a4223b7b42c48d8c13f7ba88a49050/shell-annual-report-2014.pdf

Shell. (2014). *Sustainability: Reporting-centre: Reporting-centre-archive.* Retrieved from Shell: /reporting-centre/reporting-centre-archive/_jcr_content/root/main/section_2106585602/tabs/tab_1645439879_copy_/text_copy_copy_copy__1589128498/links/item0.stream/1742906422080/5c6c36fe6dfd91d443076a8669530907f708e178/shell-sustainability-report-2014.pdf

Shell. (2015, Dec 31). *Results-and-reporting: Annual-report-archive.* Retrieved from Shell: https://www.shell.com/investors/results-and-reporting/annual-report-archive/_jcr_content/root/main/section_812377294/tabs/tab_61705099_copy_234306435/text_copy.multi.stream/1742905718142/f5446aa830443e923e6bba2090ffdcb92d5c04b5/shell-annual-report-2015.pd

Shell. (2015). *Sustainability: Reporting-centre: Reporting-centre-archive.* Retrieved from Shell: /reporting-centre/reporting-centre-archive/_jcr_content/root/main/section_2106585602/tabs/tab_1645439879_copy/text_copy_copy_copy__1589128498/links/item0.stream/1742906428598/a99353d6a7d1026b1a72cb581ad13055b7976a52/shell-sustainability-report-2015.pdf

Shell. (2016, Dec 31). *Results-and-reporting: Annual-report-archive.* Retrieved from Shell: https://www.shell.com/investors/results-and-reporting/annual-report-archive/_jcr_content/root/main/section_812377294/tabs/tab_61705099_copy_298665386/text_copy.multi.stream/1742905719637/d469749711efb88eb61e60dcf29d8c1e97e57b4b/shell-annual-report-2016.pd

Shell. (2016). *Sustainability: Reporting-centre: Reporting-centre-archive.* Retrieved from Shell: /reporting-centre/reporting-centre-archive/_jcr_content/root/main/section_2106585602/tabs/tab_1645439879/text_copy_copy_copy__1589128498/links/item0.stream/1742906433760/37ee3bc4799b4bf9efa3127795b6b72818779c40/shell-sustainability-report-2016.pdf

Shell. (2017, Dec 31). *Results-and-reporting: Annual-report-archive.* Retrieved from Shell: https://www.shell.com/investors/results-and-reporting/annual-report-archive/_jcr_content/root/main/section_812377294/tabs/tab_61705099_copy_311777559/text_copy.multi.stream/1742905721156/d5cefaebb1db5459377daadd45d85fb805b6c957/shell-annual-report-2017.pd

Shell. (2017). *Sustainability: Reporting-centre: Reporting-centre-archive.* Retrieved from Shell: /sustainability/reporting-centre/reporting-centre-archive/_jcr_content/root/main/section_2106585602/tabs/tab_978158744/text_copy_copy_copy_/links/item0.stream/1742906438442/7494c7e7e754d375d80bd30b1771903121fc1358/shell-sustainability-report-2017.pdf

Shell. (2018, Dec 31). *Results-and-reporting: Annual-report-archive.* Retrieved from Shell: https://www.shell.com/investors/results-and-reporting/annual-report-archive/_jcr_content/root/main/section_812377294/tabs/tab_61705099_copy_579650462/text.multi.stream/1742905607084/dac9fae46b135df3789722f19e0b9cc5b6d282a4/shell-annual-report-2018.pdf

Shell. (2018). *Sustainability: Reporting-centre: Reporting-centre-archive.* Retrieved from Shell: /reporting-centre-archive/_jcr_content/root/main/section_2106585602/tabs/tab_405218944/text_copy_copy_copy__1531262537/links/item0.stream/1742906442699/d4988d7329c1d78188681c9ed36a0156daaea40b/shell-sustainability-report-2018.pdf

