



Master's Thesis –University of Bergen (UIB)

Breaking out of the Loop: Mitigating short-termism in the building and construction industry, by moving beyond sustainable strategies and developing a sustainable pathway.

Master's thesis - Master of Philosophy in Sustainability | Climate Change and Energy Transition (SVT)



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Spring Semester 2023

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Preface

Purpose

This Master Thesis is an academic research project that is part of the final evaluation of the two-year master programme in sustainability, rooted in the research group: *climate change and energy transition* at the university of Bergen (UIB). This thesis is part of the 30 ECTS credits subject “Internship-based Master Thesis”- SDG351 and builds on the mandatory 30 ECTS credits master subject – SDG349 Internship.

Through the course SDG349, I spent four months as an intern at an international consulting firm on the west coast of Norway, at their Bergen office. During the internship I was assigned to the company’s building division and the climate, energy and environment unit. The internship was spent observing, conducting interviews, attending meetings, and conducting field observations, while solving different tasks and working on different projects for the company. Through the internship I gained first-hand knowledge related to sustainability issues and interdisciplinary problem solving in the building and construction industry, especially in Norway and to some extent in a Scandinavian context.

The first-hand knowledge gained from interviews, observations, and experiences from the internship, form the basis for several of the questions and issues later presented and discussed in this master’s thesis. Due to the interdisciplinary nature of this master’s degree, an interdisciplinary approach was chosen, to better integrate different methods, theories, and concepts, while gaining a deeper and more holistic understanding of the researched concepts and phenomenon investigated in this thesis.

The internship was finalized with a project delivery to the company, where I presented an overview of my findings to the different divisions in a presentation. These findings have a central part in this master’s thesis and will be presented in the findings chapter.

The viewpoints and opinions that may be expressed in this thesis are those of the author and cannot be interpreted as the official opinions of the university or institute.

Executive Summary

This master thesis will address the green transition in Norway, especially with regard to restructuring strategies related to Vestland and more specifically Bergen. The overall objective of the thesis is to investigate and later discuss the various solutions that exist and strategies that exist today, as well as what solutions are needed to succeed with the large-scale transformation of society that is needed to develop a low-emission society, focusing on sustainable buildings and urban environments, future-oriented energy solutions, resource conservation strategies and future-oriented solutions to route communities and cities for a changing climate. The thesis explores how the building industry, the authorities and society at large can work towards a common goal of a more sustainable society, where one plays on the side of nature. The thesis highlights challenges and opportunities that have emerged through information from various contributors to the project, through interviews, conversations, which form large parts of the knowledge base for the thesis, together with relevant theory that describes sustainability issues in light of national [regional] challenges, while also linking to larger international challenges that also affect national processes and value chains in a global society.

The master thesis attempts to anchor parts of sustainability theory to the UN's increasingly well-known sustainability goals, where some are selected and described in this context, while at the same time putting sustainability theory in the context of other theories that have not traditionally been linked to the concept of sustainability, but which offer the concept a new dimension.

The purely technical aspects of construction are beyond the scope of this research, but some materials, energy systems and structures, will be described as part of the practical approach to sustainability solutions.

The company where the internship was held can benefit from setting aside time and resources for competence enhancement in sustainability, so that they can meet customers and projects with a better understanding of how this can affect society and create increased value over time.

Research suggests that this phenomenon is not reserved for this company, but for much of the consulting business in the construction industry. Attempts are made to

squeeze in professional content for competence enhancement during the lunch period to avoid having to bear the cost of invoicing internal hours, which in turn supports the point and lack of willingness on the part of the company/industry to raise the level of competence, as they do not see the value of taking the cost this entails.

Short-term gains trump what may be a more profitable decision in the long term, which requires a need to raise one's sights and think more long-term about the concept of cost. Cost as a concept must encompass a broader scope than just economics, but also costs of nature and natural resources, and costs associated with emissions and projection costs. There is a misconception that societies and industries have a choice between paying for restructuring or not, this cost will come, it is just a question of how extensive it will be and when.

The main conclusion is that the industry has to transition from talking and discussing sustainability issues and move towards action and implementation of mitigating actions.

