



Norwegian University
of Life Sciences

Master's Thesis 2022 30 ECTS

Faculty of Landscape and Society

Assessing ESG Risks and Opportunities for Photovoltaic Companies Operating in Norway: What are Future Focus Points?

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International Environmental Issues

Acknowledgements

This report presents a Master's thesis that was written in the spring of 2022 at the Faculty of Landscape and Society at the Norwegian University of Life Sciences. The thesis marks the end of two educational and exciting years as a student at NMBU, and I could not have been happier with the choice of education and school as I have had countless (Zoom) classes in my favourite fields: climate change and sustainability. Therefore, a general thank you goes to the Faculty of Landscape and Environment for facilitating a Master's degree of the highest quality. I also want to thank NMBU's School of Economics and Business who allowed me to take several classes outside of my faculty. Lastly, I want to give a big thank you to my supervisor, Tor A. Benjaminsen, for guiding me through the thesis and keeping up with me despite multiple changes in research and topics.

The thesis is partly written in collaboration with Otovo, and I could not have been more pleased and thankful for the collaboration. A special thank you to Mette Rye-Larsen who has helped me throughout the whole process, Andreas Bentzen for helping me come up with an interesting and optimistically useful research topic, and Lars Ekeland for participating in the interview and sharing data and material benefitting the study. Also, big thank you to the rest of the participants: Trine Kopstad Berentsen (Solenergiklyngen) and Jon-Ola Pedersen (Ecosol). The limitations chapter of the thesis would have been a lot longer without your participation.

Declaration

Declaration I, Sabine Hammerstad, declare that this thesis is a result of my research and findings. Sources of information other than my own have been sited and a reference list has been appended. This work has not previously been submitted to any other university for award of any type of academic degree.

Date: 16/05/22

Abstract

Companies are increasingly pressured to be socially conscious and environmentally responsible by multiple sources, including political representatives, regulators, interest groups, and perhaps more than ever, by investors. The argument is crystal clear: businesses no longer exclusively serve their group of shareholders, they also have a greater responsibility for other stakeholders like customers, employees, and society. In this respect, environmental, social and governance (ESG) considerations have emerged as a major influencer on investing practices, and businesses are increasingly called upon to address and report on ESG related criteria. It may be presumed that the Norwegian photovoltaic industry, by the course of its renewable nature, is considered lucrative by sustainability-minded investors and capitalists. However, this only rationalises and accounts for one-third of the ESG metrics, and in the competitive and constantly developing Norwegian reporting environment, it can be argued that if investors increasingly use ESG criteria in their screening process, the need to identify ESG risks and opportunities will extend to solar companies as well. The task of examining ESG risks and opportunities relative to solar companies operating in Norway is yet to be done, which is what this paper intends to examine. The report is based on data collection through interviews with companies from the Norwegian solar market, a content analysis of sustainability reports from third-party companies, and literature reviews. Through the frameworks PESTEL and SWOT, the report identifies ESG risks and opportunities for photovoltaic companies operating in Norway. The study demonstrates that the most critical ESG risks are connected to the companies' reliance on China for production and manufacturing, which presents several difficulties for monitoring and securing good environmental, social, and government practices in the entire supply chain. From the opportunity perspective, it is concluded that increased effort in filling reporting gaps and shortcomings, is rewarding for securing patient capital.

Table of Contents

Abstract	3
Chapter 1: Introduction	8
<i>1.1 Increasing Corporate Purpose through Sustainable Investing</i>	<i>8</i>
<i>1.2 Background</i>	<i>10</i>
1.2.1. The Photovoltaic Industry	10
1.2.2 The Norwegian Photovoltaic market.....	10
<i>1.3 Problem Motivation</i>	<i>12</i>
<i>1.4. Study Area</i>	<i>14</i>
<i>1.5 Delimitations.....</i>	<i>15</i>
<i>1.6 Thesis Structure.....</i>	<i>15</i>
Chapter 2: Otovo	16
Chapter 3: Theoretical Background	17
3.1 PESTEL Analysis	17
3.2 Criticism of PESTEL.....	19
3.3 SWOT Analysis.....	19
3.4 Criticism SWOT	20
3.5 PESTEL/SWOT Combination	21
Chapter 4: Methodology.....	21
4.1 Research Process	21
4.2 Research Design.....	22
4.3 Data Collection.....	24
4.3.1 Phase 1: Literature Review.....	24
4.3.2 Phase 2 & Phase 3: Semi-structured Interviews	25
4.3.3 Interview Guide.....	25
4.3.4 Sampling and Strategy	26
4.3.5 Ethical Considerations	26
4.3.6 Phase 3 part 2: Content Analysis	27
Chapter 5: Literature Review.....	27
Chapter 6: Results and Findings	29

6.1. What is ESG and what are the challenges of reporting on it?	30
6.1.1 Evolution of Sustainability Reporting	30
6.1.2 ESG: Explanation and Dimensions	32
6.1.3 ESG in Practice	34
6.1.4 Valuation of ESG.....	35
6.1.5 The GRI Framework.....	36
6.1.6 Shortcomings ESG	37
6.2 How important is ESG reporting for photovoltaic companies operating in Norway?	38
6.2.1 Short Term Capital.....	39
6.2.2 Long Term Capital.....	40
6.2.3 Critical Questions from Customers.....	40
6.2.4 Critical Questions from investors.....	41
6.2.5 Importance of ESG for PV Companies Operating in Norway.....	42
6.3 What ESG risks and opportunities exist for photovoltaic companies operating in Norway?	43
6.3.1 ESG Risks	43
6.3.2 Environmental Dimension.....	43
6.3.3 Social Dimension	45
6.3.4 Governance Dimension.....	45
6.3.5 Ukraine-Russia Conflict.....	46
6.4 ESG Opportunities.....	47
6.4.1: Environmental Dimensions.....	47
6.4.2: Social Dimension	48
6.4.3: Government Dimension	48
6.4.4 Ukraine-Russia Conflict.....	48
6.5.5 Local Supply Chains.....	48
6.5 Screening of Sustainability Reports	49
6.7 Summarised PESTEL	51
6.8 Summarised SWOT.....	52
Chapter 7: Discussion	53
7.1 Importance of ESG for PV companies operating in Norway.....	54
7.1 ESG Risks and Opportunities	55
7.1.2 Environmental Dimension.....	55
7.1.3 Social Dimension	57
7.1.3 Government Dimension	59
7.2 General Discussion.....	61

Chapter 8: Conclusion	61
8.1 Future Research.....	62
Chapter 9: Sources	63
Chapter 10: Appendix	73
10.1 Semi-structured Interviews.....	73
10.1.1 Interview Guide	73
10.1.2 Interview Otovo.....	74
10.1.3 Interview Solenergiklyngen	81
10.1.4 Interview Ecosol.....	84
10.2 Content Analysis.....	85
10.2.1 Sustainability Reports	85
10.2.2 Content Analysis Coding	86
10.2.3 Scatec Solar GRI Database 2017-2019	86
10.2.4 GRI Datasets utilised.....	89

List of Figures

Figure 1: Investment funds incorporating ESG data	6
Figure 2: Sankey Diagram Energy System EU-28.....	11
Figure 3: The Basic PESTEL Framework.....	17
Figure 4: The Basic Swot Diagram	20
Figure 5: Sanders and Stappers (2008) “fuzzy-front-end” Research Design	22
Figure 6: Figure 5: Timeline Evolution of Corporate Social Responsibility.....	31
Figure 7: 1st version of Global Reporting Initiative (GRI) framework and measurement parameters. 36	
Figure 8: PESTEL framework.....	51
Figure 9: SWOT Framework.....	52

List of Tables

Table 1: Data method and collection for each phase of the thesis.....	23
Table 2: CSR vs ESG (focus, channel, implementation, metrics, and reporting)	32
Table 3: CSR vs ESG (practical examples).....	32
Table 4: ESG framework (international frameworks)	33
Table 5: Key Findings from the Sustainability Reports (Scatec, Canadian Solar, and Solar Power Europe).	49
Table 6: SASB’s Evidence for Sustainability Disclosure Topics for Solar Industry (2015).....	50

Abbreviations

CSR - Corporate Social Responsibility

EEMRIO - Environmentally extended multiregion input-output

ESG - Environmental, social, governance

EU - European Union

EV – Electric Vehicle

GRI - Global Reporting Initiative

IEA - International Energy Agency

IOLCA - Input-Output Life Cycle Assessment Analysis

LCA - Life Cycle Assessment

NUES - Norsk utvalg for eierstyring og selskapsledelse (Norwegian Committee for Corporate Governance)

OECD - Organisation for Economic Co-operation and Development

PV - Photovoltaic

SASB - Sustainability Accounting Standards Board

SMEs - Small and medium-sized enterprises

TI - Transparency International

WB - The World Bank

Chapter 1: Introduction

1.1 Increasing Corporate Purpose through Sustainable Investing

Investors' focus on corporate responsibility has significantly increased over the preceding decades, with a peculiar spike in attention on sustainability during the past few years (Macey, 2022). The message from the growing proportion of sustainability-minded investors is crystal clear: businesses no longer exclusively serve their group of shareholders, they also have a greater responsibility for other stakeholders like customers, employees, society, and the environment. In the end, if companies are to maintain and fortify their licence to operate, they are, more or less, bound to ally their business model with a statement of 'corporate purpose' which articulates the board of directors' view of their company's distinctive contribution to society (Busco et al, 2020). The need to formulate and vocalise this corporate purpose has only intensified over the past years, and today, investor focus on social responsibility has evolved from being a niche interest to a pillar of investment strategies around the world.

The investors are by no means pursuing the same investments strategies, risk tolerances, and substantive issue interest, however, a common denominator is found in a demand for better corporate sustainability information which often is framed in terms of environmental, social and governance (ESG) metrics (CFA Institute, 2017; Etsy and Cort, 2020; UNPRI, 2018). The Global Sustainable Investment Alliance estimated in 2016 that approximately \$23 trillion of assets are managed by way of some form of responsible investment strategy, a share that globally increased by 34% from 2016 to 2018 (GSIA, 2019). With respect to the act of incorporating ESG data, the U.S. SIF Foundation (2018) calculated that the number of investment funds applying it has risen from 55 in 1995 to over 10,000 in 2018.

Figure 1: Investment funds incorporating ESG data

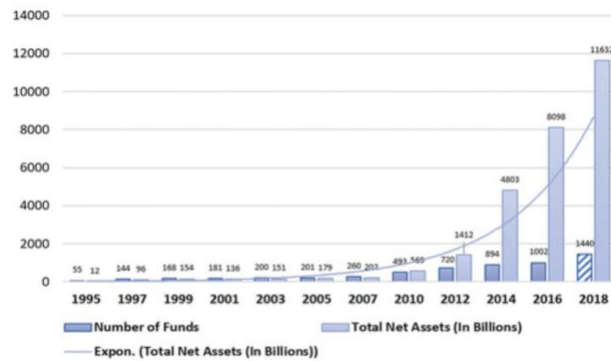


Figure 1. Investment funds incorporating ESG data, 1995 to 2018, U.S. SIF Foundation.

The motivation for doing so can be found in investors' desire to align their portfolios with their values, whether these values include a commitment of 'doing good' or are purely motivated by profit. The latter is somewhat portraying the dividing opinions of sustainable investing. While some see it as an ideology that implies a financial sacrifice, others see it as a strategy that fabricates a competitive edge (Sivola and Landau, 2021). Recent studies and statistics have shown that there is a shift toward profitable sustainable investing, meaning that the act of doing good often is sweetened with the promise that it will be beneficial for a company's bottom line and shareholders (Sivola and Landau, 2021; Khalid et al, 2021). In fact, the financial loss from overlooking or disregarding the sustainable shift can be worse as companies by no means are immune to the consequences of irresponsibility. Business operations and financial figures are very much sensitised to ethics and reputation, and in reality, companies can either consider sustainability aspects in advance or delay it until problems surface (Cappucci, 2018). Similarly, investors can either invest in performing sustainability analyses to forecast risks and opportunities or wait until things break down. This very apparent situation can be described as a game-changer in the financial market, where companies with good ESG performance have a unique opportunity to gather investors from the capital market who are looking to strengthen their corporate purpose or portfolio (Jebe, 2019). One of the industries that can take advantage of this apparent green capital trend is the Norwegian solar industry (*note: solar and photovoltaic (PV) is used interchangeably in the rest of the thesis*).

1.2 Background

1.2.1. The Photovoltaic Industry

Increasing concern over climate change together with fossil fuel price volatility has caused many governments, businesses, and consumers to accelerate the use and investment in alternative energy sources that can reduce humankind's dependence on traditional sources like oil and gas (Goddard, 2015). Offering a clean and endless supply of energy, solar panels have been put forward as an important part of the renewable transition, where the up-to-date deployment of solar photovoltaic (PV) technology has consistently outpaced the preceding decade's expectations. Case in point, within the period 2010 to 2019, the installed capacity of PV has risen from 25 to 600GW which is the largest net growth of any generation of technology (Frankfurt School-UNEP Centre/BNEF, 2019). The main driver of this progress is PV's growing cost competitiveness; benchmark levelized costs of solar energy fell 81% in the reference period 2009-2019 (IEA, 2019). The aftermath of the promising statistics has led to optimistic forecasts of PV's future dominant role, for instance, that of reaching a global installed capacity of more than 20 TW₆₋₈ (Haegel et al, 2019). Others are more sceptical, anticipating lower enlargement by reason of more land-use constraints and grid flexibility (Hansen et al, 2017; International Energy Agency, 2019). Either way, the thought that solar power will play a key role in future energy production seems to be a harmonised one.

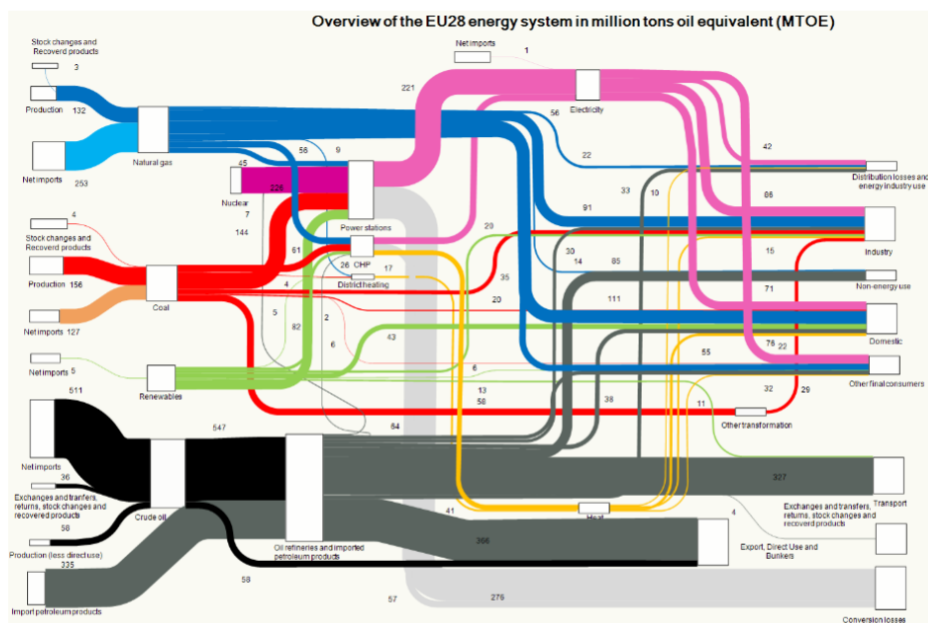
1.2.2 The Norwegian Photovoltaic market

The Norwegian market is a rather exceptional case because solar power has not constituted a significant part of the national electricity energy mix. This is because Norway's electricity production mostly has stemmed from its strong hydropower industry, which produces energy adequately for 93-96% of the nation's energy generation by way of low-cost and clean energy (Energifakta Norge, 2022). The large supply of affordable energy has a strong correlation to why a Norwegian household on average has consumed more electricity than commonplace, which for instance has allowed a rapid scale-up in the use of electric vehicles (EV) (Nordic EV Barometer, 2018). Despite this, several authors note that there are many advantages to making solar power a larger part of the country's energy mix (Xue et al, 2021; Solenergiklyngen and Multiconsult, 2018; Overholm, 2015).

Firstly, former, and current times have demonstrated that ‘energy crisis’ is not a strange word in the global news media. There is a range of issues that affect gas and electricity sectors, for instance, extreme weather conditions, economic and political situations and availability of supply are factors that ultimately cause high volatility in the markets (IEA, 2021). This includes 2021’s rapid global economic recovery, exceptionally hot summers accompanied by cold winters, and reduced gas supply from Russia - conclusively contributing to more energy market turbulence in Europe (Xue et al, 2021).

Secondly, there are seasonal variations in demand. During the cooler months, the demand for energy increases, and during this period, the electricity from hydropower alone is not sufficient to cover the entire domestic consumption level. This means that the import of energy is indispensable, where deficit or shortage mainly is covered by energy generated from oil, gas, and coal (in 2018, Norway imported 8340 GWh) (NVE, 2020; SSB, 2022; Energifakta Norge, 2022). This share could be replaced with clean energy that would reduce global CO2 emissions through higher investment in PV energy (Xue et al, 2021).

Figure 2: Sankey Diagram Energy System EU-28



Note: this Sankey diagram shows the composition of the primary energy entering the energy system of the EU-28 in 2013 (updated in 2016), and where this primary energy was used, either as losses or as consumption by specific sectors of the economy. The units are million tonnes of oil equivalent (Mtoe)

Source: European Energy Agency (EEA) (2022)

Additionally, the large dependence on hydropower comes with a clear downside, namely that it is insufficient in dry seasons, and when this is the case, the citizens of Norway are forced to pay a higher price for electricity. In line with data from Solcellekysten (2016), the cost of electricity from PV is less than from the grid (assuming that PV panels have a lifetime of 30 years, and the average cost of generated electricity is 0.69 NOK/kWh).

A few countries have started to address the uncertainty surrounding their heavy hydropower dependence. Brazil, for instance, a country where hydropower constitutes 70% of the energy mix, has started to upscale the use of solar energy (Xue et al, 2021). Also, Canada, previously 62% reliant on energy coverage from hydropower, scaled up the use of non-hydroelectric because of the environmental- and social costs related to hydropower development, e.g., habitat loss and fish migration (Solcellekysten, 2016; Xue et al, 2021). In recent years, this debate has also become apparent in Norway, where it has been documented a significant interest in increasing the diversification of renewable or green energy sources such as solar and wind power (Energifakta Norge, 2022). Although Norway, with varying climatic and Nordic conditions, may not seem like the ideal place to install solar panels, it has been proven that a colder climate favours solar PV (Benjaminsen, 2018). The irradiance is naturally a lot lower than in countries located closer to the Equator, however, a chillier temperature will increase the PV output, and as such, increase the voltage that makes the cell generate more electricity (Benjaminsen, 2018). The above-mentioned factors are perhaps part of the reason why commercial agents expect that solar power will, in good harmony, be more and more present in the future energy mix of Norway (Solenergiklyngen and Multiconsult, 2018).