Shell. (2019, Dec 31). *Results-and-reporting: Annual-report-archive.* Retrieved from Shell: https://www.shell.com/investors/results-and-reporting/annual-report-archive/_jcr_content/root/main/section_812377294/tabs/tab_61705099_copy/text.multi.stream/1742905535559/8c8164754553b82936622a42fd542a06a7a717f8/shell-annual-report-2019.pdf

Shell. (2019). *Sustainability: Reporting-centre: Reporting-centre-archive.* Retrieved from Shell: /sustainability/reporting-centre/reporting-centre-archive/_jcr_content/root/main/section_2106585602/tabs/tab_721786461/text_copy_copy_copy_/links/item0.stream/1742906443442/63673458f07802ea0b0c9f05e85084fb445c30d5/shell-sustainability-report-2019.pdf

Shell. (2020, Dec 31). *Results-and-reporting: Annual-report-archive.* Retrieved from Shell: https://www.shell.com/investors/results-and-reporting/annual-report-archive/_jcr_content/root/main/section_812377294/tabs/tab_61705099/text.multi.stream/1742905483000/46170ccf92a7a52ea02ed46c8a94770928c69208/shell-annual-report-2020.pdf

Shell. (2020). *Sustainability: Reporting-centre: Reporting-centre-archive.* Retrieved from Shell: www.shell.com/sustainability/reporting-centre/reporting-centre-archive/_jcr_content/root/main/section_2106585602/tabs/tab_66628456/text_copy/links/item0.stream/1742906414010/dfcb8b4f924831d394e111a4b71ced1dba07abfc/shell-sustainability-report-2020.pdf

Shell. (2021, Dec 31). *Results-and-reporting: annual-report-archive.* Retrieved from Shell: https://www.shell.com/investors/results-and-reporting/annual-report-archive/_jcr_content/root/main/section_812377294/tabs/tab_338953895/text.multi.stream/1742905417223/ddb70e54fdb262fa1e81db12f2d92233672f779d/shell-annual-report-2021.pdf

Shell. (2021). *Sustainability: Reporting-centre: Reporting-centre-archive.* Retrieved from Shell: /sustainability/reporting-centre/reporting-centre-archive/_jcr_content/root/main/section_2106585602/tabs/tab_598795121/text_copy_copy_copy_/links/item0.stream/1742906404689/177c3ffdf8569f5b4ded34845ba698da7b44cac3/shell-sustainability-report-2021.pdf

Shell. (2022, Dec 31). *Results-and-reporting: Annual-report-archive.* Retrieved from Shell: https://www.shell.com/investors/results-and-reporting/annual-report-archive/_jcr_content/root/main/section_812377294/tabs/tab_1219767661/text.multi.stream/1742905354181/24ff673614687df7a13f18ce0cbd126cd73bc788/shell-annual-report-2022.pdf

Shell. (2022). *Sustainability: Reporting-centre: Reporting-centre-archive.* Retrieved from Shell: www.shell.com/sustainability/reporting-centre/reporting-centre-archive/_jcr_content/root/main/section_2106585602/tabs/tab_274730988/text_copy_copy/links/item0.stream/1742906415853/a8cd71d354a0f93be5e9d7ca67243da915bc4ffa/shell-sustainability-report-2022.p

Shell. (2023, Dec 31). *Results-and-reporting: annual-report-archive.* Retrieved from Shell: https://www.shell.com/investors/results-and-reporting/annual-report-archive/_jcr_content/root/main/section_812377294/tabs/tab/text.multi.stream/1742905301176/ce28b952e201476287788cfcf35406e464f9785c/shell-annual-report-2023.pdf

Shell. (2023). *Sustainability: Reporting-centre: Reporting-centre-archive.* Retrieved from Shell: https://www.shell.com/sustainability/reporting-centre/reporting-centre-archive/_jcr_content/root/main/section_2106585602/tabs/tab/text_copy/links/item0.stream/17