Sammendrag

Denne master oppgaven vil ta for seg den grønne omstillingen i Norge, spesielt med hensyn til omstillings strategier knyttet til Vestland og mer spesifikt Bergen. Det overordnede målet med oppgaven er å undersøke og senere diskutere de ulike løsningene som finnes og strategier som eksisterer i dag, samt hvilke løsninger som skal til for å lykkes med den storstilte omstillingen av samfunnet som må til for å utvikle et lav-utslippssamfunn, med fokus på bærekraftige bygninger og bymiljø, fremtidsrettede energi løsninger, ressurs bevarende strategier og fremtidsrettede løsninger for å rute samfunn og byer for et klima i endring. Oppgaven utforsker hvordan Bygg industrien, myndighetene og stor samfunnet kan jobbe mot et felles mål om et mer bærekraftig samfunn, hvor man spiller på lag med naturen. Oppgaven belyser utfordringer og muligheter som har kommet frem gjennom informasjon fra ulike bidragsytere til prosjektet, gjennom intervju, samtaler, som danner store deler av kunnskapsgrunnet for oppgaven, sammen med relevant teori som beskriver bærekrafts problematikken i lys nasjonale [regionale] utfordringer, samtidig som det knyttes til større internasjonale utfordringer som også påvirker nasjonale prosesser og verdikjeder i et globalt samfunn.

Master oppgaven forsøker å forankre deler av bærekrafts teorien til FNs etter hvert kjente bærekrafts mål, hvor enkelte er plukket ut og beskrevet i denne konteksten, samtidig som bærekraft teorien settes i sammenheng med andre teorier som gjerne tradisjonelt ikke har vært knyttet til bærekrafts-begrepet, men som tilbyr begrepet en ny dimensjon.

De rent byggetekniske aspektene knyttet til konstruksjon er utenfor rammen av denne forskningen, men enkelte materialer, energisystemer og konstruksjoner, vil bli beskrevet som en del av den praktiske tilnærmingen til bærekrafts løsninger.

Selskapet hvor praksisperioden ble avholdt kan ha nytte av å sette av tid og ressurser til kompetanseheving innen bærekraft, slik at de kan møte kunder og prosjekter med en bedre forståelse for hvordan dette kan påvirke samfunnet og skape økte verdier over tid.

Forskningen tyder på at dette fenomenet ikke er forbeholdt dette selskapet, men for store deler av konsulent virksomheten i bygge bransjen. Det blir forsøkt å presses inn

faglig innhold for påfyll i lunsj-perioden for å unngå å måtte ta kostnaden for å fakturere interntimer, som igjen underbygger poenget og manglende villighet fra selskapet/industrien til å heve kompetansenivået, da de ikke ser verdien av å ta den kostnaden dette innebærer.

Kortsiktige vinninger trumfer det som langsiktig kan være en mer lønnsom beslutning, som krever at man må heve blikket og tenke mer langsiktig rundt begrepet kostnad. Kostnad som begrep må favne bredere enn kun handle om økonomi, men også kostnad på naturen og naturressurser, og kostnader knyttet til utslipp og fremskrivende kostnader. Det er en misforståelse at samfunn og industrier har et valg mellom å betale for omstilling eller ikke, denne kostnaden kommer, det er bare snakk om hvor omfattende den først blir.

Acknowledgements

I would like to start by thanking my main supervisor Professor Asgeir Sorteberg from the Geophysical Institute (GFI) at the University of Bergen (UIB), for an incredibly good thesis collaboration, by being an indispensable conversational partner and mentor. Thank you for taking the time to dive into different topics, good discussions, guidance through the thesis writing and for all the motivational talks through this process. Thanks to my Co-supervisor Associate Professor Kjetil Rommetveit from the Centre for the Study of the Sciences and the Humanities (SVT) at UIB, for being the critical voice in my head, always pushing for improvements and asking the tough questions and all the support through the internship. I would also like to thank Devyn Helen A. Remme & Johannes A. Oldervoll for creating an open and inclusive space in our master seminars at UIB, where discussions were allowed to flow freely and by advising, supporting, and motivating us as student along the way. You have both been an amazing support and advisory team, making this thesis writing experience a good one. Thanks to Professor Roger Strand (SVT) at UIB for all support during the internship.

A special thanks to all project participants, informants, and interviewees that contributed to this thesis by sharing essential insight, industry knowledge and engaging in industry discussions, the research would not have been possible without you. Thanks to the HVAC, Energy and Environment group in Bergen for allowing me to take part in their everyday life, get to know them and be a part of several projects during the internship.

I would also like to take to opportunity to thank friends and family for all support and motivation throughout this thesis project, and a special thanks to my patient partner Espen for all the love and support in this process.

Finally, thanks to the SVT Administration at UIB for support and facilitation throughout the course of study and the master's writing.

Glossary/Important abbreviations

Anthropocene – A term used to simply describe the time (geological epoch) during which humans have had a substantial impact on our planet.

Blue-Green Roofs - “Vegetated roofs built to manage stormwater by delaying and retaining rainwater runoff on rooftops”.

CSR – “Corporate Social Responsibility”.

EEA – “European Economic Area” [EØS]

EFTA – “The European Free Trade Association”

EPD – “Environmental Product Declaration”.

HVAC – “Heating, Ventilation and Air Conditioning” - [VVS]

NIMBY – “Not In My Back Yard”.