1.3 Problem Motivation

According to Solenergiklyngen and Multiconsult (2018), a clear shift with respect to an upscale or expansion of Norwegian solar energy is apparent in 2015 and onwards, where both the number of solar suppliers and installed panels have witnessed significant growth. With this growth, it follows that the market and business operators within enlarges. Solenergiklyngen and Multiconsult (2018) have noted that sun-related companies roughly appear every week, where new players are challenging and turning the traditional business models upside down, even dipping toes and successfully establishing themselves in international markets. Furr and

Kapoor (2017) point to how there has been an ‘industry shakeout’ in recent years, expectantly because of the many diversifying entrants and start-ups selecting different technology (e.g., crystalline silicon *vs* thin film), business models and logistics, aiming to compete for dominance on several characteristics. Goddard (2015) similarly brings attention to how companies in the U.S have struggled to stay competitive, where an explanation in part can be attributed to the amplified low-cost production in emerging economies, e.g., China and India, which again can be attributed to government subsidies and low operational costs. For illustrative purposes, China experienced the most growth in 2020, where solar network connections increased by 60% (to 48 GW), approximately 2.5 times the capacity of the second-largest market, the U.S. Another big ‘solar surprise’ is how Vietnam was the third biggest market in 2020, demonstrating how fast their scale-up took place because they went from producing no solar energy to over 9GW in less than three years (Solenergiklyngen and Multiconsult, 2018).

These examples illustrate how fast the solar industry can fall, but also expand or transform, under the ‘right’ circumstances. The ‘right circumstances’ are greatly linked with access to patient capital, and scholars stress that insufficient capital is the biggest resistance to solar industry development (Shuiying et al, West, 2014). Seemingly, solar energy is regarded as an attractive investment, especially considering the growing number of investors looking to ‘green’ their portfolios. However, there is no research confirming or contradicting that assumption. Furthermore, Solenergiklyngen and Multiconsult (2018) concluded in a study that the rapid Norwegian PV market growth has caused an increased desire in establishing an updated overview of the status quo of the contemporary market and its development. They elaborate by saying that this would entail a debate about prospective competitive advantages, challenges and risks present in the Norwegian solar industry, profitability and viability, research and innovation activities, current and future energy requirements, and market development and drivers. One of the topics they suggest should be brought up for discussion is how the access to venture capital and competent investors will be in the future, and to what extent investors find it attractive to invest in solar energy. Cappucci (2018) points to how investors today want to avoid ‘better-option’ scenarios, e.g., oil instead of coal, and instead focus on establishing ‘complete green’ energy markets, where ESG performance is an influential framework to use in detecting those markets. Having this in mind, a question arises:

What ESG risks and opportunities will be particularly determinative in the coming years for photovoltaic companies operating in Norway?

As a guide to answer the above problem statement, three research questions (Sub RQs) have been formulated and will be addressed throughout the study:

Sub RQ1: What is environmental, social and governance (ESG) reporting and what are the challenges of reporting on it?

Sub RQ2: How important is ESG reporting for photovoltaic companies operating in Norway?

Sub RQ3: What ESG risks and opportunities exist for photovoltaic companies operating in Norway?

1.4. Study Area

As indicated in the problem statement, this thesis will focus on photovoltaic companies operating in Norway. The primary reasoning for this is that when it comes to environmental, social, and governance dimensions, especially the social and governance aspects, criteria, risks, and opportunities tend to be highly influenced by national policy and guidelines. Furthermore, as the study aims at providing helpful research and insights, a broader study area could harm the exploratory depth of the paper.

It is also necessary to provide some clearance around the term ‘solar companies operating in Norway’. The research is not limited to only Norwegian solar companies, but all companies in the PV industry operating in Norway. Although the Norwegian industry is relatively small, there are different niche sectors within it. In general, the PV industry in Norway can be divided into two markets: the private market (delivering panels for households) and the commercial market (delivering panels for commercial buildings). As it is in the study’s interest to provide ESG guidance to all solar companies operating in Norway, no limitations were set on this matter.

1.5 Delimitations

The main limitation of the research is the sample size and composition of the qualitative interviews. Only three persons participated in the interview, and consequently, the findings can contain errors. Data from third-party sources were utilised to secure accuracy in the thesis, however, some of the external data used did not address critical findings from the interviews. Another limitation of the thesis is the sample composition. The three participants and their respective companies are very different, both in terms of general features such as size, number of operating years, niche market, and business model, but also in terms of experiences with ESG. Therefore, some of the results are only confirmed by one company, which in the worst case can contain biases. Also, as the data quantity for each interview turned out rather uneven, the findings will not necessarily have the same level of relevancy for all PV firms operating in Norway.

1.6 Thesis Structure

Introduction and overview

The first section of the thesis covers background and motivation, along with the problem statement and research questions for the thesis.

Theory and Literature

This section is dedicated to the theoretical framework of the study. It covers the theories used to answer the research questions, their justifications and shortcomings, and a literature review of relevant research.

Methodology

This part of the thesis covers the methodology chosen for answering the research questions and gives the reader insight into how the data has been collected.

Results

The results section will present findings from the methodology chosen and lay the foundation for the discussion.

Discussion

In the discussion chapter, a more detailed presentation of the findings will be laid forth, in addition to scientific back-up for the arguments.

Conclusion

The final section of the paper will provide answers to the research question and present recommendations for further research related to the present topic.

Chapter 2: Otovo

This research is written in collaboration with the Norwegian solar company Otovo. Otovo was founded in 2016 and has since then become the leading provider of turnkey rooftop home solar solutions in Norway. Otovo offers solar panels and installation services for commercial and residential properties through its online marketplace. Their data-driven platform enables prospecting customers to get an estimate of the number of solar panels suitable on their roof, how much energy they can produce, and a price estimate, by typing in their address. They use their original proprietary technology to find the best price on panels and installers for specific customers based on an automatic bidding process between available installers. During their first year, Otovo became the market leader in residential solar in Norway, and has since then, sold more than 6000 solar systems throughout Europe and expanded to five other countries. They further expect to launch in 3 more countries by 2023.

Although this thesis is written in collaboration with Otovo, this does not imply that the research is written in their interest, only is relevant for them, or is by and large made up of their data. In the interest of choosing a research area and topic that can be of help to solar companies operating in Norway today, an inquiry to Otovo was made, asking if they had any research gaps or research interest where ESG reporting was one of them. To exclude potential biases, interviews with other companies operating in Norway have been completed in addition to third-party substantiation. That being said, they did participate in the semi-structured interview, allowing a more comprehensive knowledge gathering as no time limit was set. The interview

and conversation also led to new materials beneficial for the research, namely an ESG reporting questionnaire from a potential investor.

Chapter 3: Theoretical Background

In this chapter, the theoretical tools used for answering the research questions are introduced and evaluated. As the purpose of the thesis is to identify ESG opportunities and risks of particular importance for solar companies operating in Norway, it is important to use a theoretical framework that can capture all micro-and macro-environmental factors that influence the market. Perhaps more important is that the selected framework is capable of being adjusted to external and internal analyses that are crucial for the thesis target while allowing a debate of a potential ranking of the identified factors, as well as being able to distinguish between manageable and non-manageable ones. A framework that has these abilities and as such is chosen is the combination of PESTEL and SWOT (Gillespie, 2007).

3.1 PESTEL Analysis

A PESTEL analysis is an acronym for a tool utilised to identify the macro (external) forces that can influence organisations or market's future growth (Unicef, 2015). By taking into account key external drivers of change, the framework can motivate firms to consider long-term goals and to choose sustainable business innovation and investment strategies (Stuiver et al, 2016). PESTEL has been described as an ideal choice when a researcher aspires to analyse risks and opportunities a market or a company faces (Rastogi and Trivedi, 2016). It offers two basic functions; it allows the identification of an operational environment and provides data and information that enables a prediction of future situations and circumstances (Yüksel, 2012). The different factors represented by each letter in PESTEL are; Political, Economic, Social, Technological, Environmental, and Legal (Unicef, 2015).

Figure 3: The Basic PESTEL Framework



Political factors indicate the methods through which a government intervenes in the economy, for example, through government policy, political stability, foreign trade policy, tax policy, labour law, environmental law and trade restrictions. To improve business performance, organisations must respond to the current and anticipated future legislation and adjust their operations accordingly.

Economic factors include economic growth, interest rates, exchange rates, inflation, and the disposable income of consumers and businesses. On occasion, the factors are categorised into macro-economic (management of demand in a given economy) and microeconomic (maximum spending of the customer) factors.

Social factors, also known as socio-cultural factors, are the areas that involve shared beliefs and attitudes of the population. These factors include population growth, age distribution, health consciousness, and career attitudes. These factors are of interest as they permit researchers to understand the motivational forces of their customers.

Technological factors change quickly and influence the markets and the management in three distinct avenues: firstly, in methods of producing services and products; secondly, in methods of service and product distribution; thirdly, in methods of communicating with the target markets.

Environmental factors have become important because of the increasing scarcity of raw materials, pollution target requirements, ethical and sustainable company practices and carbon footprint targets determined by governments. Increasingly, the consumers demand that the products are sourced ethically, and if possible, from a sustainable source.

Legal factors include health and safety, equal opportunities, advertising standards, consumer rights and laws, product labelling and product safety. Companies must be cautious of what is legally permissible to trade successfully. If an organisation trades globally, this can become a very complex factor, as each country possesses its own rules and regulations.

3.2 Criticism of PESTEL

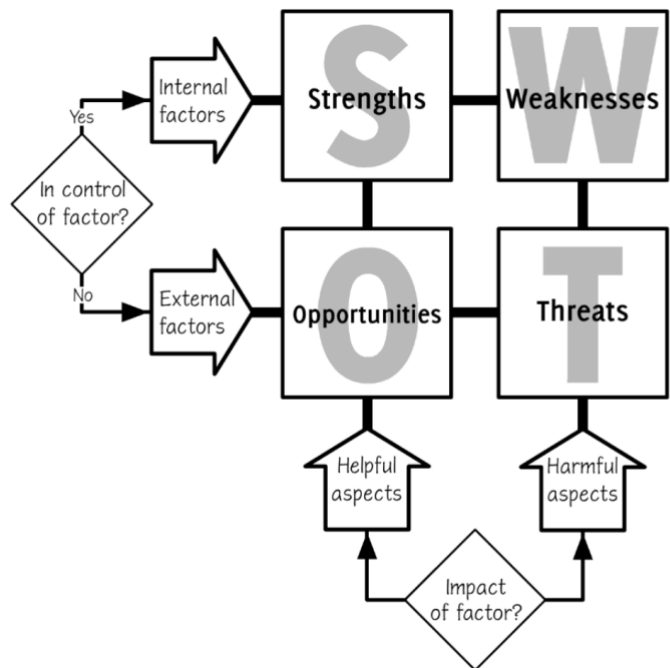
A PESTEL analysis is based on assumptions and predictions, the findings can result in inaccurate conclusions (Morris & Weeks, 2020). To judge and understand the problems that the company is encountering, each factor needs to be thoroughly examined in terms of the degree of impact, where collecting extensive external information and data on each factor is necessary to make accurate decisions, and requires patience and effort (Morris & Weeks, 2020). Failing to do so can lead to misinterpreted information and various losses for a company. Also, as PESTEL only focuses on external factors, the framework isolated has been described as an insufficient tool for determining strategic planning (Chartered Management Institute [CMI], 2013). Therefore, it is suggested that PESTEL should be combined with frameworks capturing internal factors (e.g., SWOT) to obtain a greater understanding (CMI, 2013).

3.3 SWOT Analysis

A SWOT analysis is used to define a company's or market's strengths, weaknesses, opportunities, and threats. More specifically, it identifies and specifies critical internal and external attributes that either are helpful or harmful for an objective. Decision-makers, e.g. stakeholders or shareholders, can use SWOT by evaluating to what extent there is a strategic fit amongst internal and external characteristics of the objective, and furthermore, decide if attributes can give an advantage (strength), disadvantage (weakness), on elements of the environment that has the possibility to be exploited as an advantage (opportunity) or could cause trouble (threats) in reaching the goal or objective (Lupu et al, 2016). The different categories are very much interrelated to one another, and it is thus useful to not only analyse them separately but also together. Case in point, a strength can likely open an opportunity, and

similarly, weakness may also present an opportunity and if lucky, eliminate a weakness. When performing a SWOT analysis, only precise and verifiable attributes will be considered, the lists containing the most significant factors prioritised and trimmed as necessary, and the generated options are taken through a so-called strategy formation process and applied at the most suitable decision levels (Lupu et al, 2016). As such, the SWOT framework is very much used in decision-making processes where a global goal is predefined, and decisions can be expected to be evaluated in through a ‘yes’ or ‘no’ form. The framework is also very fitting in situations where a decision must be made in a short amount of time. Here, it is agreed in advance that although the decision may not be the best, it is acceptable for implementation (Srdjevic et al, 2012).

Figure 4: The Basic Swot Diagram



3.4 Criticism SWOT

According to Morris (2005), there is an inherent circularity in the underlying logic of SWOT analysis as it is impossible to know what constitutes a strength or weakness without knowledge of the external environment, and furthermore that it is impossible to understand whether something is a risk or opportunity without knowing if a company has the necessary resources to exploit or minimise it. Similarly, Vlados and Chatzinikolaou (2019) state that SWOT only accounts for static components, which do not necessarily reflect a company’s actual situation.

Therefore, they suggest that SWOT analysis must be accompanied by supplemental frameworks to give maximum utility and efficiency and that it needs to focus more on the future, and not the past, to get correct findings. Also, as SWOT is being examined within or in conjunction with an organisation or industry, the SWOT analysis comprises a biased risk (Gürel & TAT, 2017).

3.5 PESTEL/SWOT Combination

While SWOT focuses on central factors such as opportunities and threats, PESTEL has been described as a more in-depth sequel of the SWOT analysis. According to Srdjevic et al (2012), the synergy between SWOT and PESTEL enables more extensive and accurate analysis of different complex systems and their multidimensional interplay with the environment. An example of this is also made by Vorthman (2008) who argues that although SWOT enables a recognition of positive and negative internal factors of an existing system, it is necessary to apply the PESTEL analysis as well to receive a further analysis of these factors. Sunje et al (2010) describe an interesting implementation approach, namely that SWOT is utilised for internal factors while PESTEL provides an analysis of the system environment.

Chapter 4: Methodology

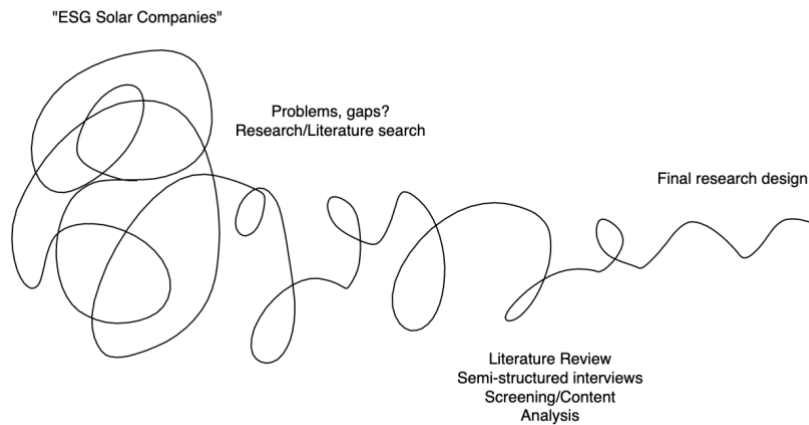
The present chapter will describe the methodological approach for the thesis. This entails an accurate explanation of the research design, justification for the chosen outline and structure, and a complete description of the data collection process. The chapter will also comment on how the data analysis methods are accounted for, the quality of the research, and lastly discuss any prominent ethical considerations surrounding the research.

4.1 Research Process

The process of writing this thesis can be categorised as an iterative one, where the preliminary topic started at a broad level before converging into a more specific topic and research question. Sanders and Stappers (2008) state that the fuzzy front end is relative to the present project, both as a design- and writing process. As observed in figure 4, the initial phase is referred to as ‘fuzzy’ because of “the ambiguity and chaotic nature that characterises it,” before the process

gradually converges into more specific definitions and concepts (Sanders and Stappers, 2008, p. 7).

Figure 5: Sanders and Stappers (2008) “fuzzy-front-end” Research Design



As illustrated in figure 4, the starting point was “ESG and Solar companies”. Gradually, based on extensive research and literature search, the thesis narrowed itself to ESG risks and opportunities for solar companies operating in Norway, before interviews and literature reviews led to the final design.

4.2 Research Design

When carrying out a research project, the first course of action is deciding upon a research design and structure. According to Saunders et al (2019), the choice of research design is in essence a plan for how to execute the project and should describe the methodological approaches that explicate how the research question will be answered. The overall goal is to come to a decision about a research design that provides useful insights into the area under study. In social science methodology, a distinction between quantitative and qualitative methods is made. Shortly explained, quantitative data is information that is encoded into numbers while qualitative data is information that is explained or put forth in the form of words (Ghauri & Grønhaug, 2005). The problem statement of a research paper is ultimately deciding the methods that are chosen. The present thesis aims to investigate what ESG risks and opportunities that will be of particular importance for photovoltaic companies operating in Norway in the coming years. Seeing that this specific topic is grounded in a fairly novel field of research, both with respect to ESG in general and assessing it in the area of solar companies,

the research is suited to be an exploratory project, designed to gather insights and understanding of a subject matter that has not been explored to the extent possible. Saunders et al (2019) state that the exploratory approach is seemingly when a project's purpose or intent is to clarify the current understanding of an issue or phenomenon. When choosing the exploratory design approach, it is important that a researcher concentrate on collecting information and data, observe participants, and attempt to build explanations out of the findings as the research goes along (Ghauri & Grønhaug, 2005). I argue that this approach will benefit the investigation of the problem because it will “provide an in-depth elucidation of the object of interest” (Grønhoj & Bergenholtz, 2016, p. 66).