42906426699/4ef5cfa607e5e308ad8a68fc3ddffbe6342f8fa8/shell-sustainability-report-2023.pdf

Shell. (2025, 05 01). *Annual Reports archive*. Retrieved from Shell: https://www.shell.com/investors/results-and-reporting/annual-report-archive.html#vanity-aHR0cHM6Ly93d3cuc2hlbGwuY29tL25ld3MtYW5kLWluc2lnaHRzL2FubnVhbC1yZXBvcnRzLWFuZC1wdWJsaWNhdGlvbnMvYW5udWFsLXJlcG9ydHMtZG93bmxvYWQtY2VudHJlLmh0bWw

Shell. (2025, 05 01). *Sustainability Reporting Center Archive*. Retrieved from Shell: https://www.shell.com/sustainability/reporting-centre/reporting-centre-archive.html

Song, P., Gu, Y., Su, B., Tanveer, A., Peng, Q., Gao, W., . . . Seng, S. (2023). The Impact of Green Technology Research and Development (R&D) Inestment on Performance: A Case Study of Listed Energy Companies in Beijing, China. *Sustainability, 15*(16), 1-24.

ST1. (2017). *About-us: Sustainability: Reporting.* Retrieved from ST1: https://media.ffycdn.net/eu/st1/uHW9UEFYSMMj3terZWBi.pdf?content_type=game_changer_report

ST1. (2018). *About-us: Sustainability: Reporting.* Retrieved from ST1: https://media.ffycdn.net/eu/st1/eNmA3vZ8VBjrqFn24XPT.pdf?content_type=game_changer_report

ST1. (2019). *About-us: Sustainability: Reporting.* Retrieved from ST1: https://media.ffycdn.net/eu/st1/C27Jx8U6YrxaU8hvS8L5.pdf?content_type=game_changer_report

ST1. (2020). *About-us: Sustainability: Reporting.* Retrieved from ST1: https://media.ffycdn.net/eu/st1/fnPvyTGMzLSQn8yx2eaz.pdf?content_type=game_changer_report

ST1. (2021). *About-us: Sustainability: Reporting.* Retrieved from ST1: https://media.ffycdn.net/eu/st1/NrzcbBo4YMPF9D774gTt.pdf?content_type=game_changer_report

ST1. (2022). *About-us: Sustainability: Reporting.* Retrieved from ST1: https://media.ffycdn.net/eu/st1/z5PTxDsGRdz28HmoooYd.pdf?content_type=game_changer_report

ST1. (2023). *About-us: Sustainability: Reporting.* Retrieved from ST1: https://media.ffycdn.net/eu/st1/KkJJvB7kg2DhuzGFSjvm.pdf?content_type=game_changer_report

ST1. (2025, 05 01). *Sustainability: reporting*. Retrieved from ST1: https://st1.com/about-us/sustainability/reporting

Statista Research Department. (2025, April 15). *uk-brent-crude-oil-price-changes-since-1976*. Retrieved from Statista: https://www.statista.com/statistics/262860/uk-brent-crude-oil-price-changes-since-1976/

Swedish Research Council. (2017). *Good Research Practice.* Stockholm.

Taghizadeh-Hesary, F., & Naoyuki Yoshino. (2019). The way to induce private participation in green finance and investment. *Finance Research Letters, 31*, 98-103. https://doi.org/https://doi.org/10.1016/j.frl.2019.04.016.

United Nations Framework Conventon on Climate Change. (2015-12-12). The Paris Agreement. *United Nations Treaty Collection, Chapter XXVII 7. d*. Retrieved from https://unfccc.int/sites/default/files/resource/parisagreement_publication.pdf

Vithessonthi, C., & Racela, O. C. (2016). Short- and long-run effects of internationalization and R&D intensity on firm performance. *Journal of Multinational Financial Management*, 28-45.