NZEB – “Net-Zero Energy Building” - [Buildings that produce as much energy as they consume and can produce surplus energy].

nZEB - “nearly Zero Energy Building”- [Buildings with low energy demand and covers the remaining energy needs from renewable energy].

Passive House – Global standard for energy efficient building design, developed in the 1990s. Specific criteria established by the Passive House Institute.

PM – Project Manager

Tender – “Offers submitted by a tenderer in a tendering competition, based on award criteria” – [Anbud].

General conditions for design and build contracts:

EC- “Execution Contract” - [Utførelsesentreprise].

EP – “Early partnering/project alliances”

PPP – “Private Public Partnership” – [Partnering Model Adapted to Public Builders].

TC - “Total Contract” – [Totalentreprise]

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Introduction

“One cannot step twice into the same river, for the water into which you first stepped has flowed on” – Heracleitus (*Davenport, 1979*).

This quote has traditionally been interpreted to mean that “*The only constant in life is change*”; this notion, has been attributed the Greek philosopher Heracleitus (c. 540 - c. 480 BCE), a notion that still resonates today, maybe more than ever before. The global society as a whole is experiencing unprecedented changes to the climate and the environment, with record breaking heat waves through Europe, followed by drought and damage to harvests. The world has also been experiencing heavy rains, floods, and landslides. Extreme weather events are becoming increasingly more common and are occurring in a higher frequency than ever before, all around the world. Through the past years extreme weather events has gradually exposed how fragile our accommodations, infrastructure and supply chains are to different changes and how far away most countries are from living in robust societies, equipped to deal with the climate, energy- and environmental crisis that inevitably will impact people and societies in the foreseeable future. The ongoing energy crisis in Europe has largely reshaped the energy debate and uncovered how co-dependent nations really are.

Background and Research Question

During the last decade, the global net anthropogenic GHG-emissions, were reported to be higher than any previous time in human history, where global population growth and gross domestic product (GDP) per capita have been strong drivers of CO_2 emissions (IPCC, 2023), the global population is still growing, although at a lower growth rate (UN, 2022). According to UN's world population prospects of 2022, the world's population were projected to reach 8.5 billion by 2030 and 10.4 billion by 2100 (UN, 2022), continuously increasing strains on the world's resources and increasing energy demands. To mitigate the negative impacts of climate change, it is necessary for societies to transition from hydrocarbons to renewable energy sources. At the same time, there is projected growth in demand for energy corresponding with industrial development. In Norway, decarbonization and the establishment of new

industries are expected to increase demand from electricity substantially. Bergen municipality is seeking to stem the increased energy demand through locally produced solar energy, aiming at a total production of 65MW by 2030, as part of the municipalities' "*Green Climate Strategy*", up from the installed 2.8MW per 2019 (Bergen Kommune, 2023).

According to the municipality, the building and construction industry stands for vast amounts of direct and indirect GHG-emissions, in addition to being the largest producer of waste and claiming [using] large areas in the region (Bergen Kommune, 2023). Over 50 percent of the waste originating from the construction industry is related to end-of-life activities [demolition], connected to the fact that recycling strategies are hard to implement in the industry (Shashi et al., 2023), additionally knowledge about sustainable buildings and materials vary (Bergen Kommune, 2023).

The global climate and environmental crisis, caused by resource depletion, pollution and ecological degradation have left the global society with an enormous amount of intertwined environmental and societal issues. Complex societal issues as the ones mentioned above, demand attestation and resolution through cooperation between countries, policy makers, institutions and industries to mitigate climate change and develop a more robust socio-economic system. This extensive need for cooperation has given the sustainability concept a new interdisciplinary dimension, which is often under communicated and under stated, which will be addressed and discussed later.

Although the sustainability concepts at their earlier stages was closely related to eco-movements and the definition of sustainable development in the Brundtland report 1987, the concepts have evolved with time, and their meanings have adapted to new technologies, societal needs and demands in *the age of the Anthropocene*. The concepts of *sustainability* and *sustainable development* entails an extensive body of knowledge and have through the decades inherited different meanings and definitions. The understanding of sustainability is often tied to the act of reducing greenhouse gases, especially related to CO_2 emissions from anthropogenic sources, such as: industrial processes, fossil fuel combustion and emissions from land use (IPCC, 2022). The fact that the concepts are dynamic and adaptive can also make them difficult to grasp and explain, as will be discussed later on.

The thesis will discuss the multiuse of space and how we can allocate and utilize area also managing stormwater and providing green spaces in the cities through smart space development. The thesis will seek to connect theories and different ways of knowing, that have not traditionally been connected to sustainability issues, in an effort to bridge some of the gaps between the theory and practice of sustainability. The thesis will offer an alternative way of framing sustainability issues and aim to bring attention to some of the missing links between the societal discussion about how to sustain and the question of what to sustain.