That being said, a generic solution or research design will not be suitable as the problem statement is embedded in a contextual sectorial setting. Furthermore, the main research question will be answered by three very different subsequent research questions with respect to data collection, where a different method for data collection is appropriate for each sub-question. Therefore, I have chosen to divide the next sections into three different phases, where each phase is dedicated to a subsequent research question. The first phase of data collection is dedicated to the sub-research question 1, *what is environmental, social and governance (ESG) reporting and what are the challenges of reporting on it*, and will be investigated through a literature review. The second phase is dedicated to sub research question number two; *how important is ESG reporting for photovoltaic companies operating in Norway*, while the third and last phase is partial to sub research question three; *What ESG risks and opportunities exist for photovoltaic companies operating in Norway?* A sequential explanatory mixed methods research strategy has been chosen for phases two and three, which means that data from both a quantitative semi-structured interview as well as a qualitative screening of sustainability reports has been collected and analysed sequentially. The semi-structured interviews are used to tune in on risks and opportunities most relevant for Norwegian companies operating in Norway and exclude factors applicable to other countries, while the screening will elaborate on these topics in the course of identifying hot spots relevant to the ESG framework. The data design for all the phases is laid out in *table 1*.

Table 1: Data method and collection for each phase of the thesis

What ESG risks and opportunities will be particularly determinative in the coming years for photovoltaic companies operating in Norway?

Research Question	Phase	Data collection	Methodology
SubRQ1	1	Literature Review	Qualitative
SubRQ2	2	Semi-structured Interview	Qualitative
SubRQ3	2+3	Semi-structured Interview + Content Analysis	Qualitative

4.3 Data Collection

4.3.1 Phase 1: Literature Review

To give the readers an overview of what ESG is and what the shortcomings of using it as a performance tool are, a literature review was conducted. According to Tranfield et al (2003), reviews are very useful when a researcher aims to evaluate theory or evidence in a specific thematic area or examine the validity and accuracy of certain theories. Literature reviews offer many approaches; it can be narrow, e.g., if a researcher wants to take a closer look at effects between two variables, or broad, e.g., if a researcher wants to explore the collective evidence in a certain research area. In addition, literature reviews are helpful when the intention is to give readers an overview of a certain research issue, like in this thesis' case. Ordinarily, this sort of review aims to evaluate and examine the level of understanding and state of knowledge on a particular topic, and furthermore make readers aware of potential research gaps and shortcomings (Snyder, 2019). The literature review conducted to answer the first research question will take on a semi-systematic approach. The semi-systematic approach has been laid forth as an appropriate choice when the question under research is broad, and the analysis and evaluation are qualitative (Snyder, 2019). The data used in the literature review was gathered through secondary sources, such as Google Scholar and Oria Library. The data included significant literature regarding the evolution of sustainability reporting, the concept of ESG and its limitations with respect to measuring and evaluation, and screening methods used when accessing the corporate purpose of firms. A critical and objective perspective was combined during the process to collect valid literature.

4.3.2 Phase 2 & Phase 3: Semi-structured Interviews

A major part of the thesis includes semi-structured interviews with three persons with key expertise on the topic. Semi-structured interviews are a qualitative approach to collecting data. Kvale (1983, pp. 173 f.) defines the qualitative research interview as "an interview, whose purpose is to gather descriptions of the lifeworld of the interviewee with respect to interpretation of the meaning of the described phenomena." Semi-structured interviews are a middle ground where the researcher has questions prepared but will allow the interviewee to guide the conversation to a certain extent. If the interviewee has an interesting comment, the researcher can follow up on that comment in semi-structured or unstructured interviews. The questions can be customised based on the pre-planned questions when utilising a semi-structured interview guide. This allows for more in-depth talks and, if necessary, follow-up inquiries, where a respondent is given the opportunity to provide any information that he or she believes is relevant to the study (Johannessen et al, 2016). Semi-structured interviews are ideal for gathering and analysing preliminary data on a specific topic. When researchers don't have a lot of scholarly knowledge on a subject, they frequently start by talking to people and agency representatives to gather enough information to get a sense of the area or topic they're interested in. For these tasks, the semi-structured interview method was found appropriate because the information on the Norwegian solar industry in relation to ESG reporting is very scarce.

Collected data from interviews is of high importance for the results presented about ESG risks and opportunities for PV companies operating in Norway. Therefore, it is important to note that the information may be biased as the interviewees could have personal interests or lack a holistic standpoint. As a result, available secondary sources such as annual and sustainability reports were examined to further evaluate the interview data.

4.3.3 Interview Guide

An interview guide was created prior to the interviews to address the most important research questions. The flexibility allowed by semi-structured interviews led to that the three interviews ended up quite differently with concerns to structure. Case in point, in one of the interviews, the participant started discussing all the topics without interference as he was given the questions in advance. In another case, the participant did not have time to read the question beforehand, so a more structured approach was necessary. *See appendix 10 for the full interview guide.*

4.3.4 Sampling and Strategy

The procedure of selecting study participants is known as sampling. To guarantee that data is acquired from the most competent people or agencies, the selection of participants is a crucial aspect of every research effort (Ahlin, 2015). After identifying the hypothetical population—to whom or what do researchers intend to generalise their findings—researchers decide who (e.g., people) or what (e.g., agencies) to sample (Daniel, 2011). Because of the specific and narrow research area, there were approximately 15 firms of interest. However, only three firms had time to participate in the interview which naturally limited the sample options. One of the interviews was executed at the respective office in Oslo, one was carried out through Teams, and the last was carried out over the phone. It is possible to argue that the small participation scale is a delimitation of the thesis, where a larger sample could benefit the study. However, we argue that the three interviews conducted provided a large amount of data that fulfils the objective of the study. As the thesis was written in collaboration with Otovo, we also received data sources that we did not take into consideration in advance, for instance, a real ESG questionnaire that they had received from a potential investor. It is also important to note that as the collected data from the interviews have high relevance for the report, a content analysis of sustainability reports published by companies not participating in the interview was conducted to mitigate the risk of biases or personal interest in the interviews.

4.3.5 Ethical Considerations

When conducting research, there are ethical considerations that the researcher must consider. Participant consent is one of the most important considerations to protect the privacy of participants and informants in the project. The researcher should for instance make sure that the participant is clearly informed about the purpose of the research, and how they will use the data, and let the respondent know that they at any time can remove themselves from the project (Rogers et al., 2012). Before the interviews took place, I asked for permission to record the interview and made sure that the participant was fully aware of the purpose of the research, including each research question connected to the interview, and if we were allowed to use the firm's and person's name in the thesis. I also received a private document containing useful information from one of the respondents, however, this information will be very limited as requested by the participant.

4.3.6 Phase 3 part 2: Content Analysis

To substantiate and supplement the data retrieved from the interviews, a content analysis of the three sustainability reports from solar companies reporting on the GRI's Sustainability Disclosure Database (hereafter GRI Database) was conducted. Briefly, content analysis is employed to make replicable and valid inferences from texts or other relevant matters to the contexts of their use (Kleindorfer et al, 2005). Content analysis has been extensively used to analyse patterns of SR or CRS reporting, both concerning a general review or model development purpose, or targeting specific industries (Calabrese et al, 2015; Hsu et al, 2013; Susie et al, 2018). The main reason for choosing the GRI Database is that it, as of now, is the largest database for sustainability reports (232 of the world's largest 250 corporations report via GRI). Secondly, it enables one to find targeting competitors, also within similar scales, in the same market or industry, and see what material topics they are reporting on (Susie et al, 2018). Lastly, the GRI Database has been described as a convenient choice when a researcher wants to observe leading market player(s) for benchmarking purposes and compare it to other companies or cases (Susie et al, 2018). This allowed us to identify two PV companies reporting in the GRI Database, see what standards they report on, and further conduct an analysis of their interconnected sustainability reports to evaluate the materiality and relevance of information disclosed. The analysis was carried out based on the information retrieved from the semi-structured interviews, allowing for a list of classification rules related to the dimensions present in the research questions to be identified. The input in the reports was analysed for frequencies and furthermore coded into the pre-established dimension categories.

Chapter 5: Literature Review

The literature on photovoltaic companies in relation to ESG is for the time severely scarce. The lack of information on the topic is not only limited to the Norwegian PV market but extends to international markets as well. ESG is a comparatively new concept which may explain the shortage of research. That said, when broadening the search to comparable terms, e.g., corporate responsibility or sustainability strategies in general, a few studies have undertaken the task of examining the PV industry in a broader sustainability context.

Gervais et al (2021a) took on the task to explore sustainable strategies for PV, or more specifically, reviewing challenges that lie ahead of the PV sector and filling in gaps on existing shortcomings. Their study is predominantly targeting the production phase of solar panels, hence the use and management of raw materials and production line outputs, though some of their findings also address reporting and CSR practices. According to the authors, most large PV companies use the Global Reporting Initiative (GRI) standards to report on matters like water use and wastewater generation, energy consumption, commitment to environmental standards (e.g. RE100), reduction of materiality intensity and waste, recycling, accidents on work, discrimination, anti-corruption policy, supplier assessment framework (Gervais et al, 2021a). Their recommendation is that PV companies should focus more on gaps commonly overlooked, which based on their findings, are reduction in material intensity, use of recycled content, and treatment of production line outputs. They further note that it is important to establish Key Performance Indicators (KPI's), which also should be standardised and complemented by context-based or science-based approaches. Gervais et al (2021a) also direct attention to issues related to human rights or the social aspect of ESG. They point out the importance of taking full ownership and responsibility for their supply chain, which should be handled with full transparency and secured with a high level of traceability from an external body or third party. Although the paper covers 16 key points that will improve PV companies' sustainability strategies, it is important to note that most so-called sustainability gaps are not analysed in detail and that the paper builds on the larger goals outlined in the SDG 12 framework. The SDG 12 framework is also utilised by Gervais et al (2021b) as a lens to map sectoral gaps in the PV industry. According to them, the SDG framework provides an entry point for PV stakeholders to review their impacts holistically as it makes ecological sustainability, criticality, and circularity compatible. By use of gap analysis, the authors argue that the PV sector, by and large, lacks common key performance indicators which consequently causes a fragmented and uncertain sustainability landscape. They further point to how PV companies need to invest resources into creating more coherence with respect to their sustainability leadership and collaborate on the sectoral level in all topics of SDG 12. Particularly, the researchers point to how solar agents should implement strategies that are linked to substantial techno-economic hurdles, for example, batteries.

There also exists some literature that focuses on sustainable materiality and techno-commercial factors in the photovoltaic industry. In their paper *Ecodesign, Ecolabeling and Green*

procurement Policies - enabling more Sustainable Photovoltaic, Wade et al (2018) attempt to evaluate the impact and effectiveness of different regulatory and voluntary initiatives on the sustainability profile of PV electricity generation by applying the concept of life cycle assessment (LCA) and Product Environmental Footprint Category Rules (PCRs) for PV electricity generation. The authors quantified the LCA footprint from the PEFGRs results by using 15 environmental indicators laid forth by the European Union and three additional indicators specified in the PEFGRs draft. From this, they were able to determine so-called hotspots or root causes with respect to PV panels' biggest environmental impact. Their findings suggest that these hotspots (e.g., mineral, fossil and renewable resource depletion and supply chain electricity) are mostly linked with the production of panels, though some are also attributed to installation, mounting and module operations. According to the authors, to improve the environmental performance of PV systems through sustainability initiatives, instruments should mirror and focus on the identified hotspots. Although the study successfully reveals root causes for predominant environmental hotspots, the authors are not successful in quantifying benchmarks of the different measures and initiatives because they are yet to be fully implemented and are still in an evolving phase (PV Magazine, 2021). Although the study concerns the PV panel's environmental impact, it does not cover all aspects with respect to ESG, and it can further be said that it is more production- and technology-focused. In contrast, the present study will not go deeply into or pin down techno-economic impacts, but rather maintain a broader view and focus on overarching risks and opportunities existing within the ESG framework.

Chapter 6: Results and Findings

This chapter includes a representation of the findings. Chapter 6.1 shares the information obtained through the literature review applied to answer the research question: What is ESG and what are the challenges of measuring it? Chapter 6.2 displays the results related to the research question; is taking notice of ESG performance important for photovoltaic companies operating in Norway? Here, the information gathered through interviews will be categorised according to 5 guiding questions. The last section of the findings is dedicated to the research question; what ESG risks and opportunities will become particularly important for PV companies operating in Norway in the coming years? The considerable amount of information

obtained from the semi-structured interviews will be categorised according to the three dimensions of ESG, and furthermore positioned into the PESTEL and SWOT frameworks.

6.1. What is ESG and what are the challenges of reporting on it?

A debate about ESG or sustainability reporting (SR) necessitates attention and consideration of how corporate, environmental, and social reporting has developed, starting from a period in which there was little room for sustainability in investment analysis, to more recent periods where it has received a more cumulative momentum exceeding initial niches and used in more incorporated forms of reporting.

6.1.1 Evolution of Sustainability Reporting

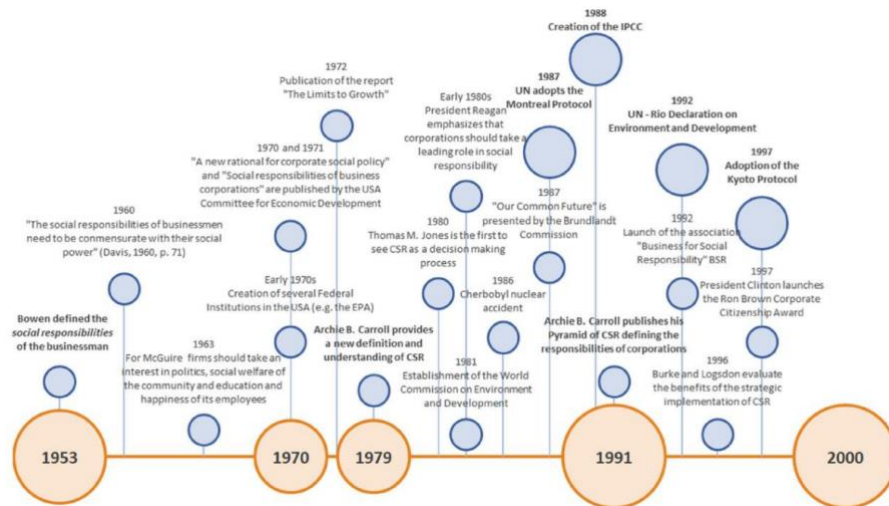
While advocacy groups, investors and some business leaders possibly were some of the initial promoters for SR, governments have also played a historic role in formally acknowledging the cruciality of corporate reporting beyond the strictly financial ones. The call for SR or environmental reporting was already treated seriously during Agenda 21 in 1992, when the world's governments agreed that '(b)usiness and industry, including transnational corporations, should be encouraged: (a) to report annually on their environmental records, as well as on their use of energy and natural resources' (Hohnen, 2012). The agreement occurred after several climate pledging events, especially the Brundtland Report: our common future of 1987 (Asogwa et al, 2021), which became a landmark event as it developed guiding principles for sustainable development. This event is closely linked to the well-known concept of the triple bottom line approach (TBL) (practical approach balancing the people, profit, and planet dimensions). It also resonates with the corporate social responsibility (CSR) discourse, demonstrating the likeliness of overlaps and the potential for conflation of all the different concepts when practically applied (MacNeil and Esser, 2022; Agudelo et al, 2017). Agudelo et al (2019) also point out some other environmental influences on the development of SR/CSR, including:

- United Nations Montreal Protocol (1987)
- Formation of the Intergovernmental Panel on Climate Change (IPCC - 1988)
- Kyoto Protocol (1997) • United Nations Millennium Developments Goals (2000)
- United Nations Global Compact (2000)

- The Paris Agreement (2015)
- United Nations SDGs (2015)

Figure 6: Figure 5: Timeline Evolution of Corporate Social Responsibility

Source: Maren (2021)



Although the different corporate sustainability paradigms, often referred to as the “trilemma” (CSR, TBL, ESG), have caused perplexity and confusion in past business environments, there seem to be some agreeable differential factors of CSR and ESG today. Preliminary, ESG investing is predicated on the presumption that its continuant factors are material for the risk and return profile of financial investments (MacNeil and Esser, 2022; Etsy and Cort, 2020). Comparable, CSR lacks quantifiable data to validate its outcomes. Khalid et al (2021) and Heller (2021) make a point in the same vein, namely that while CSR is more focused on supplying accountability within an organisation, ESG aims to gather and measure data-driven metrics appropriate to business objectives and stakeholders. This view entails that CSR commitments are first and foremost communicated through marketing messages and so forth, whereas ESG with its specific metrics evaluates a company’s holistic performance and as such brings a new layer of meaning. This is further clarified in table 5 and table 6 which demonstrate two ways scholars typically differ on CSR and ESG.

Table 2: CSR vs ESG (focus, channel, implementation, metrics, and reporting)

Source: MacNeil and Esser (2022)

	CSR	ESG
Focus	Ethical responsibility and accountability	Portfolio risk and return, linked to metrics, benchmarks and indices
Channel	Corporate entities	Institutional investors and the investment chain
Implementation	Board decision-making	Integration into portfolio selection and engagement
Metrics	None	Multiple, with different custodians, scope and legal effect. Limited verification. Ratings add another layer of complexity
Reporting	Mainly non-financial reporting (NFR)	Mainly through 5 sustainability frameworks (CDP, CDSB, GRI, IIRC, SASB) ^a

Table 3: CSR vs ESG (practical examples)

Source: (Heller, 2021)

Examples of CSR	Examples of ESG
Community involvement or volunteering	GHG emissions and climate risk
Helping employees advance careers	% of women or people of color (POC) on the board
Participating in fair trade agreements	Pay equity, diversity, and inclusion
Donating products or services	Ethical behavior and anti-corruption

*Heller, C. (2021, February 17). From CSR to ESG: How to kickstart your ESG program in 2021. Navex Global Risk and Compliance Matters. <https://bit.ly/3iEKsRt>.