Wu, Z. (2022). The Analysis of the Relationship Between ESG and Profitability of Stocks by Linear Regression. *Proceedings of the 2022 International Conference on mathematical statistics and economic analysis (MSEA 2022)*, 699-703. https://doi.org/10.2991/978-94-6463-042-8_100

Xie, H., Yang, J., Yu, W., Yang, Y., & Wu, W. (2020). The Time-lag Effect of R&D Investment on the value of listed companies in China: A cross-industry analysis. *Journal of Creating Value, 6*(2), 217-231. https://doi.org/https://doi.org/10.1177/2394964320923543

Xu, B., & Lin, B. (2024). Green finance, green technology innovation, and wind power development in China: Evidence from spatial quantile model. *Energy Economics, 132*, 107463. https://doi.org/https://doi.org/10.1016/j.eneco.2024.107463

Zhang, S., & Xie, G. (2023). Promoting green investment for renewable energy sources in China: Case study from autoregressive distributed Lagged in error correction approach. *Renewable Energy, 214*, 359-368. https://doi.org/https://doi.org/10.1016/j.renene.2023.05.131

Appendix A: Statistical robustness

This appendix presents details on the various steps validating the statical relevance of the developed model. The skewness was analyzed at first, using the Sktest. When analyzing the regular variables, skewness and kurtosis were observed for several variables because the values of Pr(skewness), Pr(kurtosis) and Prob>chi2 were lower than 0.05, thus indicating skewness and kurtosis. The number of environmental policies (ENV_POL) was the only variable complying with these requirements, as per Table 12.

Table 12. Summary of the skewness and kurtosis analysis via the Sktest for the dependent, independent and control variables.

Variable	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Percentage net profit	55	0.0907	0.0101	8.24	0.0162
Share price	34	0.0012	0.1504	10.23	0.0060
Sustainable investment share – Same year	53	0.0038	0.8912	7.46	0.0240
Sustainable investment share – Year before	49	0.0017	0.4025	8.99	0.0111
Sustainable investment share – Two years before	44	0.0015	0.2642	9.53	0.0085
Oil price	55	0.3252	0.0001	12.61	0.0018
Number of environmental policies	55	0.1270	0.2739	3.72	0.1557

Additionally, the Shapiro-Wilk Test was also performed to have a further assessment in terms of data normality. The results are presented in Table 13.

Table 13. Summary of the Shapiro-Wilk Test for the dependent, independent and control variables.

Variable	Obs	W	V	z	Prob>z
Percentage net profit	55	0.92001	4.056	3.003	0.00134
Share price	34	0.73772	9.158	4.615	0.00000
Sustainable investment share – Same year	53	0.84688	7.540	4.323	0.00001
Sustainable investment share – Year before	49	0.82740	7.989	4.427	0.00000
Sustainable investment share – Two years before	44	0.81032	8.071	4.420	0.00000
Oil price	55	0.91964	4.075	3.013	0.00129
Number of environmental policies	55	0.95701	2.180	1.672	0.04730

The Shapiro-Wilk Test confirmed the non-normality of the analyzed variables, as the values of Prob>z should be higher than 0.05 to consider a variable as normally distributed. All considered variables have Prob>z values lower than 0.05.

The following transformations were made aimed at identifying potential improvements:

- Ln
- Log
- Square root
- Cubic root
- Inverse Hyperbolic Sine (IHS)
- Box-Cox

Challenges were observed when implementing these transformations. One example is the presence of negative or lower than one values, which is not compatible with ln, log and roots transformations. When using these transformations, these values were removed, thus reducing the number of observations. As fewer observations may weaken the statical relevant of the model, it was chosen to disregard these transformations if they were reducing the number of observations. Among the remaining transformations, the only variable that improved to a level passing the Sktest was the share price. The values of the ln-transformed variable are summarized in Table 14 as reference.

Table 14. Summary of the skewness and kurtosis analysis via the Sktest for the ln-transformed version of the variable representing the share price.