In the 1980s The United Nations present the most widely acknowledged definition of *sustainable development* in “*Our common future*”: “*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*” (Brundtland, 1987).

However, the report was not only targeted at governments, but also towards private enterprises, including small business owners and multinational companies with an economic income greater than some nations, with the means to initiate far-reaching improvements and changes through their activities (Brundtland, 1987). The great initiatives from companies and industries that were called upon, have yet to make their grand entrance, although some companies are doing far more than others in an effort to transition and become more environmentally friendly. This in turn corresponds to the need for enhanced cooperation and partnerships towards solving global environmental and climate changes.

In this thesis the sustainable development goal (SDG) number [7, 11,12] will be used to frame some of the questions. SDG #7, focuses on the goal to reach affordable, reliable and sustainable energy, SDG#11, is focused on the development of inclusive, safe, and sustainable human settlements, while SDG #12 is concerned with ensuring sustainable consumption and production patterns. Although the scope has been focused on the aforementioned SDGs, actions towards mitigating short-termism in the building and construction industry will also contribute to other SDGs such as #13 regarding climate action. Other SDGs could have been relevant to include and discuss in this thesis, but due to the scope of the research and time limitations it was necessary to choose a few aspects to focus on.

The realm of sustainability is vast, interconnected and often made up of different types of problems and issues. To build strong empirical evidence, it is an advantage present rigorous statistical evidence through analysis. However, the historical perspective and evidence related to climate-policy and interventions are very limited, leaving us with expected scenarios and pathways (IPCC, 2023). This thesis aims at investigating and describing certain occurring phenomenon and observations made in the field, while acknowledging the inherent complexity of sustainability.

Research Question

“How can sustainability as concept and practice drive societal change and become part of the main strategy for the building- and construction industry?”.

Sub question: What are the societal costs of not going green?

Theory chapter

A short history of sustainability

The conceptualization of sustainability and sustainable development is not a new idea. In their early stages, the concepts were closely tied to eco-movements. In the 1700s there were a growing concern for resource scarcity linked to deforestation, and new forest management gave us the term *sustainable*. In the 1860s, G. P. Marsh advocated for the importance of conservation and restoration of landscapes and watersheds (*Man and Nature, 1864*), paving the way for an early conservation movement, followed by G. Pinchot’s contributions (*Treatise on conservation, 1910*) and the development of conservationism. The early conservation philosophy based on long-term benefits for humans, were later supplied with the concept of preservation. According to J. Muir: “Preserving nature required a reverential attitude, a belief in nature’s inherent value”. Muir argued that there was a need for preservation and not only conservation of nature, presenting the idea of nature’s intrinsic value (Thiele, 2016) (and not just a human resource pool for consumption and exploitation).

In the 1960s new ecological concerns appeared as those mentioned by Rachel Carson (*Silent Spring, 1962*), followed by environmental concerns of human overpopulation as depicted by P. Ehrlich (*The population bomb, 1968*) and B. Commoner’s (*The closing Circle, 1971*) describing the world’s unjust resource distributions. In the 1970s the concerns for overpopulation, resource depletion and pollution came together in (*The limits to growth, 1972*), where the concept sustainability was set in a larger global context and not just isolated to one practice, such as forest management

(Thiele, 2016). In the 1980s The United Nations (UN) and The World Commission on Environment and Development (WCED) presented the most widely acknowledged definition of *sustainable development* in “*Our common future*”, more commonly referred to as the Brundtland report, 1987 (Thiele, 2016).

The UNs definition of sustainable development has widely shaped the public discussion concerning sustainability issues and how the world community should work towards a more sustainable future. However, some researchers criticise the definition and states that the interpretation of the definition has led the debate astray, due to confusion surrounding the meaning of “sustained development” [Grober, U. (2010).; Daly, H. E.]. The definitions focus on development was targeted towards the less developed parts of the world, lacking basic health care, education, and energy access. The rest of the worlds inhabitants were urged to keep their consumption within the boundary limits of the system and acknowledge that sustainable development does imply limits on the consumption of resources and on the biospheres capacity to absorb the effects of human impact on the environment (Brundtland, 1987). According to 2020 numbers, the Norwegian population accounted for the second highest consumption in Europe, with an average climate footprint of 11 tons of CO_2 equivalents per capita. Through the interconnectedness of value-chains and far-reaching global implications of national consumption, the municipality of Bergen is also responsible for GHG-emissions, resource depletion and inequalities that can be traced to other part of the world (Bergen Kommune, 2023).