6.1.2 ESG: Explanation and Dimensions

Environment, social, and governance (ESG) is a sustainability accounting framework that aims to improve standardised disclosure of environmental, social and governance information. It appears to respond to the many calls for standardisation of corporate sustainability data, seeking to provide greater clarity and comparability in connection with enterprise performance on ESG issues. According to Eurosif (2014), an integration of ESG entails that managers ‘include ESG risks and opportunities into traditional financial analysis based on a systematic process and appropriate research sources’. It is a forward-looking business approach which supposedly creates long-term shareholder value by embracing opportunities and mitigating risks derived from social, environmental, and governance developments, where a lot of information reflecting a firm’s practice on these dimensions is collected and analysed (Duuren et al, 2016). The environmental impacts evaluated during ESG analysis commonly include energy emissions, waste, climate change and a manifold of environmental programmes. The social dimension can be analysed by for example taking into consideration a company’s view and practice of human rights, working conditions and product liability. Aspects pertaining to

governance may include anti-corruption- and bribery, tax payments, management behaviour, and selection of managers/board of directors (Sivola and Landau, 2021). A short description of the dimensions, their connected factors, and their definition can be found in *table 4*.

Table 4: ESG framework (international frameworks)

Source: Busco et al (2020)

Dimension	Factors	Definition
Environmental (E)	<ul style="list-style-type: none"> • GHG emissions • Energy consumption and efficiency • Air pollutants • Water usage and recycling • Waste production and management (water, solid, hazardous) • Impact and dependence on biodiversity • Impact and dependence on ecosystems • Innovation in environmentally friendly products and services 	Environmental matters that may have a positive or negative impact on the financial performance or solvency of an entity, sovereign, or individual.
Social (S)	<ul style="list-style-type: none"> • Workforce freedom of association • Child labor • Forced and compulsory labor • Workplace health and safety • Customer health and safety • Discrimination, diversity, and equal • Opportunity • Poverty and community impact • Supply chain management • Training and education • Customer privacy • Community impacts 	Social matters that may have a positive or negative impact on the financial performance or solvency of an entity, sovereign, or individual.
Governance (G)	<ul style="list-style-type: none"> • Codes of conduct and business principles • Accountability • Transparency and disclosure • Executive pay • Board diversity and structure • Bribery and corruption • Stakeholder engagement • Shareholder rights 	Governance matters that may have a positive or negative impact on the financial performance or solvency of an entity, sovereign, or individual.

Since its initial proposal in 2004, ESG considerations have been aggressively implemented in Europe, America, and other industrialised countries. The European Union's (EU) Green Deal, which includes the sustainable finance initiative and the related taxonomy, has demonstrated how seriously regulators take ESG related disclosure and risks, creating a common classification system for sustainable economic activities in hope of guiding investors in a green direction while having set definitions of a sustainable activity to prevent greenwashing (European Commission, 2022). The ESG variables are continuously constructing a new pattern of long-term growth, where failing to rightfully implement it means lost opportunities (Cappucci 2018). ESG has been widely studied, practised, and promoted in the practical sector, and it has piqued the curiosity of academicians from all over the world. Today, surveys show that most investors believe that the right ESG strategy will have a positive impact on long-term investment performance, and in most cases, this strategy entails fully integrating ESG factors

in the process of investing in a way that lower ESG risks and capitalises on ESG opportunities (Cappucci, 2018).

6.1.3 ESG in Practice

A comprehensive analysis of ESG aspects is said to broaden and deepen any investment analysis because the value creation of a company is not, or less, pendent on financial statements (Lev and Gu, 2016). Furthermore, it accounts for information that is not found in traditional financial statement analysis, particularly as regards risks and opportunities and companies' direct and indirect effects on society and the environment (Sivola and Landau, 2021). From a strategic investment perspective, investors will use ESG performance as a criterion for investment decisions, however, how they apply these criteria varies significantly. Case in point, some ESG investment analysis commonly applied is (Amel-Zadeh and Serafeim, 2018; Duuren et al, 2016):

- **Negative screening** is the exclusion of specific industries, companies, or practices from a fund or portfolio on the grounds of specific ESG criteria.
- **Positive screening** is the inclusion of certain industries, companies, or practices in a fund or portfolio on the grounds of specific minimum ESG criteria.
- **Relative/best-in-class screening** is the investment in sectors, companies, or projects selected for ESG performance relative to industry peers (selecting the best 25-33% regarding ESG).
- **Overlay/portfolio tilt** is the use of certain investment methods or products to shift specific aggregate ESG attributes of a fund or investment portfolio to the desired level (e.g., carbon footprint).
- **Thematic investment** is investment in themes explicitly related to ESG factors, such as clean energy or green technology.
- **Engagement/active ownership** is the use of shareholder power to influence business behaviour through direct corporate engagement (i.e., contacting senior management and/or boards of directors), filing or co-filing shareholder resolutions, or proxy voting guided by ESG criteria.
- **Full integration** into individual stock valuation is a specific inclusion of ESG elements into traditional financial analysis of individual equities (e.g., as inputs into cash flow predictions and/or cost-of-capital estimations).

6.1.4 Valuation of ESG

It is important to understand and get an overview of how sustainability aspects typically are measured and incorporated into investment analysis. The term *materialisation* has vital importance when discussing the inclusion of ESG aspects. In brief, “materiality acts to set information disclosure thresholds, separating what should be disclosed from what could be disclosed as part of required reporting” (Jebe, 2019, pp.647). Put more simply, materiality refers to the significance of a specific measure as part of a company's ESG analysis. In many contexts, materiality can be objectively defined. This is the case in the Securities and Exchange Commission (SEC) in the US, who leaves it up to firms to decide what material information should be disclosed (Sætra, 2021).

Consequently, a range of various standards and frameworks for reporting and disclosure on ESG have been put forth, creating a landscape that often is described as an “alphabet soup,” marred by a dizzying array of choices and few clear guidelines from regulators. That said, there are several major organisations aiming to create a globally used sustainability reporting framework and standardised sets of ESG materiality metrics, the most known are the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), and the World Economic Forum’s (WEF) (Krueger et al, 2021) GRI is the most generally used standard for nonfinancial disclosures, in the form of sustainability reports, and it can be combined with other frameworks (Krueger et al, 2021). Unlike the GRI, which focuses on a broad variety of stakeholders, the SASB focuses on investors specifically (Sætra, 2021). In early 2021, GRI and SASB published a collaborative report entitled “*A Practical Guide to Sustainability Reporting Using GRI and SASB Standards*”, highlighting the applicability of using both standards for sustainability disclosures. As the SASB framework for the solar industry is a research brief as of today, the thesis will not go more into detail of the framework, however, it is generally recommended to use it as it provides the most impactful industry-specific disclosure topics (Maren, 2021). However, The GRI framework is relevant for one of the methods utilised in the thesis, and thus, a more detailed description is provided in the next section.

6.1.5 The GRI Framework

GRI is as of today the most widely used SR framework. Having been established in 1997, the GRI database is the world's oldest and most frequently used voluntary sustainability reporting system (Krueger et al, 2021)

Figure 7: 1st version of Global Reporting Initiative (GRI) framework and measurement parameters.

Source: Krueger et al (2021)



Since then, the GRI sustainability reporting has been further developed, namely the subsequent frameworks G3 and G3.1 (an updated version of G3) and the fourth-generation guidelines G4. Sector supplements have also been provided, and most recently, a waste-, universal- and sector standard has been launched (2021). GRI's standards are probably the most widely adopted global ESG reporting standards, where its database has been referred to as the most comprehensive data repository with respect to ESG reports. As of 2017, their Asset4 Database contained more than 50,000 ESG reports (Krueger et al, 2021). In the reports, companies must publish 'significant' environmental, social, and governance information according to the GRI's overarching disclosure principle. Also, the reports must include the date when a report was added to the database, guidelines followed (e.g. G1, G2, G3), application level, declaration level, country, OECD membership, report address, region, sector etc, which can be linked to the quality of the reports (Fernández-Feijóo et al. 2012). Specific GRI standards also exist for

Economic (GRI 200s), Environmental (GRI 300s), and Social (GRI 400s) disclosures (Global Reporting Initiative (GRI) & Global Sustainability Standards Board (GSSB), 2020) (Maren, 2021).

A detailed explanation of how the different standards and metrics are measured falls outside of the scope of this thesis, though, in the interest of understanding the complexity and shortcomings (next section) of ESG, a brief explanation of the measurement in practice is of interest. According to Popescu et al (2022), Life Cycle Assessment (LCA) is a best practice tool in the field of sustainability assessment that is used to examine the impact of project-based financial instruments like green bonds (Gibon et al, 2020). Input-Output LCA analysis (IOLCA), based on EEMRIO databases, is used for macro-scale assessments to trace the development of global environmental consequences at the industry level (Goldhammer et al, 2017; Wiebe, 2018). Investment funds are a collection of economic operations from many sectors and geographies. As a result, IOLCA can be used to assess the environmental impact at the fund level, where asset owners and regulators lack the ability to measure full life cycle holding-level impacts consistently (Goldhammer et al, 2017). The social and governance dimension is, with reference to the environmental dimension, not that concrete in their approach. In short, they are mostly constructed out of ‘questions’ relevant to the different parameters, for instance, ‘does an organisation include diverse backgrounds in the decision process?’.

6.1.6 Shortcomings ESG

While sustainability offers opportunities for out-performance, this phenomenon must also be examined in a critical light. Although the reporting on ESG has been said to contribute to increased transparency, it has also been formulated that a great deal of work remains to better formulate and understand the standards of ESG data that will underpin important information in forthcoming disclosures. The many ESG frameworks have left a lot of confusion, both with respect to where financial actors gather the information used to assist existing portfolios and future investments, but also how they use the information in their investment process.

According to several scholars, the biggest issue with ESG within investment management is the deficit of quality of ESG information (Barker and Eccles, 2018; Amel-Zadeh and Serafeim, 2018). This entails that the information given has a so-called standardisation deficit, meaning

that the information available has inefficiencies with respect to reliability, relevance, comparability, and completeness (Barker and Eccles, 2018). According to Amel-Zadeh and Serafeim (2018), the lack of a sufficient standardisation causes large barriers for investors in their selection, screening and investment strategies, as well as causing a recurring issue regarding how to integrate ESG information in decisions regarding investment. The High Meadows Institute (2019) affirms this statement, pointing to how this insufficiency is a result of not having a universal or standardised definition of ESG, as well as some accepted and agreeable standards that can serve as guidelines in terms of measuring and reporting the ESG performance of firms. Case in point, Li and Polychronopoulos (2020) found that as of the end of 2019, 70 different firms had provided some sort of company specific ESG rating. Their report did not even account for a multitude of investment banks, government organisations and research organisations that carry out ESG related research that aims to create customised ratings. In a similar vein, Fish et al (2019) document that over 600 ESG ratings were produced in 2018.

This is not necessarily problematic if all ratings were effectively similar, but this is a contrary case in the ESG environment. A significant portion of academic literature has demonstrated the deviation of ESG ratings for uniform firms (Berg et al, 2019; Chatterji et al, 2016; Li and Polychronopoulos, 2020; Semenova and Hassel, 2016). These dissimilarities are not only present when it comes to how firms measure the different ESG criteria, but also as regards what criteria are reckoned to be worth measuring (Cornell and Damodaran, 2020). In some instances, the criteria are furthermore highly numerous, making it complicated to distinguish the criteria that are pertinent from those that are not, especially considering that some frameworks cover over 120 ESG indicators (e.g., Bloomberg). The most highly publicised indicators are usually accounted for (e.g., carbon emissions, pollution, diversity, human rights), however, financial institutions are yet to agree on how they are to be measured.

6.2 How important is ESG reporting for photovoltaic companies operating in Norway?

As the problem statement indicates, taking notice of ESG criteria is particularly important for industries that want, or need, to attract the “sustainable-minded” investors which are using ESG performance and criteria as a guideline in their investment strategies. Therefore, it is of interest to explore if taking notice of ESG criteria is of interest and importance for photovoltaic

companies operating in Norway. This research question has been explored through semi-structured interviews. The interview in relation to the matter was primarily guided by six questions, that is:

1. How important is it to find investors from the capital market today?
2. How competitive do you expect it to be to find investors from the capital market in 3-5 years?
3. How competitive do you expect it to be to find investors from the capital market in 5-10 years?
4. What are some critical questions investors typically ask?
5. What are some critical questions customers typically ask?
6. What are some current demands from investors which did not exist 3-5 years ago?

As the interview was semi-structured, the above questions were first and foremost used as a guideline. That said, the following sections will be categorised according to their thematic stance. The results include references and direct quotes from the informants, which are marked in yellow in the transcriptions in *appendix 10.1.2-10.1.4*.

6.2.1 Short Term Capital

All respondents agreed that it is very necessary to receive capital from investors in the short run. In Otovo's case, it will take some time before the company is profitable, meaning that it is important to gather external capital in the short run. Although they earn a profit on every sale that is made, this is not enough to cover the operational costs in the next few years.

"If you invest in Otovo, you take a bet today to win jackpot in a few years"

The above-written quote highlights the need for short-term capital in the market today. The company will, according to its business model, be profitable in some years, however, they need capital today to make this return in the future. Enova identifies itself in these declarations, saying that external capital today is crucial for them in order to hire the people necessary. On another note, Solenergiklyngen makes a point about how many companies have managed to

become fully profitable and are thus not too dependent on external capital in the coming years. Even so, the respondent states that external capital naturally is extremely beneficial for potential growth.

Nevertheless, the respondents point out that the willingness to invest has very much increased during the last five years. According to the participant from Otovo, there is much better access to capital today than it was five years ago. He points to how this naturally has to do with the green shift in the mindset of investors, but naturally also has a lot to do with the fact that Otovo has grown in maturity. The interviewee also draws attention to another important factor that can affect access to capital, which is interest rates. According to him, solar power can fall under the category of ‘growth stocks’, which are often characterised as being more attractive when interest rates are low. When interest rates are low, investor interest for ‘general stocks’ decreases because the return of investments is estimated to be lower, and the access to capital for Otovo increases. This is a two-way mechanism, meaning that when interest rates are high, the access to capital for Otovo increases.

6.2.2 Long Term Capital

In this thesis, long term capital refers to capital that is gathered after 5-10 years. The respondents are like-minded when it comes to the necessity for this prolonged investment. Everyone stressed the need for short term capital, though, believes that they will be financially stable in a couple of years. The expected amount of time before they do not depend on investment from the capital market varies and naturally depends on several factors such as firm size and expansion plans.

6.2.3 Critical Questions from Customers

The respondents have different answers when questioned if they have received any critical questions from customers. In the case of Otovo, their general thought is that customers already have made up an opinion about solar panels when calling Otovo.

“Customers are somehow less focused on this I would think, at least relative to investors and governments that demand. And it's not because customers are not concerned about the

environment, but those who choose to buy solar panels have in a way a kind of idea that it is wise both for the environment and for the wallet”.

That being said, they do point to how some questions can be raised:

“...there are some questions you can get, it is also what concerns more human rights, value chains and such things you will also be able to get questions from customers”.

Solenergiklyngen notes that although this may not be common for private purchasers, it is definitely a topic for public purchasers such as municipalities. Because ESG topics are highly present on today's agenda, it is important that public purchasers investigate and ask questions regarding different matters like supply chains, materials etc, to choose the most sustainable paths.

6.2.4 Critical Questions from investors

It is evident that investors are increasingly concerned with environmental, social, and government factors related to firms of interest, including those solar companies. When asked if they have been subject to any critical questions or demands concerning their operations, two of the respondents used expressive words like “absolutely” and “for sure” to demonstrate that this is more and more common and unavoidable in today’s environment. The respondent from Solenergiklyngen states:

“Yes, absolutely. Especially in relation to the Norwegian companies that operate in foreign markets, investments from large discoveries etc, it is very important to have good reporting. You may not actually be allowed to operate if not”.

Otovo is undoubtedly also stressing the need to invest in good reporting frameworks and tools. When asked about their general experience, Otovo answers:

“What we experience is that investors come and demand details about our business and what we have of CO2 emissions and how we handle waste, whether we buy quotas for

business travel - lots of different questions. And they expect us to provide information about such things”

They further elaborate that they believe sustainability reporting, or more concrete ESG reporting, is and will increasingly continue to be exceptionally important. They also bring to attention a prominent point, namely that although many investors set high standards for their investment decisions as regards ESG, where more aspects of reporting are a form of voluntary disclosure in many countries, much of the reporting is in fact mandatory. They further stress that the next few years will require even more transparency and disclosure, where some new rules are in force already in 2022. With reference to this regulation, companies are aware of what this entails, however it is expected that this will just be the beginning of an area characterised by disruption and rapid restructurings. Also, as indicated in the methodology chapter, Otovo had concrete examples of demands with respect to reporting from potential investors which will be further explored in chapter 7.1.

6.2.5 Importance of ESG for PV Companies Operating in Norway

When finishing up the first part of the interview, Solenergiklyngen was directly asked if they thought it would be important to take notice of ESG performance with reference to solar companies operating in Norway. The answer was:

“Yes, I think it's important. Also, the solar cell industry and the Norwegian business community consist of a lot of SMEs who do not have the capacity to understand this, the big ones are probably leading the way and it depends on it, the big ones can teach the small ones. I think it is more and more important now with legislation and guarantees that the Norwegian solar cell market depends on in the future. I think it plays an important role”.

Otovo was not asked directly as the interview naturally touched on the topic. They stated that the rules and guidelines for reporting are not restricting companies to emit or act in a certain way. Companies are obligated to report, and this is how investors and customers can make an informed decision when choosing their products or portfolio.

“...is not so much I directly in rules, it is not like you cannot emit so much CO2, instead, more that you have to provide information about what you release. It is also the intention that when

investors and customers receive information, they will choose producers, manufacturers and companies who are good at ESG”.

- Otovo

6.3 What ESG risks and opportunities exist for photovoltaic companies operating in Norway?

After having established that taking notice of ESG criteria is important for solar companies operating in Norway, the second part of the semi-structured interviews could proceed. Here, the goal was to explore what the companies participating thought would be the most prominent risks and opportunities in the coming years with reference to ESG reporting- and criteria. This included more detailed questions regarding the three different dimensions, and furthermore, in light of recent energy political turmoil affecting energy supply, see if the Ukraine-Russia conflict would have an impact on their operations. The interview in relation to the matters was primarily guided by five questions, that is:

1. What are the most critical issues with respect to social factors?
2. What are the most critical issues with respect to governance factors?
3. What are the most critical issues with respect to environmental factors?
4. How important is the role of policy funding with respect to the Norwegian solar industry?
5. How can the Russia-Ukraine conflict affect Otovo and other Norwegian solar power agents?