Variable	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
lnSHARE_PRI	34	0.6788	0.3938	0.95	0.6228

Despite this improvement, it was decided to keep the original variable untransformed, thus keeping consistent with the remaining variables.

Further measures were required to address the issues observed in terms of data normality. After the various regressions, the Shapiro-Wilk Test was performed on the residuals. In case non-normality was observed also for the residuals, the regression was modified considering robust standard errors by adding the command: “vce(robust)”.

Heteroskedasticity was checked using the *hettest* function. The variables’ skewness probably caused heteroskedasticity when running the linear regression, as this issue was observed when performing the regression having the share price as dependent variable. If required, this issue was mitigated by running a “robust” regression, using the *rreg* function.

Finally, the *ovtest* was carried out to check for potential omitted variables and the *vif* test was carried out to check for potential multicollinearity. No issues were reported after running these checks.

Appendix B: Policies

Table 15: Summary of the environmental policies for each country considered.

Country	Year	Policy/Initiative	Description
NO	1991	Carbon Tax Introduced	Norway became one of the first countries to implement a carbon tax on emissions.
NO	2008	Climate Agreement	Cross-party agreement to cut greenhouse gas emissions by 30% by 2020.
NO	2012	Prohibition of Fossil Fuel Heating	Norway banned the installation of fossil fuel-based heating systems in buildings.
NO	2016	National Climate Change Act	Established legally binding emission reduction targets in alignment with the Paris Agreement.
NO	2019	Electric Vehicles Incentives Expansion	Provided significant subsidies and incentives, making EVs over 50% of new car sales.
NO	2020	Ban on Gasoline-Powered Cars Announced (by 2025 Target)	Norway committed to phasing out gasoline and diesel car sales by 2025.
NO	2021	Carbon Capture and Storage (CCS) Investments	The government heavily invested in CCS technology, including the "Northern Lights" project.
SE	1991	Carbon Tax Introduced	Sweden implemented one of the world's highest carbon taxes to reduce emissions.
SE	2009	Energy Efficiency Improvements	National program launched to enhance energy efficiency across industries.
SE	2017	Climate Policy Framework	Sweden set legally binding net-zero targets for greenhouse gas emissions by 2045.
SE	2018	Fossil-Free Sweden Initiative	Collaborative effort to transition industries to fossil-free production methods.
SE	2021	Ban on Extraction of Fossil Fuels Announced	Sweden committed to ending the extraction of coal, oil, and natural gas.
SE	2023	Expansion of Green Energy Investments	Increased funding for renewable energy projects, including wind and solar power.
FI	1990	Climate and Energy Strategy Introduced	Initial framework to reduce greenhouse gas emissions and promote renewable energy.
FI	2015	Energy and Climate Roadmap 2050	Long-term plan to make Finland carbon-neutral by 2050 through energy transition.
FI	2019	Climate Neutrality by 2035 Target Announced	Finland committed to achieving carbon neutrality by 2035—the most ambitious in the EU.

FI	2020	Ban on Coal for Energy Production by 2029	Legislation passed to phase out coal use entirely by 2029.
FI	2021	Climate Change Act Updated	Strengthened the Climate Change Act with legally binding targets aligned with carbon neutrality.
FI	2023	Investment in Carbon Sink Projects	

NL	1990	National Environmental Policy Plan (NEPP)	Early framework addressing environmental and climate issues.
NL	2013	Energy Agreement	Agreement focused on renewable energy expansion and energy efficiency.
NL	2015	Climate Adaptation Strategy	Comprehensive plan to adapt to climate risks like flooding and sea-level rise.
NL	2019	Climate Agreement	National pact with legally binding targets to reduce emissions by 49% by 2030.
NL	2020	Ban on Coal for Electricity Generation	Legislation to phase out coal-based power plants by 2030.
NL	2021	Circular Economy Transition	Focused on reducing waste and promoting a circular economy to lower emissions.
NL	2023	Investment in Offshore Wind Projects	Increased funding for offshore wind farms to meet renewable energy goals.