Over three decades after UNs “Call to action”, the world is still discussing how to move from words to action, while new crises and challenges are starting to take effect. As described by the Brundtland report, the environmental, development- and energy crisis are not separate crises, but one and the same (Brundtland, 1987) and must therefore be treated as such. This wicked nature of different sustainability issues is what makes them difficult to explain and sometimes even grasp. As stated by the Bergen municipality, it is problematic that the responsibility for following up physical climate risk has been assigned to so many different actors and sectors, making it challenging to see the whole picture. The municipality also states that it is a challenge that we neither pay for, nor have mechanisms that make visible the

environmental impacts of our consumption, increasing the risk of greenwashing in different sectors (Bergen Kommune, 2023).

The task of finding and defining goals is important, as it is considered a central part of a planning process (Rittel & Webber, 1973), making it an inherently important part of the task to describe the path societies and nations should follow during the next decades on the road to becoming more sustainable and “future-proof”, through the creation of robust societies. The development of the *Millennium Development Goals* (MDGs) and the later adaptation of the *Sustainable Development Goals* (SDGs), were an effort made by the UN to locate and define common global sustainability goals and targets, based on different scopes and timeframes. To restructure and change the value and goal systems of the time, the MDGs were targeted towards developing countries, while the 17 SDGs were of a more universal character, applying to all countries, regardless of their development level. As described by Meadows it does not matter through which knowledge lens one investigates a problem or concept, everything that is seen is actually there, the point is that each lens allows the observer to get a more complete knowledge of the world, making them complementary (Meadows, 2008).

Sustainability, it often divided into weak and strong sustainability. Weak sustainability is described to be oriented towards short-term goals and short-term economic gain, with less regard for long term environmental concerns and ethics. On the other hand, strong sustainability is characterised by acknowledging the intrinsic value of nature, with focus on ethical considerations. In contrast to weak sustainability that can appear shallow, strong sustainability questions the idea of indefinite economic growth, and whether this unlimited growth is compatible with a system of resource depletion and continuous ecological degradation [the moral limits of the market economy]. Weak sustainability is described to lean towards a more anthropocentric view, while strong sustainability adopts a more ecocentric view, referring to a more nature centred value system.

The global energy crisis has uncovered how interlinked and dependent Europe have been on energy supply from Russia. Russia’s invasion of Ukraine in 2022, further exposed how fragile the world economy is for restrictions in energy supply, especially related to oil and natural gas. Although renewable energy policies long have been under scrutiny and blamed for record high electricity prices in some

markets, this energy crisis shows the strength of -and need for diversification. Clean energy sources have thus far protected consumers and levelled out what could have been even higher pressure on fuel prices (IEA, 2023). As an EEA-EFTA state Norway has access to EUs internal energy market and must abide to the market rules, allowing free movement of energy products, competition and facilitating cross-border trading. This means that Norway is bound to EUs legislation and directives governing the electricity and gas sectors. As a result of this market integration, the Norwegian society has also been exposed to the changes in the European energy market.

The wickedness of wicked problems

The act of locating problems and defining problems is a difficult task in itself, in addition, wicked problems are often characterised by being difficult to define, lacking an objective correctness [no true – false or good and bad solutions] and lacking the opportunity to learn from previous problems, due to the inherently unique nature of wicked-problems. Consequences will follow different implementations over an indefinite period of time [every attempt counts], without the ability to directly test its effectiveness. It is also difficult knowing if and when the goal has been achieved. Wicked problems are never solved, but occasionally re-solved (Rittel & Webber, 1973). In essence, the wickedness of wicked problems is what makes them challenging.

Sustainability issues can be characterized and framed as wicked problems. The global nature of sustainability as a concept makes it fundamentally difficult to define in national, regional, and corporate terms, thus also difficult to track. Sustainability issues and problems are often interconnected and have wide reaching consequences and implications. The global climate- and environmental crisis threatening the structures and systems of modern societies demonstrate this complex relationship. The interconnectedness of sustainability problems also demonstrates the fact that many wicked problems are made up of other smaller problems or rather that they are symptoms of other problems, adding to the complexity. When a great number of

actors seek to collectively solve complex problems, the considered solutions heavily depend on problem definition and the worldview in which it is discussed. Hence, there is no one size fits all when dealing with sustainability problems. Some argue that the belief that complexity can be governed, is an illusion and that the decision makers should aim for achieving some form of governing in complexity, referring to the argument that no knowledge is perfect (The MAGIC Consortium, 2020).