6.3.1 ESG Risks

6.3.2 Environmental Dimension

As both the interviews and literature suggest, solar panels are usually built of hazardous substances and raw materials that can harm the environment. When the distribution of environmental impacts is examined across the life cycle and the various categories, it becomes clear that the production stage and the construction stage (mounting and installation) are responsible for the larger part of the environmental impact of a representative, residential-scale

PV installation (Wade et al, 2018). This is consistent with Otovo's familiarity:

"Our largest emissions are related to the production of panels produced in China"

According to the respondents, between 90-95% of all panel components are produced in China, and from the information they shared, it is evident that this is also the main cause of concern with respect to critical environmental factors for the companies interviewed. The respondent from Solenergiklyngen elaborates on the matter:

"The environment or the imprint - getting proper control of it is important. It makes a difference whether it is produced with coal power in Mongolia or hydropower on Hærøya, also you do not have complete control over everything with batteries. There are ever better products, less use of lead or other heavy materials. The solar cell industry has a job to do there".

The respondent also alludes to the risks of having multiple suppliers and sub-suppliers, which leads to less control of the production and manufacturing, as well as the materials and environmental damage interconnected. Ecosol also has concerns in this direction, saying that long-distance production results in unanswered questions related to the production and management of the supply chain. Apart from the production aspect associated with faraway supply chains and production, he further brings up another point, which is the transportation of solar panels.

"Because it is speculated that 90-95% of all solar cells are produced in China, how is that done? The cost of transport to get this to Europe by boat and its CO2 footprint. I wish that solar panels could have been more short-distance than they are - that is what we are looking for when we search for new products. There are also many suppliers who are concerned that things should not be from China anymore."

The production and building stages remain the most important in terms of their contribution to life cycle environmental impacts, even though the environmental impact shares of the life cycle stages will vary among different PV technologies. Mineral, fossil, and renewable resource

depletion, human toxicity (cancer and non-cancer effects), freshwater ecotoxicity, particulate matter potential, and acidification potential are the primary categories contributing to cumulative weighted environmental impacts.

6.3.3 Social Dimension

As idem in the present thesis, the respondents also very much agree on what the most critical aspect of the social dimension is for ESG performance and reporting. As previously highlighted, the production of solar panels for the Norwegian by and large takes place in China, where it is suggested that this poses a threat with respect to not having control of all company-related operations and the humans involved. Particularly, violations of human rights, forced labour, and discrimination poses a large risk as this is considered highly important when it comes to ESG screening and performance. It is obvious that Otovo has given this a lot of thought. They point to several legislations such as the Gender Equality Act and Åpenhetsloven (Transparency Act) which they believe will be even more important in the time to come. In short, the Act set out guidelines and policies regarding human rights, discrimination, equality, and labour violations, which equally target in-firm operations and operations related to contractors.

“One thing is in your own business, but also in the supply chain you use. We have a lot of Chinese products, so is it exploitation of ethical groups or others in some of the firms we use? Are some of our producers involved in human rights violations? This is something we increasingly have to report on”.

6.3.4 Governance Dimension

The governance dimension did not receive as much attention or response as the other two dimensions, indicating that it as of now does not pose the biggest threat to solar companies operating in Norway. That being said, Otovo draws attention to a very tangible regulation that has a direct influence on the government dimension of ESG:

“As for governance, there are guidelines that may apply in particular to listed companies, in Norway there is something called NUES, which is a Norwegian corporate governance body or forum that makes recommendations for how to run companies”

Solenergiklyngen do not necessarily mention any specific regulations or business practices, however, the respondent seems confident that many of the transparency rules will appeal to the governance dimension as well. She emphasises that they don't necessarily know what the new regulations will mean or imply, though is positive that it will impact all levels of business.

6.3.5 Ukraine-Russia Conflict

Russia's unprovoked invasion of Ukraine has roiled energy markets and geopolitics, driving up oil and gas prices to levels not seen in nearly a decade and causing several countries to rethink their energy suppliers. Russia is the world's top oil exporter to global markets, according to the International Energy Agency, and its natural gas powers the European economy. Economic sanctions have been imposed on Russia by the United States, the European Union, and others, as well as efforts to wean themselves off the country's fossil fuels. Even though Russian energy up to date continues to flow into the energy systems of countries claiming to ban their supply, the EU, through REPower EU, has ambitious plans of making Europe independent from Russian fossil fuels well before 2030 (EU, 2022). As Russia in 2021, prior to the invasion, accounted for approximately 40% of EU's natural gas in 2019, it was of interest to explore how the solar companies operating in Norway thought the conflict would affect them, and furthermore investigate if any ESG risks or opportunities presented themselves because of this.

It was obvious that all three people who took part in the interview had a lot on their minds when asked how the Russia-Ukraine conflict could affect them. Ecosol explained that they are a niche company in the solar industry as they only operate with BIPV/integrated solar cells (this means that they install in-roof panels contrary to putting the panels on top of the tiles). Consequently, they need to deliver a totality, which inter alia consists of metal, plumber, and steel, where Ecosol opines that the conflict will affect the prices and availability of these raw materials. That said, the respondent makes it clear that he is very unsure of what other impacts the conflict may pose, nevertheless believes that the steel shortage is more predictable seeing as Russia supplies an incredible amount of it to the European market.

Otovo draws attention to how the conflict can unfold two very distinct outcomes. If the conflict does not escalate outside of Ukraine and Russia, the outcome can be positive (note that the respondent says positive with quotation marks as he does not consider any of the happenings to be positive) for solar companies as the EU presumably will invest quite a lot in European

energy sources and renewables like solar energy. This presumption is strengthened by the fact that their stock price increased in the mid of March. The respondent also states that the conflict has caused many people to become more aware of their energy supply, and more reluctant to have Russian gas in the pipes of their houses. This may in turn increase the interest in becoming more self-supplied with energy, making solar panels an appealing choice. That having been said, there are also very apparent risks and threats, especially if the conflict escalates to other countries:

“For example, if China were to be involved in this, it would be bad to supply solar cells as all panels are mostly produced there, and also to a certain extent, labour. There are not many Ukrainians who have been working around in the countries we have, but in Poland we have seen that there have been suppliers who have had Ukrainian people at work who have now gone home to fight, so quite a hefty scheme”.

When the respondent from Solenergiklyngen was interviewed, the Ukraine-Russia conflict was on the near agenda though yet to be fully discussed so she did not speculate too much about the topic. However, she made one thing very clear: there is already an energy crisis so the demand for solar cells will become much higher.

6.4 ESG Opportunities

The next section will summarise the main findings from the interviews with respect to ESG opportunities PV companies operating in Norway can take advantage of. Many of the answers are based on the risks previously discussed, though when the interview allowed to, some questions directly isolated opportunities.

6.4.1: Environmental Dimensions

When discussing the most critical aspects of operating in the Norwegian solar market with respect to the environmental dimensions, some opportunities presented themselves. First and foremost, the data collected from the interviews revealed that having good reporting on all the environmental factors associated with production, transport, and installation is important to stay competitive and attract investors and customers. For many sustainable minded investors, a lack of sufficient reporting and information can be enough to make them lose interest, despite operating in an apparent green industry.

6.4.2: Social Dimension

As indicated earlier, being heavily reliant on production in China is, and will continue to be, the biggest risk with respect to the social dimension. Being able to say and prove that all aspects within the social dimension are at the forefront (or as good as possible) would naturally pose a big opportunity.

6.4.3: Government Dimension

The only risk that presented itself when discussing risks and opportunities related to the government dimension of ESG was focusing on equality and ethicality in the workplace, particularly in the management- and board of director groups (this also extends to the social dimension). According to one of the respondents, having an uneven distribution of gender and ethnicity is not received well by many investors, and can potentially drive them away at first glance. This also presents an opportunity, that is to make sure that management positions are diversified.

6.4.4 Ukraine-Russia Conflict

The Ukraine-Russia conflict presents a somewhat “make or break”-scenario, depending on if the conflict escalates or not. Supposing that it does not escalate to other countries than those presently involved, several opportunities present themselves. As indicated by one of the respondents, the EU is in strong need to substitute the energy imported from Russia. In order to speed up the decoupling of Russian gas, while simultaneously facilitating a sustainable transition, it is expected that the EU will subsidise and invest heavily in renewable sources.

6.5.5 Local Supply Chains

After having discussed the many issues with supply chains in China, it was of interest to ask about the possibilities of moving the supply chain to Europe. Otovo explained that the biggest barrier is that China is the only country that have been successful in producing panels in the large scale demanded today (other countries are producing as well, however, this is not comparable to the scale in China). He points out that they started to develop production sites many years ago, and thus have the necessary equipment, production sites, logistics, and manufacturers in place, where it will take many years to compete with them. Other advances are that a lot of the natural resources used in the production of panels come from China, and

naturally, the access to cheap labour. According to the participant from Solernegiklyngen, there is an enormous interest in moving the supply chain to western countries in Europe, where an EU representative supposedly said that they will do ‘whatever it takes’ to bring home the supply chain. Although moving the supply chain have great relevance to ESG risks and opportunities, it will not be discussed further as it expectantly will take many years, where the present thesis and its results are predominantly important for a shorter-term perspective.

6.5 Screening of Sustainability Reports

With the purpose of cross-checking and supplementing the data retrieved from the interviews, a screening of three sustainability reports from pioneer solar companies and other solar experts was carried out. The sustainability reports that were used were already structured into environmental, social, and governance factors, however, they were not sorted into risks and opportunities per se. Some of the reports had specific recommendations for solar companies with respect to the different factors, and furthermore so-called “hotspots” for solar’s most critical impacts and consequences. The main findings displayed in table 5 are defined by content analysis which included a cross-checklist of frequencies found in the sustainability reports and furthermore had direct relevancy to the GRI frameworks. In table 5, the findings are categorised according to the ESG factors and furthermore classified into risks or opportunities.

Table 5: Key Findings from the Sustainability Reports (Scatec, Canadian Solar, and Solar Power Europe).

Sources and interconnected GRI Framework Appendix 10.2.

Screening of Sustainability Reports									
Firm	Year of Publication	Market	Environmental		Social		Governance		Source
			Risks	Opportunities	Risks	Opportunities	Risks	Opportunities	
Scatec Solar	2017 & 2019	Commercial, Large Scale	<ul style="list-style-type: none"> - Negative impact on biodiversity - increased transportation - noise, waste water generation -air travel 	<ul style="list-style-type: none"> -Conduct ESIA's for all projects - implementing resettlement and livelihood restoration plans - emission reporting (direct, indirect and others) 	<ul style="list-style-type: none"> - Injury rates at work sites - Lack of detailed reporting on spills (volume, material, and its impacts) 	<ul style="list-style-type: none"> - Conduct ESIA's for all project HSE key priority - engage security personnel at operational sites - monitor all subcontractors - Expand GRI reporting practices - Training personnel (human rights) 	<ul style="list-style-type: none"> - Operating in countries exposed to corruption - Partner/supplier different attitude to culture/values - Lack of female representation in the management 	<ul style="list-style-type: none"> - Cooperation with governments and local authorities - Risk assessments of potential partners - perform due diligence of potential suppliers 	2017: https://annualreport2017.scatecsolar.com/content/uploads/sites/3/2020/01/Scatec-Solar-Sustainability-report-2019.pdf 2019: https://annualreport2019.scatecsolar.com/content/uploads/sites/7/2019/02/Scatec-solar-sustainability-report-2017.pdf
Canadian Solar	2020	Commercial, Large Scale	<ul style="list-style-type: none"> - Not included the potential environmental upside that N-type modules could contribute to emissions reduction targets - Increased electricity intensity of the cell manufacturing operations - Waste intensity 	<ul style="list-style-type: none"> - Designed half-cell solar modules - Report detailed environmental intensity metrics covering all global manufacturing operations from ingot, wafer, cell to module - 3rd party Life Cycle Assessment - GHG Payback Time - Water recycling facilities. 	<ul style="list-style-type: none"> - Low female workforce % globally - High injury rates 	<ul style="list-style-type: none"> - Community commitments - Talent Strategy, Training and Development courses for locals - Decreasing injury rates 	<ul style="list-style-type: none"> - One of nine directors is female - Independent directors in the Sustainability Committee 	<ul style="list-style-type: none"> - Free of the conflict minerals illegally produced in operational countries - FCA training for all employees 	http://investors.canadiansolar.com/static-files/6108bde-2991-4365-b2a7-6d2d6111622
Solar Power Europe	2021	Policymaker PV value chain	<ul style="list-style-type: none"> - Exclude sustainability considerations to external supply chain actors - Current way of manufacturing goods is going to be rethought - High carbon electricity in manufacturing process - PV modules with Lead - Disruption of ecosystems, biodiversity 	<ul style="list-style-type: none"> - sustainable supply chain - Reduce solar's footprint, primarily on modules - carbon footprint calculation for modules - Ecodesign and Energy Label for PV modules - Promoting local PV manufacturing - Recovering the small fractions of valuable materials - Marketplace for second-life PV modules - Map out and integrate ESG considerations at procurement level. 	<ul style="list-style-type: none"> - Complex value chain - Study by Accenture Strategy found that more than one third of consumers in the UK will walk away from a brand when disappointed with its social stances - Poor risk assessment 	<ul style="list-style-type: none"> - Bringing benefits to local communities where solar panels are produced - Monitor supply chain labour practices and relations with local communities at large - Develop and implement a management system to address human rights within the organisation (third party expert advice) - Integrate human rights considerations into supply chain contracts and management 	<ul style="list-style-type: none"> - scrutiny and pressure from government regulators - sustainable corporate governance that ensures strong supply chain transparency 	<ul style="list-style-type: none"> - Not receiving public and governmental acceptance - Diversity in management 	https://api.solarpower.eu/openapi/uploads/2121_SPE_PV_Sustainability_Best_Practices_Benchmark_10_nr_42172946.pdf

By screening the report from Canadian Solar, it became evident that the Sustainability Accounting Standards Board (hereafter SASb) had released some sustainability disclosure topics that do not constitute material information today but could at some time in the future. The sustainability disclosure topics were pinpointed based on the frequency of relevant keywords in documents related to five publicly listed companies of the Solar Energy Industry. The results are displayed in a Heat Map, where a score out of 100 indicates the relative importance of the topic among SASB's initial list of 43 generic sustainability issues.

Table 6: SASB's Evidence for Sustainability Disclosure Topics for Solar Industry (2015)

Source: SASB (2015)

Sustainability Disclosure Topics	EVIDENCE OF INTEREST				EVIDENCE OF FINANCIAL IMPACT				FORWARD-LOOKING IMPACT		
	HM (1-100)	IWGs		EI	Revenue & Cost	Asset & Liabilities	Cost of Capital	EFI	Probability & Magnitude	Externalities	FI
		%	Priority								
Energy Management in Manufacturing	75*	92	1t	High	•			Medium	•		Yes
Water Management in Manufacturing	50*	-	-	High	•		•	Medium	•		Yes
Hazardous Materials Management	38	100	1t	High	•	•	•	Medium	•		Yes
Community & Ecological Impacts of Project Development	29	-	-	Medium	•	•	•	High		•	Yes
Management of Energy Infrastructure Integration & Related Regulations	63*	77	2	High	•	•	•	High	•	•	Yes
Product Lifecycle Environmental Impacts	44	-	-	Medium	•	•	•	Medium	•		Yes
Materials Sourcing	25	77	3	Medium	•	•	•	Medium	•		Yes

It should be stressed that SASB’s findings are based on five large-scale solar companies, naturally lessening the relevance for companies operating in Norway. Because of this thesis limitation of not going into techno-environmental details of the production of panels, which can be of high relevance for environmental risks and opportunities, the evidence from SASB can optimistically provide a guidance as to what companies may expect to include in their materiality disclosure and reporting.

6.7 Summarised PESTEL

Figure 6 presents the identified main external forces related to the ESG metrics that impact solar companies operating in Norway. The table is based on the PESTEL framework, presented in chapter 3.1, and divided into different factors.

Figure 8: PESTEL framework

<p style="text-align: center;">Political</p> <ul style="list-style-type: none"> ● Trade barriers/turbulent conditions in Europe ● Potential risk of corruption in producing/manufacturing countries 	<p style="text-align: center;">Economic</p> <ul style="list-style-type: none"> ● National and global market growth ● Investors increased focus on ESG reporting ● Higher willingness to invest in companies with sufficient reporting ● Interest rates 	<p style="text-align: center;">Social</p> <ul style="list-style-type: none"> ● Complex supply chains (difficulties of tracking), reliance on production in China ● Increasing consumer environmental and social awareness ● Human rights, equality, etc, increased attention and influential power
<p style="text-align: center;">Technological</p> <ul style="list-style-type: none"> ● Reliance on lead (Pb) and other conflicted raw materials ● More local supply chain 	<p style="text-align: center;">Environmental</p> <ul style="list-style-type: none"> ● New regulations and standards - current ways will be rethought ● Techno-environment externalities ● Water- and recycling management ● Electricity intensity used in production, manufacturing, and installation 	<p style="text-align: center;">Legal</p> <ul style="list-style-type: none"> ● National regulations: Åpenhetsloven (Transparency Act) and NUES ● Regulating industry standards for materiality and sustainable initiatives.

Note: Summarised PESTEL analysis for PV companies operating in Norway.

6.8 Summarised SWOT

Table 4.2 presents the identified key internal and external factors impacting ESG reporting for PV companies operating in Norway. The matrix is based on the SWOT analysis, presented in chapter 2.3, and covers strengths, weaknesses, opportunities, and threats.

Figure 9: SWOT Framework

Strengths	Weaknesses
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<ul style="list-style-type: none"> - Renewable energy sources attractive to investors - Solar power feasible in the Norwegian climate - Strong national policies on reporting 	<ul style="list-style-type: none"> - Reliant on China for production and manufacturing - Difficulties in tracking all suppliers and sub-suppliers - Long-distance production and transportation - High carbon electricity in the manufacturing stage
<p>Opportunities</p> <ul style="list-style-type: none"> - Achieve “best in class” status (opens a much larger selection of potential investors) - Setting KPIs and early monitoring for long-term tracking - Make equality in management positions a short-term priority - Social acceptance 	<p>Threats</p> <ul style="list-style-type: none"> - New regulations expected for the industry - Not being able to sufficiently report on the whole supply chain - Russia-Ukraine conflict escalates - Trade barriers harming supply-chains

Note: Summarised SWOT analysis for PV companies operating in Norway.

The SWOT analysis presented above in table 4.2 will form the base for a discussion regarding ESG risks and opportunities PV companies operating in Norway in the coming years.

Chapter 7: Discussion

The main purpose of this thesis was to understand if solar companies operating in Norway should take notice of ESG criteria, and if so, what criteria (risks and opportunities) in particular. The previous chapter exhibited the results from the data utilised to answer the main research question, while this chapter will discuss the findings. The results, together with the theoretical framework presented in chapter 4, form the basis for discussion in this chapter.