Appendix C: Code

Commented Code generalized to illustrate a procedure for processing the data

```
cls
clear all

//import the data
import excel "/location/Financials - Energy companies.xlsx", sheet("Stata") firstrow

// destring variables
drop if REV == 0
drop if NET_PRO == 0
//drop if LOWC_INV=="null"
drop if REV==.

//Select only companies or years
//keep if Company == "Equinor" //| Company == "Shell" | Company == "Neste"
//drop if Company == "St1" //| Company == "Preem"
//keep if Year == 2023

foreach var of varlist _all {
   local len = length("`var'")
   if `len' < 3 {
      drop `var'
   }
}

destring LOWC_INV, replace

//sktest
sktest PERC_NET_PRO SHARE_PRI PERC_LOWC_INV PERC_LOWC_INV_1 PERC_LOWC_INV_2 OIL_PRI
ENV_POL
swilk PERC_NET_PRO SHARE_PRI PERC_LOWC_INV PERC_LOWC_INV_1 PERC_LOWC_INV_2 OIL_PRI
ENV_POL


//Pre-study: effect of ENV_POL on PERC_LOWC_INV
regress(PERC_LOWC_INV ENV_POL)
hettest
ovtest
vif

//predict residuals, residuals
//swilk residuals

regress PERC_LOWC_INV ENV_POL, vce(robust)

// % net profit

regress(PERC_NET_PRO PERC_LOWC_INV OIL_PRI ENV_POL)
hettest
ovtest
vif

//predict residuals, residuals
//swilk residuals

regress(PERC_NET_PRO PERC_LOWC_INV_1 OIL_PRI ENV_POL)
hettest
ovtest
vif
```

```
//predict residuals, residuals
//swilk residuals

regress(PERC_NET_PRO PERC_LOWC_INV_2 OIL_PRI ENV_POL)
hettest
ovtest
vif

//predict residuals, residuals
//swilk residuals

regress(PERC_NET_PRO PERC_LOWC_INV)
hettest
ovtest
vif

//predict residuals, residuals
//swilk residuals

regress(PERC_NET_PRO PERC_LOWC_INV_1)
hettest
ovtest
vif

//predict residuals, residuals
//swilk residuals

regress(PERC_NET_PRO PERC_LOWC_INV_2)
hettest
ovtest
vif

//predict residuals, residuals
//swilk residuals

//Share price
rreg(SHARE_PRI PERC_LOWC_INV OIL_PRI ENV_POL)

//predict residuals, residuals
//swilk residuals

regress SHARE_PRI PERC_LOWC_INV OIL_PRI ENV_POL, vce(robust)

rreg(SHARE_PRI PERC_LOWC_INV_1 OIL_PRI ENV_POL)

//predict residuals, residuals
//swilk residuals

regress SHARE_PRI PERC_LOWC_INV_1 OIL_PRI ENV_POL, vce(robust)

rreg(SHARE_PRI PERC_LOWC_INV_2 OIL_PRI ENV_POL)

//predict residuals, residuals
//swilk residuals

rreg(SHARE_PRI PERC_LOWC_INV)

//predict residuals, residuals
//swilk residuals

rreg(SHARE_PRI PERC_LOWC_INV_1)

//predict residuals, residuals
//swilk residuals
```

```
rreg(SHARE_PRI PERC_LOWC_INV_2)

predict residuals, residuals
swilk residuals

regress SHARE_PRI PERC_LOWC_INV_2, vce(robust)
```

Appendix D: List of Sources for the data

Shell:

2023: Annual report 2023 (Shell, 2023)	Sustainability report 2023 (Shell, 2023)
2022: Annual report 2022 (Shell, 2022)	Sustainability report 2022 (Shell, 2022)
2021: Annual report 2021 (Shell, 2021)	Sustainability report 2021 (Shell, 2021)
2020: Annual report 2020 (Shell, 2020)	Sustainability report 2020 (Shell, 2020)
2019: Annual report 2019 (Shell, 2019)	Sustainability report 2019 (Shell, 2019)
2018: Annual report 2018 (Shell, 2018)	Sustainability report 2018 (Shell, 2018)
2017: Annual report 2017 (Shell, 2017)	Sustainability report 2017 (Shell, 2017)
2016: Annual report 2016 (Shell, 2016)	Sustainability report 2016 (Shell, 2016)
2015: Annual report 2015 (Shell, 2015)	Sustainability report 2015 (Shell, 2015)
2014: Annual report 2014 (Shell, 2014)	Sustainability report 2014 (Shell, 2014)
2013: Annual report 2013 (Shell, 2013)	Sustainability report 2013 (Shell, 2013)

Equinor:

2023: Annual report 2023 (Equinor, 2023)	Sustainability report 2023 (Equinor, 2023)
2022: Annual report 2022 (Equinor, 2022)	Sustainability report 2022 (Equinor, 2022)
2021: Annual report 2021 (Equinor, 2021)	Sustainability report 2021 (Equinor, 2021)
2020: Annual report 2020 (Equinor, 2020)	Sustainability report 2020 (Equinor, 2020)
2019: Annual report 2019 (Equinor, 2019)	Sustainability report 2019 (Equinor, 2019)
2018: Annual report 2018 (Equinor, 2018)	Sustainability report 2018 (Equinor, 2018)
2017: Annual report 2017 (Equinor, 2017)	Sustainability report 2017 (Equinor, 2017)
2016: Annual report 2016 (Equinor, 2016)	Sustainability report 2016 (Equinor, 2016)
2015: Annual report 2015 (Equinor, 2015)	Sustainability report 2015 (Equinor, 2015)
2014: Annual report 2014 (Equinor, 2014)	Sustainability report 2014 (Equinor, 2014)
2013: Annual report 2013 (Equinor, 2013)	Sustainability report 2013 (Equinor, 2013)

Preem:

2023: Annual and Sustainability report 2023 (Preem, 2023)

2022: Annual report 2022 (Preem, 2022) Sustainability report 2022 (Preem, 2022)

2021: Annual report 2021 (Preem, 2021) Sustainability report 2021 (Preem, 2021)

2020: Annual report 2020 (Preem, 2020) Sustainability report 2020 (Preem, 2020)

2019: Annual report 2019 (Preem, 2019) Sustainability report 2019 (Preem, 2019)

2018: Annual report 2018 (Preem, 2018) Sustainability report 2018 (Preem, 2018)

2017: Annual report 2017 (Preem, 2017)

2016: Annual report 2016 (Preem, 2016)

2015: Annual report 2015 (Preem, 2015)

2014: Annual report 2014 (Preem, 2014)

2013: Annual report 2013 (Preem, 2013)

St1:

2023: Gamer Changer report 2023 (ST1, 2023)

2022: Gamer Changer report 2022 (ST1, 2022)

2021: Gamer Changer report 2021 (ST1, 2021)

2020: Gamer Changer report 2020 (ST1, 2020)

2019: Gamer Changer report 2019 (ST1, 2019)

2018: Gamer Changer report 2018 (ST1, 2018)

2017: Gamer Changer report 2017 (ST1, 2017)

Neste:

2023: Annual report 2023 (Neste, 2023)

2022: Annual report 2022 (Neste, 2022)

2021: Annual report 2021 (Neste, 2021)

2020: Annual report 2020 (Neste, 2020)

2019: Annual report 2019 (Neste, 2019)

2018: Annual report 2018 (Neste, 2018)

2017: Annual report 2017 (Neste, 2017)

2016: Annual report 2016 (Neste, 2016)

2015: Annual report 2015 (Neste, 2015)

2014: Annual report 2014 (Neste, 2014)

2013: Annual report 2013 (Neste, 2013)