This leads us to the question of what it means for a nation, society, or company to act sustainably and play its role in the transition towards a more sustainable future. As mentioned by Rittel & Webber, to shape the direction of politics and re-order priorities to match stated purposes and develop new goal-directed actions, there is a need to think differently. In association to companies and industries this might imply a reorientation of professions from focusing on outputs of activities, to rather focus on the inputs into them [criteria and values]. The focus on outputs have forced companies to expand the boundaries of the system they operate in, by attempting to internalize externalities (Rittel & Webber, 1973). Thus, leading to one dimensional approaches and oversimplified solutions to inherently complex and interconnected problems. Failing to recognise complexities, thus neglecting the impact of uncertainties in governance, leads to actions and solutions based on a questionable knowledgebase. Making a choice under doubt is not the same as making a doubtful choice, choices become doubtful at the time when decision makers fail to recognise ignorance, which will be discussed later.

The conservation of options: “The no-regrets strategy”

All systems have flaws and limitations, but most importantly also opportunities for intervention and leverage points for change (Meadows, 2008).

There have been and still are different reasons why there exist adaptation gaps. In order to close some of the adaptation gaps, societies need to acknowledge the fact that maladaptation also poses as a risk factor, that can lead to irreversible actions and changes. To better understand the concept of adaptation limitations, it might be useful to differentiate between soft and hard limits. *Hard limits* represent the

adaptation options that are rapidly starting to become ineffective, hard limits are also characterized by the lack of other options if the implementation window is exceeded. In contrast, *soft limits* are lacking more effective measures in present time but might gain appropriate and effective solutions in the future. Hard limits are thought to become more frequent with rising global temperatures (Pörtner et al., 2022).

The thresholds for adaptation limits are uncertain at best and to which effect they might or might not be affected by human intervention is unknown, but the applied speed of adaptation is very likely the most important element in the effort to close adaptation gaps, alongside the factor of how fast climate impacts appear (Pörtner et al., 2022). Strong empirical evidence, built on rigorous analysis are the basis for adaptation, accentuating the problems associated with sustainability issues. There are many hard limits to consider, due to the limited experience with climate-related policy and strategies (IPCC, 2023). Meaning that many viable options are becoming ineffective, while governments and industries applies a passive “Wait-and-see-strategy”, due to the lack of evidence-based measures available.

Conserving options and Managing uncertainties

In the pursuit of conserving options and avoid future scenarios involving to many hard limits, there should be a long-term plan in place to mitigate short-termism by institutions and policymakers, with a focus on creating a sustainable pathway that can withstand adaptation and changes along the way. The conservation of options also consists of striving for a climate resilient society, where society can make use of the best technology and practices available, while keeping options open for new and improved solutions. A prerequisite for success in climate adaptation on a local level, depend on several factors, among them the ability to employ local knowledge and create a common understanding of which adaptation options that are viable and believed to be most effective. There are no one-size fits all in the work with environmental adaptation and risks management, since different countries, regions and societies face different environmental threats and obstacles and thus must tailor their solutions, with societal acceptance (Pörtner et al., 2022). The physical climate risks that are predicted to affect the future climate of Bergen, are rising temperatures,

changes in rainfall patterns and intensity, along with rising sea-levels. By some predictions it seems likely that some areas will remain permanently under water. It will be critical for the municipality to develop and implement strategies to handle large amounts of water, such as storm surges and waves in the future (Bergen Kommune, 2023).

In other words, climate adaptation measures involve the act of reducing the physical climate risks, by closing knowledge gaps and mapping potential climate risks. The only truly common factor for all nations and regions working to close the adaptation gap is the lack of time and limited resources to realize their strategies.

Sustainability as concept and practice

The maturing science field of sustainability can be understood as a problem-oriented and solution-oriented field, that aims to generate transformative knowledge that can enable sustainable action and sustainability transformations (Schlüter et al., 2022). Since the research field is maturing there still exists some research voids, especially within the construction sector. The lack of research material that have reviewed the sustainable and circular construction literature, is problematic for practitioners, researchers, and policymakers, by restricting their ability to address and evaluate key concerns and complex stakeholder benefits. The construction industry is estimated to be the fastest-growing industry in the world, during the next decade, making it an important industry to monitor in the coming years, while also tracking its environmental impacts (Shashi et al., 2023).

The recently acquired interdisciplinary meaning and understanding of the sustainability concept have also led to some unfortunate developments. Companies, industries, and sectors are trying to leverage their market positions by defining sustainability and sustainable development through the lens of business opportunities and other industry interests. This has led to tendencies of “*greenwashing*” and thereby weak sustainability, instead of genuine efforts to develop more sustainable industrial products, processes, and environmentally friendly business models to support a sustainable socio-economic system over time (Baldassarre et al., 2020).

Although the sustainability term can appear theoretical and abstract, in the way that it is conceptualised, discussed, and learned, it is important that the “users” of the sustainability term remember to speak of practicing sustainability, because it is an activity at its core and needs to be operationalised to be affective. To practice sustainability is in essence to promote change, this adaptive change is continuously pursued, but never perfected (Thiele, 2016).