7.1 Importance of ESG for PV companies operating in Norway

As the introduction and background chapters highlighted, the past decades have been influenced by exponential growth in the number of companies that measure, report, and disclose environmental, social, and governance data. The motivation for doing so may stem from the ethical spectre, though the many studies documenting that ESG information is associated with lower capital constraints are not to be concealed. In fact, most literature agrees that ignoring ESG issues lead to missed opportunities for market growth as both consumer and investor preferences are becoming ever more in favour of transparency, disclosure, and green products. The green transformation in the financial market presents an excellent opportunity for Norwegian solar companies needing external capital to become profitable. The need for this capital was highlighted in the completed semi-structured interviews, where one of the companies predicted that it would take some years before they were operationally stable, and another that capital from investors was necessary for the short-term to hire the people needed to be competitive in the market.

Although literature confirms a correlation between ESG reporting and interest from investors and financial performance, no studies confirming or disconfirming the importance of ESG reporting for solar companies operating in Norway existed. The same applied for ESG risks and opportunities (given that ESG was of relevancy) that is of particular importance in years to come. The semi-structured interviews carried out confirmed that the solar industry is no exception for the growing demand concerning disclosure and reporting despite its “green nature”. All companies were confident that ESG reporting plays, and will progressively play, an important part in the time ahead, especially in terms of raising the necessary capital. There was also a very concrete example demonstrating its contemporary importance; an ESG questionnaire from a (potential) investor for Otovo. Due to ethical and confidential reasons, the original document will not be presented, though some general information can be shared:

- The document consisted of 79 questions concerning their environmental, social and governance performance or status. This included:
 - Questions regarding their measurement, e.g., do they have an external verification on their ESG reporting?
 - Questions concerning the business’ oversight on ethics and corruption issues

- Share of female board members
 - Management the ESG performance of suppliers and contractors
 - Several questions concerning incidents at work
 - Emissions intensity of various greenhouse gases
- 27/70 questions were marked in red which meant that specific reporting would become mandatory for SMEs (Small and medium-sized enterprises) from 2022 and further on.
 - A declaration saying that to receive a full score, external links supporting the information were necessary.

These insights underpin the data retrieved from the interviews. They also confirm a previous hypothesis, namely that some investors are looking for sustainability pioneers, following the ‘*relative/best-in-class screening method*’ (ch.6.1.3), for their portfolios and expanding criteria beyond mandatory reporting metrics.

7.1 ESG Risks and Opportunities

The next section will discuss what ESG risks PV companies operating in Norway should take particular notice of in the coming years. The data foundation of the discussion is a result of the weaknesses and risks identified in the PESTEL and SWOT analysis.

7.1.2 Environmental Dimension

Although solar energy is a renewable energy source, and conceivably viewed to be an attractive investment, the data has demonstrated that there are several factors or risks that speak negatively for the energy source, especially that of its origin and production. The SWOT analysis reveals that the biggest environmental weakness with respect to the environmental dimension of ESG is the long-distance production and transportation of panels. Consequently, reporting environmental impacts through the whole production- and manufacturing stage is difficult, especially when considering that the PV industry is reckoned to have a very complex supply chain. According to Solar Power Europe (2021), some physical aspects of the production (e.g., solar PV module efficiency) can be detected without necessarily going into detail about the supply chain. A more problematic aspect is that complete producers (or full vertical integration producers) are very uncommon, where levelized production tracking is

difficult. Some may only produce wafers, cells and modules, others merely assemble modules, and some integrate silicon production (Solar Power Europe, 2021). Consequently, module suppliers may not have fast access to the data required which was collected at earlier phases of the supply chain, overall making complete transparency impossible. Having in mind that new and more comprehensive regulations and requirements for environmental disclosure are expected, in addition to extensive ESG questionnaires from Norwegian investors (exhibited in ch.7.1), a failure to report on all environmental factors of production throughout the whole supply chain constitutes a risk.

With a change in viewpoint, it is possible to reckon that this weakness also presents an opportunity. As the data revealed, increasing trust with commercial partners and consumers by ensuring high levels of transparency in the supply chain will help in gaining a competitive advantage. For instance, in the case of Otovo, if they successfully and trustfully can answer received ESG questions, or in a longer perspective, can prove that they will put effort into filling possible shortcomings, they are more equipped and prepared for upcoming funding rounds (both national and international). The participant in Solenergiklyngen pointed out that the Norwegian solar industry consists of many SMEs who fall short in capacity in terms of understanding and implementing the necessary reporting measures to stay competitive. She suggests that this might entail that larger companies lead the way when it comes to ESG reporting and disclosure, presumably as they to a larger degree depend on it to satisfy all internal and external stakeholders and fall under regulations exclusively set for bigger-sized companies (e.g., Transparency Act). Revealed through content analysis, solar industry pioneers are conducting large and comprehensive sustainability reports pointing out critical hot spots and advances in research on environmental disclosure, which smaller Norwegian SMEs can take advantage of. It should also be mentioned that the potential gain of taking the opportunity only will grow as the respondents from now expect even a larger shift in green investments, especially when interest rates are low, where PV's feasibility with hydropower comes forth as a strength. Furthermore, with respect to production weaknesses such as high electricity intensity and long-distance transportation, an ESG opportunity is put in an appearance if companies factually can demonstrate measures lined up or taken to improve negative hot spots.

SASb's Evidence for Sustainability Disclosure Topics for Solar Industry also highlights some more explicit disclosure topics in which they expect will be key material issues for the solar

industry, namely energy- and water management in manufacturing, hazardous materials management, community and ecological impacts of project development, management and energy infrastructure and related regulations, product life cycle environmental impacts, and material sourcing (*see table 6*). Although evaluating these issues in more detail goes beyond the breadth of the study, a general recommendation is to ensure that these topics are accounted for and measured.

7.1.3 Social Dimension

Awareness of social issues (e.g., human rights violation, health and safety, diversity and non-discrimination, respect for community rights, anti-corruption) is at an all-time high, owing to increased scrutiny and pressure from government regulators, customers, institutional investors, and the media. From a global perspective, large firms in the EU are already subject to social reporting obligations (Non-Financial Reporting Directive of 2014), though according to Solar Power Europe (2021), the legislation falls short of a comprehensive approach to sustainable corporate governance that assures robust supply chain openness and full information exchange. Therefore, several countries have imposed national regulations targeting the social dimension of ESG, including Norway. All three interview participants called attention to Åpenhetsloven (Transparency Act) when discussing the social dimension of ESG. It was enacted in June 2021, and it will take effect on July 1, 2022. Conceivably, the act goes the furthest in terms of safeguarding fundamental human rights and acceptable working conditions for products and services (Krajewski et al, 2021):

“The Act shall promote enterprises' respect for fundamental human rights and decent working conditions in connection with the production of goods and the provision of services and ensure the general public access to information regarding how enterprises address adverse impacts on fundamental human rights and decent working conditions” (Lovdata, 2021).

It only applies to firms that meet at least two of the following three criteria:

- Sales revenue of over 70 MNOK
- Balance sheet revenue of over 35 MNOK
- Minimum of 50 full-time employees

Approximately 9000 enterprises in Norway will be affected, including Otovo and several other PV firms operating in Norway. For them, some sections are of exceptional importance:

- **S.4: *Duty to carry out due diligence***

- a) “identify and assess actual and potential adverse impacts on fundamental human rights and decent working conditions that the enterprise has either caused or contributed toward, or that are directly linked with the enterprise's operations, products or services via the supply chain or business partners”
- b) “implement suitable measures to cease, prevent or mitigate adverse impacts based on the enterprise's prioritisations and assessments pursuant to”
- c) “implement suitable measures to cease, prevent or mitigate adverse impacts based on the enterprise's prioritisations and assessments pursuant to”, and d) track the results

- **S.5: *Duty to account for due diligence***

- b) “..information regarding actual adverse impacts and significant risks of adverse impacts...” and c) Information regarding plans to mitigate or cease actual adverse impacts

- **S.6: *Right to information***: “any person has the right to information from an enterprise regarding how the enterprise addresses actual and potential adverse impacts pursuant to Section 4”.

The above-mentioned points are directly linked with information sharing and disclosure regarding topics relating to the social dimension. Seeing as the interviewed participants put forth difficulties in monitoring human rights and other social aspects in their supply chains and with subcontractors, the Transparency Act poses a weakness, or in the worst case, a threat if obligated companies fail to comply. Case in point, a survey carried out by Accenture Strategy found that more than $\frac{1}{3}$ of consumers in the UK will walk away from a brand when disappointed with its social stances. On another note, and in accordance that firms can report on all standards necessary, the strong national regulation also poses a strength as it may attract international investors who want to secure social transparency. As indicated by the participant from Otovo and seen in the Transparency Act, the regulations applicable for solar companies today are not targeting specific benchmarks or rates (e.g., injury rate less than 1.7). Instead, it requires disclosure of materiality, which presents an opportunity. For instance, through content

analysis of sustainability reports, injuries at work in producing countries were identified as one of the most critical social weaknesses. It was evident that the companies responsible for the reports had dedicated a lot of time to reduce the risk of injury at work, as early tracking records allowed them to display that the rate was continuously decreasing. Hence, a weakness may be the difficulty of monitoring the whole supply chain, but an opportunity presents itself if resources are laid into measuring key social materiality, where companies at a later point are able to display and verify positive progression. This is arguably equally important for SMEs. Although some criteria on disclosure do not apply to them as of today, all participants highlighted that new regulations and comprehensive guidelines, including more standardised terms of sector-specific materialisation, are expected for the industry in the near future. The uncertainty surrounding new regulations naturally poses a threat, though arguable, efforts into sufficient and trusting reporting measures will not be in vain, even if it takes years for regulations to catch up with investor- and customer demands. In this context, the reports analysed put forth the importance of having external verification from an external third party (e.g., an auditing firm) to increase reliability for stakeholders and shareholders.

There also exist risks and opportunities which are not embedded in complex supply chains. As noted by the participants, sustainability reports and the GRI Framework (GRI 405), equality in management positions is arguably a strong focal point in today's business environment. Discrimination metrics, or diversity metrics, are in contrast with the complex supply chain monitors, very straightforward and easy to measure. Put differently, if companies have a lack of diversity in high positions, this information is very visible to investors and customers, and in all probability, causes reputational and legitimation issues for companies. Hence, it is of utmost importance to take 'diversity and equal opportunities' seriously. By ensuring commitments to diversity, equity, and inclusivity, not only will companies increase their social performance, but also gain greater interest from investors (PWC, 2022).

7.1.3 Government Dimension

The government dimension was the least debated topic with reference to the interviews, perhaps signalling that this causes less concern for solar companies operating in Norway. Otovo mentioned Norsk utvalg for eierstyring og selskapsledelse (NUES) (Norwegian Committee for Corporate Governance), a private regulation that presents a national recommendation for corporate governance, where the purpose of the recommendations is to

increase confidence in companies among shareholders, the capital market, and other stakeholders. The recommendations are not forced by law, however, Oslo Stock Exchange demands that companies applying for listing on its stock exchange follow NUES unless some deviations can be justified. Point 1 (*Statement of Corporate Governance*) brings up the concept of CSR, and arguably resembles the concept of ESG reporting as it recommends that the board of directors sets up appropriate systems for risk management in relation to the scope and nature of the company's operations. It is difficult to draw any firm conclusions on potential risks and opportunities related to NUES, though arguably, a problem of legitimacy can arise if a company fails to convince stakeholders and shareholders that they take social responsibility seriously. As regards solar companies operating in Norway, a weakness originating from Chinese supply chains and sub-contractors can again be identified. In particular, corruption poses a governance risk. The World Bank (WB) carried out comparative studies on the global quality of governance and corruption, where they concluded that corruption was widespread throughout Central Asia (Mark et al, 2007). Also, a report by Transparency International (TI) observed that the energy sector was the third bribery-prone sector amongst the 19 sectors analysed (Al-Kasim et al, 2013). Possibly, this makes the prospect of energy investment in these areas risky because of the consequences of corruption (e.g., low transparency, weak governance, and poor accountability), and is a highly concerning issue in international investment disputes that overall poses a risk. Being an external risk, this is certainly not something Norwegian companies operating in Norway can take full control of. Though, it is recommended that the companies monitor supply chain practices and relations with local communities at large, take a proactive stance towards an absence of corruption and have contractual purchasing processes geared toward a supplier performance that go hand-in-hand with the Zero Tolerance of Corruption Plan which serves as a guide and code of conduct for suppliers.

It is further of interest to shortly discuss the findings related to the ongoing conflict between Ukraine and Russia, and how this may affect PV companies operating in Norway. It is impossible to forecast the long-lasting impacts that the war between Russia and Ukraine will have on the solar industry in Norway. From a short-term perspective, it is possible to argue that the EU's necessity for energy, and favourably renewable energy, can cause a higher willingness to invest in renewable companies, both from governmental and private investors (this may also cause less necessity for comprehensive reporting measures, as ESG becomes rather immaterial). The risky part is that the EU's goal of independence from Russia implies more

dependence on China because the absence of Russian gas imports causes a termination of so-called ‘transition fuel’ (fuel which is supposed to be phased out as access to renewable energy increases). And, as a common denominator in this thesis, China’s chokehold on the solar supply chain does not come without risks (e.g., human rights, possibilities of corruption, energy-intensive transportation of materials). Also, assuming that the conflict spread out to more countries, political turmoil can lead to more barriers in international trade, e.g., with China, threatening all operations (Reuters, 2022), and furthermore decrease the access to installation workforce.

7.2 General Discussion

In the above-mentioned discussion, it is very clear that most of the risks are associated with being extremely reliant on production in China, which again raises risks associated with ESG monitors of the supply chain. Not only is it difficult to gather accurate and comprehensive information about the stance of various social, environmental, and governance aspects, but it is also many risks associated with the supply of raw materials, potential political conflicts that may turn business models upside-down, and even risks associated with political turmoil that threatens production and transportation. It is also difficult to make accurate conclusions of what ESG materiality issues investors will be most influenced by as regulations or guidelines for the solar industry are yet to be determined, which naturally limits the study. That said, some general recommendations can be made with respect to mitigating ESG risks, namely, to use the GRI Framework on materiality issues that are not industry-specific, use the SASB standards to locate potential gaps for more sector- and environmental-specific disclosures, secure diversity and equality in all management positions, and determine early KPIs to demonstrate plans of progression and track improvements over time.

Chapter 8: Conclusion

Environmental, social, and governance (ESG) reporting has become critical to attracting investors in recent years. Despite the solar industry’s green nature, the thesis has demonstrated that they by no means are an exemption from fulfilling investors' demands of ESG disclosure and performance today. As raising capital is important for solar companies operating in Norway

in the next few years, it is crucial that they establish sufficient and valid reporting measures to make sure that they do not miss out on the growing pool of sustainability-minded investors that uses ESG in their investment analysis. Today, no specific ESG criteria for the renewable energy industry has been defined, meaning that it is difficult to forecast precisely what is in store for the solar industry in Norway. However, literature reviews, semi-structured interviews, and content analysis of sustainability reports and reporting frameworks have allowed a broader identification of ESG risks and opportunities that will be influential for the solar industry with respect to gathering external capital in the coming years.

The ESG risks identified are by and large a result of being reliable in China for production and manufacturing. Foreign production causes direct risks to all the three dimensions of ESG, and most of the risks are associated with the complexity and difficulties of monitoring and tracking all ESG metrics investors assumingly want. Reconceiving the issues, it is also possible to argue that putting resources into bridging monitoring gaps should be a key priority for PV companies operating in Norway. This is particularly important when taking into account that ESG disclosure demands from investors are most attentive to efforts taken to address risks. Having said that, it is difficult to pinpoint exactly what reporting risks and opportunities solar companies operating in Norway should be attentive of as it is still a lot of uncertainty regarding new expected regulations. However, some more explicit and manageable opportunities have been identified, namely to secure diversity and equality in all management positions, establish KPIs, and monitor expected materiality standards to track improvements over time.

8.1 Future Research

PV companies operating in Norway have, as everyone else, a growing responsibility to secure that their operations have good environmental, social and governance practices. This responsibility does not only extend to operations carried out within the walls of the office, but also all operations directly or indirectly linked to their product or service, including those of their suppliers and sub-contractors. As demonstrated throughout the study, this responsibility comes with several risks, predominantly caused by the difficulties of measuring, controlling, and disclosing all-important ESG aspects that investors may demand. The present thesis did not have sufficient data to identify the difficulties more in detail, e.g., what criteria are most tangled to determine/measure, where a suggestion is that future research should focus on

uncovering this in more detail. This could also entail studies focusing on the different production sites in China. Additionally, it would be very interesting to perform a similar study with data gathered from investors and not solar companies, as it would be beneficial to know how they perform their ESG analysis, what criteria that is of exceptional importance for them, and what reporting frameworks they use to determine materiality for specific industries.

Chapter 9: Sources

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Chapter 10: Appendix

10.1 Semi-structured Interviews

10.1.1 Interview Guide

Research Question: Why is it important that solar companies operating in Norway take notice of ESG criteria?

1. How important is it to find investors from the capital market?
2. How competitive is it to find investors from the capital market today?
3. How competitive do you expect it to be to find investors from the capital market in 3-5 years?
4. How competitive do you expect it to be to find investors from the capital market in 5-10 years?
5. What are some critical questions investors typically ask?
6. What are some critical questions customers typically ask?
7. What are some current demands from investors which did not exist 3-5 years ago?
8. What is your definition of ESG?
9. How important is the role of policy funding with respect to the Norwegian solar industry?
10. Why do you think it is important that Norwegian solar companies take notice of ESG performance today?

Research Question: What ESG risks and opportunities will become particularly important in the coming years?

6. What are the most critical issues with respect to social factors?
7. What are the most critical issues with respect to governance factors?
8. What are the most critical issues with respect to environmental factors?

9. How important is the role of policy funding with respect to the Norwegian solar industry?
10. How can the Russia-Ukraine conflict affect Otovo and other Norwegian solar power agents?

Transcript

Note: All interviews were carried out in Norwegian. The coming transcriptions have been translated by google translate.