Why should we care about Uncertainty and Ignorance?

As described by Rittel & Webber, it is the inherent wickedness of social problems that make them hard to define and grasp (Rittel & Webber, 1973), the complexity of these types of problems, makes intervention based on targeted measures difficult and the outcome of such measures harder to predict. If one can acknowledge the limitations of predicted outcomes, there can emerge a shift from reaction, and instead lead towards prevention. The critique of this paradigm, however, is that one can never know with certainty which levels of investment and input factors that are required to prevent for example environmental harm, because effects are often known only when the point(s) of intervention is surpassed (Wynne, 1992), by reaching the systems *Hard limits*.

From a technical perspective, it is tempting to visualise a future where perfectly efficient industrial processes and production systems, results in reduced resource use and waste outputs and leads the path towards an environmentally sustainable future. According to Wynne a problem arises when the environmental policy discourse attempts to isolate the technical from the social dimensions of clean production, arguing that the cultural process of consumption and production also needs to be managed (Wynne, 1992). Even though new technological advances are an important part of the sustainable societal and industry transition, there does not exist one perfect solution or technology, that can solve all problems.

For wicked problems the limitation of available knowledge poses a serious problem, since these systems cannot be designed, manipulated, or reduced and contained within existing borders of knowledge. Such complex systems often operate with

variables that combine several parameters [composite variables]. Not all dimensions or variables can be fitted into environmental risk modelling systems. In every model there will be system limitations, leaving room for uncertainties (Wynne, 1992).

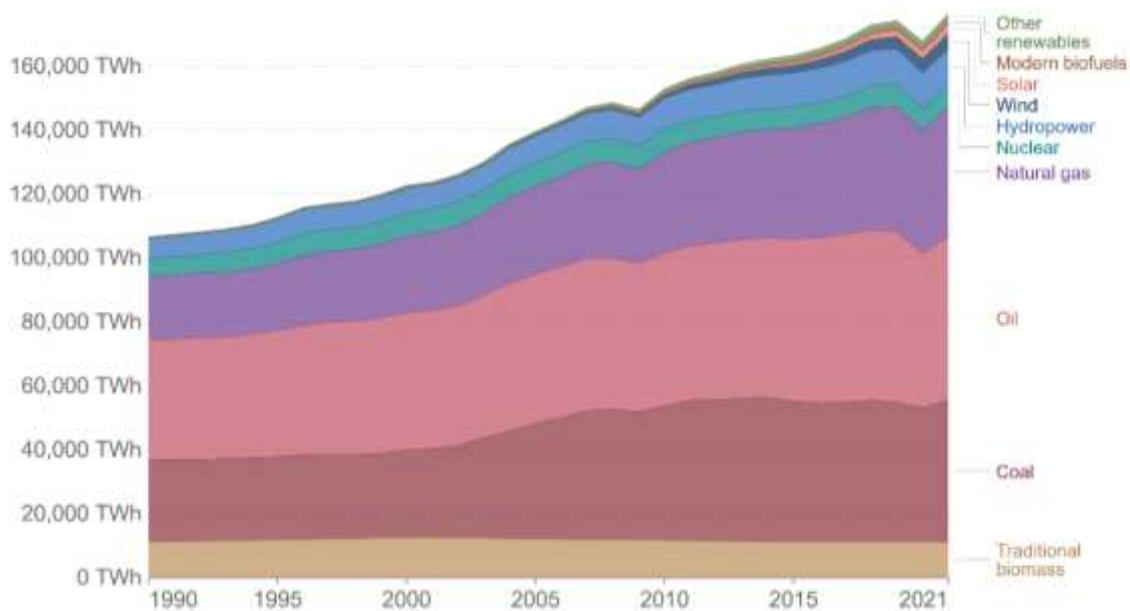
According to Wynne, one can talk about *risk*, when the system behaviour is well known, and the possibilities of certain outcomes can be quantified and defined. On the other hand, one can talk about *uncertainties* when different system parameters are known, but the probability distribution is not. A third problem called *ignorance*, is the problem of not knowing what we do not know, which increases with every commitment based on given knowledge and preconception. The fourth concept introduced by Wynne was *indeterminacy*, thus presenting the idea that contingent social behaviour also should be included in the analytical and prescriptive framework (Wynne, 1992).