Colour code

Yellow: Data quoted in Results

Blue: Interference/questions from interviewer

Green: Question from participant

10.1.2 Interview Otovo

Participant: Lars Ekeland (general council)

Date: 04.04.2022

Place: Otovo's office in Oslo

Lars:

Both investors are concerned about it, and customers are concerned about it. There are also demands from the authorities on, in increasing demands on how to operate, and especially what is reported by information about work on ESG or sustainability. And to that, if we start with what is a requirement, it often has a bit to do with how big the company is, what requirement you have to follow. If you are listed on the Stock Exchange or have more than 200 employees or such a large turnover, you come under rules that go on reporting sustainability, or how the company affects society and the environment. And there are some rules in the Accounting Act, there are at least a number of government requirements that we work with and meet. So we have made a boost to it this year and still have a lot left to continue working on it. There is also a lot of news from the EU in particular, that you have to report on various parameters, especially on climate. How the company affects CO2 emissions and how one can somehow green or not

in line with what the EU calls the taxonomy. So there are government requirements, and then there is on E, ie environment, a lot on taxonomies and rules around it, on Governance there are guidelines that may especially apply to listed companies, in Norway there is something called NUES, which is a Norwegian corporate governance body or forum that makes recommendations, for how to run companies. Also on social, there are rules in the Gender Equality Act, on gender equality and anti-discrimination. There are also new rules in the Transparency Act, more how to influence human rights, that you do not violate human rights. One thing is in your own business, but also in the supply chain you use. For us, it will typically be questions that have been raised, but in a way, we have a lot of Chinese products. Is it the exploitation of Uighurs or are some of our producers involved in human rights violations? This is something we increasingly have to report on. And there it is on everything that applies to ESG reporting, then there is a lot that, it is not very like that, directly in rules, it is not like “you can not emit so much CO2 rules, more that you have to provide information about what you release. It is also the intention that when investors and customers receive information, they will choose producers who are good at ESG. Or manufacturers and companies like. I also think so for our part, so what we do is good in a way. We make sure that people install solar panels that produce renewable energy, and that largely replaces gas and partly coal in Europe. And also in Norway it is the case that even though we have a lot of hydropower here, it is the case that when we import electricity from Europe when there are high electricity prices here or cold for example, it is often gas and coal power we import that we replace, or we can hide on water in the summer or rather use it in the winter in such water reservoirs, then it will have an effect - also in Norway. Our biggest emissions are also related to the production of panels that are produced in China. So we have calculations on how much we emit and how much positive impact our facilities have, etc. So all this is in the annual report, you can check it out. Then it is the case that investors are increasingly concerned about this, and it has to do with both the general trend in the market and the world, now people are beginning to understand that here you have to do something about climate change sooner than later. But then it is also the case that there are rules that funds and owners of shares must report on the type of companies they invest in and if there are such fund companies for example, their customers will again be concerned that the investments are sustainable . And then there are some who are concerned about it because you have to achieve climate goals, etc., but it is also to a greater extent so that companies that are not sustainable probably do not have the right to life if you look further ahead. And it can both be the right to life because you will not, for example, be in demand in

2050, but it can also be in the short term that things are banned or that you actually have to change the business. So there are some direct requirements for companies like us, there are also owners who have even stricter requirements on how we report and how things work, or what kind of investments we make. So what we experience is that investors come and demand details about our business and what we have of CO2 emissions and how we handle waste, whether we buy quotas for business travel, lots of different questions. And they expect us to provide information about such things. And what we do then is sort of twofold: one is to try to provide as much general information as possible in our annual report in particular, so that for many it will be sufficient. We also save on more direct inquiries, last year we filled out such a questionnaire from DNB which asked lots of questions about how we were. I can send you that so you can check out what they are asking for. So just do not share it with too many people.

Sabine: You talked about investors asking a lot of questions, have you heard anything directly from customers?

Lars: Yes, you can say that our customers ask something, but it's like them .. most when they come to us it is to buy solar cells, so many have a kind of commitment at the bottom when they buy solar cells . Also, there are a good number who are only concerned with how much they can save on electricity costs by having solar cells on the roof. But in a way it is those who are very critical and think that solar cells have a negative effect or think this is just nonsense, they are not necessarily our customers. We do not get many critical questions from our customers, but there have been, for example, an article last year, where some professors in Bergen had calculated that it was not profitable for the climate to install solar cells in Norway. And we did not bother to accommodate because there was so much we had to grab the article, also they did not get much more attention around it, so this we do not bother to answer. There are some who claim that this is not good for the climate, so we have calculations that prove the opposite. It's a bit like that the further south you get in Europe, the more power a panel will produce. So in the calculations we have, it is as if the production of the panels produces some emissions, but then the green electricity that is produced will replace brown electricity to such an extent that it often outweighs the small emissions that are associated with the production of the panel. But it is clear that if you put a solar panel on the North Pole, it is not a given that it gives very good production up there, and it is not so good for the environment either. But, there are no

challenges in the countries we are in. But so the customers are somehow less focused on this I would think, at least relatively speaking investors and authorities who demand. And it's not because customers are not concerned about the environment, but those who choose to buy solar panels have in a way a kind of idea that it is wise both for the environment and for the wallet. Whether it's us or someone else, I do not think there are so many critical questions from our customers then. But there are some questions you can get, it is also what concerns more human rights, value chains and such things you will also be able to get questions from customers.

Sabine: How difficult, competitive is it to find investors today?

Lars: It fluctuates a bit of course with how the market conditions are and such. But in general, there is very good access to capital within the company that does well, and much better than it was 5 years ago. But it has both with this that there has been a green shift in the mindset of investors that we should only invest in green, and in addition, otovo has gone from being a business idea and wise minds who have not proven anything, to this is okay these are people who get things done and have gone out to 7 countries and sell solar cells. So then there are more people who want to invest money in such a business than where there is a very early phase. There is a big change in market views on green investments in general, it is also the case that Otovo has grown in maturity.

Sabine: Is 5 years the benchmark for change?

Lars: I think the shift started to happen four / five years ago yes. It was he you central bank governor in England who gave a speech in 2015, breaking the tradegy of the horizon, I can send it to you. It is in a way the first time someone so high up in authority among central banks and similar authorities gave such a clear message that here one must start thinking about the climate. It was also a little later, then it was Black rock, which is the world's largest investor, they invest via funds / fund managers, invest a lot of money on behalf of people, and that was, he Larry Fink, who is the boss of Black Rock had a letter to the companies they invested in, do not quite remember the date but it was such a mindshift in how big investors started thinking about green investments. And somehow this is in a way some such major key events, but it has happened quite a lot in recent years, and perhaps especially the last 2/3 years, which I think makes companies like Otovo have attracted many investors. There is also such a more financial

thing here then, which is because like Otovo, we do not make a profit today, now it is growth that is point 1, we also make money on every sale we make, but it is not as of today enough to cover the total costs that people like me, who do not work with sales and other things, I work more legal things and finance and different things, But when we sell enough units we will eventually go with enough profits.. “If you invest in Otovo, you take a bet today to win jackpot in a few years”. And such type of growth stocks or such type of growth cases as we are, investors are very interested in when there is low interest rates, because then there are poor estimates of investments in general, so when interest rates go up there will be such dynamics that growth companies struggle a bit more. So there is more of that general thing that has nothing to do with the green. When interest rates are low, access to capital for a case like Otovo has been quite good.

Sabine: How will the Russia-Ukraine conflict affect Otovo and other Norwegian solar cell companies?

Lars: I think that provided that the conflict does not escalate outside Ukraine, because it will have some other effects if Russia suddenly tries to enter Poland, it would be negative, but if we assume that it does not escalate beyond Ukraine, it is now quite march order in the EU that we must become independent Russian gas, and they will invest quite a lot of money in renewables, including solar, and that in isolation is very positive for us. When it was announced at the beginning of mid-March, our share price went in a very positive direction. And in general it is also the case that the demand for our products, one thing is that the EU provides subsidies but also the underlying people think, that I do not want to have Russian gas in my outlet or in the pipes in the house, I would rather have self-produced electricity - there are many more who think that way. For our demand, the incident is positive in isolation, it sounds awful to say, but if you look in isolation, it is not negative on demand, but it can have more impact on delivery on the things we are going to sell. For example, if China were to be involved in this, it would be bad to supply solar cells as all panels are mostly produced there, and also to a certain extent something on labour. There are not many Ukrainians who have been working around in the countries we have, but in Poland we have seen that there have been suppliers who have had Ukrainian people at work who have now gone home to fight, so quite a hefty scheme .

Sabine: can one move production to European countries (mtp natural resources)

Lars: it is not so easy, and the reason why solar cells are produced in China now is that they standardized and made large-scale and managed it much better than everyone else managed it. So all manufacturers in China agreed that a panel is 4 * 2 metres, and they all make and use the same, and everyone can use the same warehouse / containers / logistics, also there is no doubt that there is cheaper labour in China than in Europe. With natural resources, some of the input factors or raw materials used in production are also produced in China. So as of today, there are some manufacturers outside of China, but it is not on the same scale. So it takes enough time to be able to compete with the Chinese in producing hardware.

Sabine: Are there any support schemes for solar cell companies today?

Lars: There are no subsidies for companies but for private individuals who buy. You get NOVA support in Norway, where there is a basic support of NOK 7,000 I think, there is also a support above that, or 7500, also NOK 2000 per watt that is installed up to a certain limit, so in total you can get NOK 47500 in support of Nova.

Sabine: Is this the same in all countries?

Lars: Unfortunately, it is different in different countries. In Norway, there is almost no such cash benefit, you get cash if you install solar cells, while in some other countries you can get a tax deduction if you have paid so much for solar cell installation. It varies a bit, but in some countries there are some quirky local schemes and. But there is hope that those processes in the EU will flow and shape things a little more. At the moment, the existing arrangements are a bit patchy.

Sabine: Are there any trade blockades, for example if foreign players want to enter the Norwegian market - is it possible as it is set up today?

Lars: If you are going to install solar cells in a country, the electrician must have a permit from the EU regulator. But like us, we do not have the permits, we use the local artisan companies. For us, there is no barrier if we are going into another country. Similarly, others can do as we

do, there are not many who have done it. Say that Norway is not a very large market so most people might want to look at Germany, France and Spain and such.

Sabine: How many companies have come in the last 5 years? Norwegian or operating in Norway?

Lars: I do not know, but it is quite fragmented. There are somehow not very many large players outside Otovo, but I think maybe there are 30-40 companies that supply solar cells, and before Otovo started there was almost no one who did it in Norway, In Norway the market is created a bit by Otovo while in other countries it is different.

Sabine: How big is the market?

Lars: I have some statistics on that. There is something, Nova has some statistics on how much they provide support so you can count back on how many facilities there are. In Norway, there are 4-5000 plants in raw materials now, where Otovo has about half. Then there is probably an expectation that it will grow a lot. But I think we expect. Yes no I do not know I, think it doubles in 2-3 years. I can find better numbers on this then.

Sabine: It is only private individuals you go to, not commercial buildings?

Lars: There are three segments for solar cells, private individuals, commercial buildings and large solar parks. Scatec solar park and we who are at the other end of the scale in the private market, there are also a number of players who operate commercial buildings, factories and larger installations.

Sabine: ...and not considering?

Lars: No, not yet, because our strength is that we are able to plan this facility. It needs 12 panels and so much scaffolding, and 14 km to drive, all online. These are just in-and-out operations, know everything I need to have in the car, very simple things. In a small facility, it is first if you are going to travel, make an inspection, check out the roof, this is a big extra cost, but if

you are going to install facilities with 400 panels, the small extra trip will be less part of the total price. Therefore, if there is a huge facility that we were to design, we had to take a very small margin, could not take a large margin. Therefore it makes more sense for us to be in the private market. Example: Foodora at a company party.

10.1.3 Interview Solenergiklyngen

Participant: Trine Kopstad Berentsen

Date: 06.04.2022

Place: Teams (online)

Sabine: How important is it to get external capital or have investors for the next 5 years?

No, it's not very important. It's important now, because now the volume has come up. Now the industry must take the step further, but for the time being it has its own capital in a way. Some of them have made investments to grow a little faster.

Sabine: Have you heard of any companies where past or future investors have asked some critical questions about what they need to report on?

Yes absolutely. Especially in relation to the Norwegian companies that operate in foreign markets, investments from large discoveries, so it is important to have good reporting. You may not actually be allowed to operate.

Sabine: Do you know how detailed the reports must be?

No, I have not gone into that, but it is the case that we work with specific things that are important there, so they both for their own part business ethics, **but also because there are criteria if you are to have money from international funding. Especially around ethical value chains. Have good routines for that.** We are working to get that in place now.

Sabine: How important are the subsidies?

Only important in a part of the market. Detached market - residential. There it is still important. But it is not important, more in a way regulations, framework conditions that are important than subsidies as it is today.

Sabine: Have you ever experienced that customers have asked some critical questions about where the solar panels come from, is that a topic?

Yes it is a topic for public purchasers. And Oslo municipality, etc. And it is also because those questions are pushed forward on the current schemes, it is very important to focus on public purchasers, so that they can be more sustainable.

Sabine: How can the Russia-Ukraine conflict affect Norwegian solar actors?

Yes, we actually had a meeting with soltreno now but have not seen yet. But then Ukraine was a topic in relation to how we do it further. It is easy to assume, already now there is an energy crisis so the demand will be much higher for solar cells. It takes off completely.

Sabine: Do you think that if the crisis were to escalate out of Europe, if there was an even bigger energy crisis, there would be even more demand for solar cells from the Norwegian market?

Eh, I find that difficult to say because we are in a way connected in the European market. I think it is a long way to go before solar cells become so dominant in the Norwegian power mixes that we can be bigger in Europe. We are not quite there, but in the future maybe?

Sabine: Is it important that Norwegian solar cell companies invest a lot of resources in getting good ESG performance?

Yes I think it's important. Also, the solar cell industry and the Norwegian business community consists of a lot of SMEs who do not have the capacity to understand this, the big ones are probably leading the way and it depends on it, the big ones can teach the small ones. I think it is more and more important now with legislation and guarantees that the Norwegian solar cell market depends on in the future. I think it plays an important role.

Sabine: What new regulations do you think will be decisive in the Norwegian market in the coming year?

Trine: Regulatory changes in general or in relation to financing and this theme here?

Sabine: Yes more what you come up with, thinking more in a reporting context.

Yes, the law of openness comes from the New Year, so greater transparency, clarification and business practices, these things change so you do not know exactly what is happening, for example the taxonomy. But the Transparency Act will apply to the largest already from the New Year. So we do not know exactly what it means but beyond that we know that regulations are very rapidly changing. It goes in a way on the financial. But of course changes in regulations around the development and construction of solar cells on buildings and slopes, this type of regulation is a bit like that for a trip since it is a product of a regime that depends on the monopoly's situation with hydropower. Now it's not like that anymore, now there are many other competing ways to produce power. Rules depend on the technology, which is not entirely unusual.

Sabine: What is the most critical factor associated with G, S, and E?

One must be very aware of this. 95% of solar cells are bought from China. And even though there is now a huge investment in Brussels and in Norway, where we are leading the investment, it is to take the value chain back to Europe. Is both about making the goods but also how it is produced. That it is sustainable, both the social, business, quotas, etc., human rights is an important part of it. It is underway, but we will still be dependent on buying internationally if we are to compete with the toughest in an international market. So there is the biggest risk that we do not always know how production is done in China. If you are a supplier, you can follow up, but avoid.

Sabine: How easy to move production of the materials needed to European countries, not Russia.

Yes, no where are we going to get it from? What are the alternatives, I do not know, but we will probably find out eventually. What we have to deal with are our wholesalers in Norway, and it is they who have to solve it there, not me. You know, my colleague was at a seminar last out. Solar power Europe, there they had a visit from one of the EU leaders, and she said that only "whatever it takes" is good enough to take value chains back to Europe. Of course, it's a lot about jobs, etc., but also getting goods, it's slow, it's expensive, it's unpredictable, prices have gone up from the time they were ordered until they came over the purchase. How fast can it go? The EU has shown that they have an insane ability to implement, we have seen that in

relation to the UR crisis, even though the energy crisis, we are introducing the green power EU. They will have to do it, I think it can go pretty fast, but of course, it is a big ship you have to steer, I think it is difficult to predict the number of years, but did not take very many years before China became very dominant, it was Germany and Europe before.

10.1.4 Interview Ecosol

Participant: Jon-Ola Pedersen (founder)

Date: 06.04.2022

Place: Telephone

Sabine How important is it to get external capital or have investors for the next 5 years?

That's probably important. If we are to expand and meet the market that is coming, it is important.

Sabine How important is it to get external capital or have investors for the next 5-10 years?

The most important thing is now the next 5 years. Hopefully we will get back on our feet and manage to grow organically after that. But that is the capital you need now to reach a greater level of employment. I think then - no final decision, but that's what I have in my head.

Sabine: Have you experienced that investors have asked any requirements or critical questions about ESG factors or what you should report on?

No, we do not have any investors yet. This is an area we are going into now after this season, then we will get investors, so it will probably come. But I have no answer to that question since we have not encountered it.

Sabine: How can the Russia-Ukraine conflict affect Norwegian solar actors?

For our part then, ecosol's part, they are the only ones cultivated, we are a niche company in solar cells, we are the only ones that operate with building-integrated solar cells. And it goes without saying that we must be interdisciplinary. A large part of our job since we deliver roofs, solar cells that are your roof not on another roof, there are building-integrated solar cells BIPV, so a large part of our delivery is also metal, plumber, we must deliver totality. And there we are probably affected, because steel prices and availability and raw materials are part of what we live on and we need. So yes I think it can have an impact, hard to say. I do not think relations with Russia will improve in many many years and they supply an incredible amount of steel to the European market.

Sabine: How easy to move the production of materials needed to European countries, not Russia?

Yes, no where are we going to get it from? What are the alternatives, I do not know, but we will probably find out eventually. What we have to deal with are our wholesalers in Norway, and it is they who have to solve it there, not me.

Sabine: What is the most critical factor associated with G, S, and E?

Most negative now is perhaps the uncertainty about how working conditions and emissions around production are in the East. Because it is speculated that 90-95% of all solar cells are produced in China, how is that done? The cost of transport to get this to Europe by boat, it is CO2 footprint. Could wish that solar cells could have been more short-distance than it is, that is what we are looking for when we are going to find new products. There are also many suppliers who are concerned that things should not be from China anymore.

10.2 Content Analysis

10.2.1 Sustainability Reports

Sources *Table 5*:

Scatec Solar (2019): <https://scatec.com/wp-content/uploads/sites/7/2019/02/Scatec-solar-sustainability-report-2017.pdf>

Canadian Solar (2020): <http://investors.canadiansolar.com/static-files/e10bbede-2991-4365-b2a7-fd2da6111e22>

Solar Power Europe (2021):

https://api.solarpowereurope.org/uploads/2121_SPE_PV_Sustainability_Best_Practices_Benchmark_10_mr_4217f294fe.pdf

10.2.2 Content Analysis Coding

Topic	Main Findings	GRI Framework	Paper
Environmental	<ul style="list-style-type: none"> - Procurement practices supply chain - Energy intensity, transportation and materials - Management of waste 	GRI 204 GRI 301 + 302 GRI 306	Scatec, Canadian Solar & Solar Power Europe
Social	<ul style="list-style-type: none"> - Assuring human rights (all GRI 400) - Equality in management positions - Supply chain monitoring - Injuries at work 	GRI 412 GRI 406 GRI 405 GRI 414	Scatec, Canadian Solar & Solar Power Europe
Governance	<ul style="list-style-type: none"> - Anti-corruption 	GRI 205	Scatec & Solar Power Europe

Note: The content analysis was carried out in two phases: The first was to identify list of material topics and key topics and concerned raised (GRI 102-47) in each report. After, the GRI frameworks was used to identify the topics of reporting interest. Thirdly, the main findings were determined based on frequency (e.g., number of words on a topic relative to other sections).

10.2.3 Scatec Solar GRI Database 2017-2019

Scatec Solar - GRI Index 2017-2019

Indicator	Description	Unit	2019 data	2019 reference	2018 data	2018 reference	2017 data	2017 reference
GRI 102-14	Statement from senior decision-maker			Annual Sustainability Report, pages 4-5		Annual Sustainability Report, pages 4-5		Annual Sustainability Report, page 4
Organisational Profile								
GRI 102-1	Name of the organisation			Scatec Solar ASA		Scatec Solar ASA		Scatec Solar ASA
GRI 102-2	Activities, brands, products and services			Annual Financial Report 2019 Corporate website: www.scatecsolar.com/about		Annual Sustainability Report, pages 6-7 Annual Financial Report 2018 Corporate website: www.scatecsolar.com/about		Annual Sustainability Report, page 7, 15
GRI 102-3	Location of the organisation's headquarters			Åslekrøken 11, 0277 Oslo, Norway		Karenlyst Allé 49, 0279 Oslo, Norway		Karenlyst Allé 49, 0279 Oslo, Norway
GRI 102-4	Location of operations			Annual Report 2019 Corporate website: www.scatecsolar.com/portfolio		Annual Sustainability Report, pages 6-7 Corporate website: www.scatecsolar.com/portfolio		Annual Sustainability Report, page 8-9
GRI 102-5	Ownership and legal form			Corporate website: www.scatecsolar.com/investor/share		Corporate website: www.scatecsolar.com/investor/share		Annual Sustainability Report, page 68-69 Corporate website: www.scatecsolar.com/investor/share
GRI 102-6	Markets served			Annual Financial Report 2019		Annual Sustainability Report, pages 6-7		Annual Sustainability Report, page 8-9
	Scale of organization			Annual Financial Report 2019		Annual Sustainability Report, pages 6-7 Annual Report 2018		Annual Sustainability Report, page 8-9
	Number of employees	Qty	335	Annual Sustainability Report, pages 43-46 Corporate website: www.scatecsolar.com/sustainability	246	Annual Sustainability Report, pages 46-48 + Appendix, Section 5	184	Annual Sustainability Report, page 42-44 + appendix 3
GRI 102-7	Total number of operations			Asset portfolio: 1,193 MW solar plants in operation in 10 countries 711 MW solar plants under construction in 4 countries		Asset portfolio: 584 MW solar plants in operation in 7 countries 1,071 MW solar plants under construction in 6 countries		Asset portfolio: 322 MW solar plants in operation in 5 countries 394 MW solar plants under construction in 3 countries
	Net sales (in mill. NOK)	NOK mill	6,341	Annual Financial Report 2019 page 16	4,725	Annual Financial Report 2018 page 5	1,680	Annual Financial Report 2017 page 26
	Total capitalization: debt (in mill. NOK)	NOK mill	17,399	Annual Financial Report 2019 page 24	12,383	Annual Financial Report 2018 page 43	8,853	Annual Financial Report 2017 page 105
	Total capitalization: equity (in mill. NOK)	NOK mill	3,640	Annual Financial Report 2019 page 41	2,475	Annual Financial Report 2018 page 25	1,867	Annual Financial Report 2017 page 105
	Quantity of products or services provided (MW installed)	MW	1,193	Annual Financial Report 2019 page 8	584	Annual Sustainability Report, page 7	322	Annual Sustainability Report, page 9
GRI 102-8	Information on employees and other workers			Annual Sustainability Report, pages 43-46 Corporate website: www.scatecsolar.com/sustainability		Annual Sustainability Report, pages 46-48 + Appendix, Section 5		Annual Sustainability Report, page 42-44 + appendix 3
GRI 102-9	Supply chain			Annual Sustainability Report, pages 40-42		Annual Sustainability Report, pages 42-44		Annual Sustainability Report, page 39-40
GRI 102-10	Significant changes to the organisation and its supply chain			Annual Sustainability Report, pages 6, 40-42		Annual Sustainability Report, pages 10, 42-44		Annual Sustainability Report, page 39-40
GRI 102-11	Precautionary Principle or approach			As a signatory to the UN Global Compact we respect Principle 7 and it represents a guiding principle in assessing and managing risks related to the environment, HSSE, the supply chain and other areas as described throughout this report.		As a signatory to the UN Global Compact we respect Principle 7 and it represents a guiding principle in assessing and managing risks related to the environment, HSSE, the supply chain, and other areas as described throughout this report.		We do not formally apply the precautionary principle to decision making processes across our operations, but it represents a guiding principle when it comes to assessing and managing risks related to the environment, HSSE, supply chain and other areas as described throughout this report.
GRI 102-12	External initiatives			UN Sustainable Development Goals (SDG) Global Reporting Initiative (GRI) Clean Development Mechanism (CDM) IFC Performance Standards and Equator Principles UN Global Compact (UNGC) Carbon Disclosure Project (CDP) OECD Guidelines for Multinational Enterprises		UN Sustainable Development Goals (SDG) Global Reporting Initiative (GRI) United Nations Global Compact (UNGC) Clean Development Mechanism (CDM) IFC Performance Standards and Equator Principles		UN Sustainable Development Goals (SDG) Global Reporting Initiative (GRI)
GRI 102-13	Membership of associations			Oslo Renewable Energy and Environment Cluster (OREEC) Norwegian Energy Partners (NORWEP) South African Photovoltaic Industry Association (SAPVIA) South African Wind Energy Association (SAWEA)		Oslo Renewable Energy and Environment Cluster (OREEC) Norwegian Energy Partners (NORWEP) South African Photovoltaic Industry Association (SAPVIA)		Oslo Renewable Energy and Environment Cluster (OREEC) Norwegian Energy Partners (NORWEP) South African Photovoltaic Industry Association (SAPVIA)
GRI 102-41	Collective bargaining agreements	%	9	The Company's Global HR policy and related procedures are applicable to all employees, emphasising fair salary levels in accordance with local laws and regulations. 9% percent of the workforce are covered by collective bargaining agreements.	11	11% percent of the workforce are covered by collective bargaining agreements. Annual Sustainability Report, page 49	11	Annual Sustainability Report, page 44
Report Profile								
GRI 102-45	Entities included in the consolidated financial statements			Annual Financial Report 2019		Annual Sustainability Report, Appendix, Section 4		Annual Sustainability Report, Appendix page 68-69
GRI 102-46	Defining report content and topic boundaries			Unless stated otherwise, the scope of the report includes the company Scatec Solar ASA: all employees, offices, and operations.		Unless stated otherwise, the scope of the report includes the company Scatec Solar ASA: all employees, offices, and operations.		Unless stated otherwise, the scope of the report includes the company Scatec Solar ASA: all employees, offices, and operations.
GRI 102-47	List of material topics			Annual Sustainability Report, page 11 Corporate website: www.scatecsolar.com/sustainability		Annual Sustainability Report, page 14 + Appendix, Section 2		Annual Sustainability Report, page 10-14, appendix 1
GRI 102-48	Restatements of information			N/A		N/A		N/A
GRI 102-49	Changes in reporting			N/A		N/A		N/A
GRI 102-50	Reporting period			FY 2019		FY 2018		Annual reporting
GRI 102-51	Date of previous report			FY 2018		FY 2017		FY 2016
GRI 102-52	Reporting cycle			Annually		Annually		Annually
GRI 102-53	Contact point			Julie Hamre, Senior Sustainability Manager julie.hamre@scatecsolar.com		Julie Hamre, Senior Sustainability Advisor julie.hamre@scatecsolar.com		Julie Hamre, Senior Sustainability Advisor julie.hamre@scatecsolar.com
GRI 102-54	Claims of reporting in accordance with the GRI Standards "Core option"			This report has been prepared in accordance with the GRI Standards "Core option". The climate reporting has been externally assured by DNV GL.		This report has been prepared in accordance with the GRI Standards "Core option". The climate reporting has been externally assured by DNV GL.		This report has been prepared in accordance with the GRI Standards "Core option". No external assurance.
GRI 102-56	External assurance			The climate reporting has been externally assured by DNV GL.		The climate reporting has been externally assured by DNV GL.		No external assurance.
Stakeholder Engagement								
GRI 102-40	List of stakeholder groups			Annual Sustainability Report, page 11 Corporate website: www.scatecsolar.com/sustainability		Annual Sustainability Report, page 13		Annual Sustainability Report, page 11
GRI 102-42	Identifying and selecting stakeholders			Annual Sustainability Report, page 11 Corporate website: www.scatecsolar.com/sustainability		Annual Sustainability Report, page 12-14		Annual Sustainability Report, page 10-12
GRI 102-43	Approach to stakeholder engagement			Annual Sustainability Report, page 11 Corporate website: www.scatecsolar.com/sustainability		Annual Sustainability Report, page 12-15		Annual Sustainability Report, page 10-12
GRI 102-44	Key topics and concerns raised			Annual Sustainability Report, page 11 Corporate website: www.scatecsolar.com/sustainability		Annual Sustainability Report, pages 14-17 + Appendix, Section 1		Annual Sustainability Report, pages 10-14, appendix 1
GRI 102-18	Governance structure			Annual Sustainability Report, page 8		Annual Sustainability Report, page 8		Annual Sustainability Report, page 12
GRI 102-16	Values, standards, principles and norms			Annual Sustainability Report, page 2, 8 and throughout the report		Annual Sustainability Report, page 8 and throughout the report		Annual Sustainability Report, page 7 and throughout the report
Indirect Economic Impact								
GRI 203-2	Significant indirect economic impact			Annual Sustainability Report, pages 48-50, 55-58		Annual Sustainability Report, pages 51-60		Annual Sustainability Report, pages 48-57
Procurement Practices								
GRI 204-1	Proportion of spending on local suppliers	%	30	Suppliers are defined as suppliers and service providers of goods and services to Scatec Solar Solutions (project execution) unless otherwise specified. Annual Sustainability Report, pages 40-42, 53	20	Suppliers are defined as suppliers and service providers of goods and services to Scatec Solar Solutions (project execution) unless otherwise specified. Annual Sustainability Report, pages 42-44, 53-54	20	Annual Sustainability Report, page 51
Supplier Environmental and Social Assessment								
GRI 308-1	New suppliers that were screened using environmental criteria	%	100	Annual Sustainability Report, pages 40-42	100	Annual Sustainability Report, pages 42-44	100	Annual Sustainability Report, page 40
GRI 414-1	New suppliers that were screened using social criteria	%	100	Annual Sustainability Report, pages 40-42	100	Annual Sustainability Report, pages 42-44	100	Annual Sustainability Report, page 40
Anti-corruption								
GRI 205-1	Operations assessed for risks related to corruption	%	100	All Scatec Solar's operations are assessed for risks related to corruption. Annual Sustainability Report, page 36-39	100	All Scatec Solar's operations are assessed for risks related to corruption. Annual Sustainability Report, page 40	100	
GRI 205-3	Confirmed incidents of corruption and actions taken	Qty	0	No confirmed incident of corruption registered in 2019. Annual Sustainability Report, page 38-39	0	No confirmed incident of corruption registered in 2018. Annual Sustainability Report, page 40	1	One confirmed incident of corruption registered in 2017. Annual Sustainability Report, page 37

Water						
GRI 303-1	Interactions with water as a shared resource			Annual Sustainability Report, page 23	Annual Sustainability Report, page 27	Not reported on.
GRI 303-2	Management of water-discharge-related impact			Annual Sustainability Report, page 23	We aim to report fully on water withdrawal from our operations in 2019. Annual Sustainability Report, page 27	Not reported on.
Emissions						
GRI 305-1	Direct (Scope 1) greenhouse gas emissions			Annual Sustainability Report, pages 27-30	Annual Sustainability Report, pages 21, 28-30	Annual Sustainability Report, page 31
GRI 305-2	Energy indirect (Scope 2) greenhouse gas emissions			Annual Sustainability Report, pages 27-30	Annual Sustainability Report, pages 21, 28-30	Annual Sustainability Report, page 31
GRI 305-3	Other indirect (Scope 3) greenhouse gas emissions			Annual Sustainability Report, pages 27-30	Annual Sustainability Report, pages 21, 28-30	Annual Sustainability Report, page 31
Environmental and Socio-economic Compliance						
GRI 307-1	Non-compliance with environmental laws and regulations	NOK mill	0	No significant fines or non-monetary sanctions for non-compliance with social and economic laws and/or regulations in 2019.	No significant fines or non-monetary sanctions for non-compliance with environmental laws and/or regulations in 2018.	No reporting of significant fines and non-monetary sanctions for non-compliance with environmental laws and/or regulations in 2017.
GRI 419-1	Non-compliance with laws and regulations in the social and economic area	NOK mill	0	No significant fines or non-monetary sanctions for non-compliance with social and economic laws and/or regulations in 2019.	No significant fines or non-monetary sanctions for non-compliance with environmental laws and/or regulations in 2018.	No reporting of significant fines and non-monetary sanctions for non-compliance with social and economic laws and/or regulations in 2017.
Employment						
GRI 401-1	New employee hires and employee turnover			Annual Sustainability Report, page 43-44 Corporate website: www.scatecsolar.com/sustainability	Annual Sustainability Report, page 46, Appendix section 5	Annual Sustainability Report, page 42 and appendix 3
Training and education						
GRI 404-2	Programmes for upgrading employee skills and transition assistance programmes			Annual Sustainability Report, pages 44-45	Annual Sustainability Report, pages 48-49	Annual Sustainability Report, page 43
Diversity and Equal Opportunity						
GRI 405-1	Diversity of governance bodies and employees			Annual Sustainability Report, page 44	Annual Sustainability Report, page 48	Annual Sustainability Report, page 44
Non-discrimination						
GRI 406-1	Incidents of discrimination and corrective actions taken	Qty	0	No reported incidents of discrimination in 2019. Annual Sustainability Report, page 38-39	1 One reported incident of discrimination in 2018. Annual Sustainability Report, page 40	0 No reported incidents of discrimination in 2017.
Non-discrimination						
GRI 406-1	Incidents of discrimination and corrective actions taken	Qty	0	No reported incidents of discrimination in 2019. Annual Sustainability Report, page 38-39	1 One reported incident of discrimination in 2018. Annual Sustainability Report, page 40	0 No reported incidents of discrimination in 2017.
Occupational Health and Safety						
GRI 403-2	Types of injury and rates of injury, occupational diseases, lost days, and absenteeism, and number of work-related fatalities	Qty	0	Annual Sustainability Report, pages 32-35	0 Annual Sustainability Report, pages 32-36	0 Annual Sustainability Report, page 34
Freedom of Association and Collective Bargaining						
GRI 407-1	Operations and suppliers in which the right to freedom of association and collective bargaining might be at risk			The percentage of full-time and short-term employees who are covered by formal collective bargaining agreements is 9%.	The percentage of full-time and short-term employees who are covered by formal collective bargaining agreements is 11%. Annual Sustainability Report, page 49	Not reported on.
Security Practices						
GRI 410-1	Security personnel trained in human rights policies and procedures			Annual Sustainability Report, page 21	Annual Sustainability Report, page 27	Annual Sustainability Report, page 34
Human Rights Assessments						
GRI 412-1	Operations that have been subject to human rights reviews or impact assessments			Annual Sustainability Report, page 18-22	Annual Sustainability Report, page 23-25	Annual Sustainability Report, page 31
Local Communities						
GRI 413-1	Operations with local community engagement, impact assessments and development programmes	%	100	Annual Sustainability Report, pages 18-22, 48-50, 55-58	100 Annual Sustainability Report, pages 22-30, 51-60	100 Annual Sustainability Report, page 48-59
GRI 413-2	Operations with significant actual and potential negative impact on local communities			Annual Sustainability Report, pages 18-22, 48-50, 55-58	Annual Sustainability Report, pages 22-30, 51-60	Annual Sustainability Report, page 48-59
	Number of grievances received	Qty	174	Annual Sustainability Report, pages 52-53	92 Annual Sustainability Report, pages 55-57	118 Annual Sustainability Report, page 52
	Number of grievances addressed and resolved	Qty	137	Annual Sustainability Report, pages 52-53	79 Annual Sustainability Report, pages 55-57	103 Annual Sustainability Report, page 52
Public Policy						
GRI 415-1	Political contributions			No political contributions in 2019.	No political contributions in 2018.	No political contributions in 2017.

Scatec Solar Report GRI Index: <https://annualreport2019.scatecsolar.com/wp-content/uploads/sites/5/2020/03/Scatec-Solar-Sustainability-report-2019-GRI-Index.pdf>

Full set of GRI Standards 2021: <https://www.globalreporting.org/how-to-use-the-gri-standards/resource-center/?g=0db12285-aadd-4c0f-9a58-ea5f73112470&id=11523>

10.2.4 GRI Datasets utilised

Full set of GRI Standards 2021 - English	GRI Standards
GRI 12: Coal Sector 2022	GRI Standards
Consolidated Set of the GRI Standards 2021	GRI Standards
GRI Standards Glossary 2021	GRI Standards
GRI 1: Foundation 2021	GRI Standards
GRI 2: General Disclosures 2021	GRI Standards
GRI 3: Material Topics 2021	GRI Standards
GRI 11: Oil and Gas Sector 2021	GRI Standards
GRI Standards Glossary - Simplified Chinese translation 2021	GRI Standards

For download:

<https://www.globalreporting.org/how-to-use-the-gri-standards/gri-standards-english-language/>



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