Path-dependency and lock-in effects

Governance challenges, whether institutional or connected to political processes, often fail to recognise their complex dynamics, by framing key factors as static or uniform, with linear straight forward solutions. The interrelations between some “ways of knowing” [epistemologies] and governance processes are often underplayed. Governance processes and practice often develop and transform into *path-dependencies*. Sustainability issues are examples of fundamentally interconnected problems and issues that become marginalized and overly simplified, as a bureaucratic attempt to solve problems that are much more complex, interconnected, and political than perceived. Although people experience and perceive systems and their dynamics in very different ways, a single path is often perceived to be the right one leading to progress. The continuous practice of a path often leads to *lock-in effects*, where governments for instance are attached to a specific narrative connected to a pathway, thus excluding other possible solutions. Since sustainability issues are interlinked with many system dimensions, affecting many factors and contains many elements of uncertainty, strong attachment to a particular solution or *path-dependent* processes, may neglect key aspects, properties, or dimensions, making a shift difficult to achieve (Leach et al., 2010).

The energy dilemma

As shown by the figure below, the total global energy consumption has steadily increased since the 1990s, although there has been added new energy resources into the energy-mix throughout the years. The continuously increased consumption of hydrocarbons such as coal, oil, and gas, implies that the world has constantly been demanding and consuming more energy since the 1990s, regardless of energy efficiency, new technology and innovation. This might be as a result of the population growth experienced in recent times, in addition to the efficiency paradox, where efficiency gains are described to evoke increased consumption. These contradictory effects were observed by W. S. Jevons in 1865, who remarked that in contrast to common intuition, increased efficiency does not always guarantee less resource consumption, because increased efficiency opens for new uses and applications, hence leading to new demands, called “*the Jevons paradox*”. The Jevons paradox emphasizes that not all policies may gain the desired outcome but might instead introduce unforeseen paradoxes to a complex system (The MAGIC consortium, 2020).



Source: Our World in Data based on Vaclav Smil (2017) and BP Statistical Review of World Energy

OurWorldInData.org/energy - CC BY

Figure 1. Global primary energy consumption by source, timeseries from 1990-2021. [Primary energy is calculated based on the “substitution method”, which takes account of the inefficiencies in fossil fuel production by converting non-fossil energy into the energy inputs required if they had the same conversion losses as fossil fuels] (Our World in Data, 2017).

The figure 1. shows that conventional energy has not been replaced by renewables, but just added to the total energy consumption and energy-mix. The worlds intensified consumption of energy have propelled greenhouse gas (GHG) emissions to historically high levels in the age of the Anthropocene, despite of the intensified implementation of renewables. To reduce GHG-emissions and mitigate climate change, the conventional energy sources must be replaced by the renewable energy sources, as will be discussed later. Different cause-and effects make the establishment of new energy production sites more demanding. Solar PV solutions generally have a smoother integration into the energy mix, than other energy system. PV-system are less prone to NIMBYism, due to the fact that there is no noise pollution, less visual pollution in the landscape and environmental impact, as opposed to wind turbines and wind energy production plant (Thiele, 2016).

According to energy estimates presented by “Statnett”, the transmission system operator of the Norwegian power system, a high growth scenario in 2050 might lead to annual power consumption of around 260 TWh, this corresponds to a national growth of 85 per cent compared to current consumption of 140 TWh consumed annually on a national level today. The expected demand for more energy is based on the needed conversion to a zero-emission society through electrification and the establishment of new industry. Industry growth in the region and future energy demand will depend on the frequency of new power generation establishments, development of the grid, investment, and regulations (Christiansen, 2023).

The forgotten polluter

In the past decades since the release of “*Our common future*”, attention has been focused on the sectors, industries and companies that has emerged as the most prominent polluters, driving much of the increase in global GHG-emissions. The building and construction industry has long been the forgotten polluter, despite its effect on global CO₂ emissions (UNEP, 2020). The long-interconnected value- chains and the extensive number of actors involved has made the sector demanding to regulate and track, hence the lack of industry specific mitigation policies (UNEP, -

2020). The building and construction industry uses vast amounts of energy and resources on the production of building material, in the construction phase and when transporting materials.

Emission of GHG can be explained by CO_2 equivalents, representing the sum of direct and indirect emissions from the consumption of energy carriers [delivered energy]. In Norway the direct emissions are mainly tied to the combustion of hydrocarbons, burning of biomass and other cyclic emissions [biomass and peatlands], while the indirect emissions are mainly linked to upstream processing in the value chains for energy carriers (Brattebø et al., 2014).

Research has revealed that emissions from the building-sector are mainly CO_2 related, thus directing attention to mitigation intervention including building typology, form and function, building size and repurposing buildings to avoid extensive use of new material and additional land area. The far-reaching implications and effects of building sector emissions, adds to the importance of decarbonization of the building sector, starting at the early stages such as the design phase of a project (IPCC, 2023).

The sector is claimed to be responsible for approximately 40 percent of the global carbon emissions and consumption of approximately 40 percent of the total global resources. If the emissions from the building and construction industry is added to the operational emissions, the sector also stands for 38 percent of the total energy-related CO_2 emissions globally, adding to the importance of a successful transition of the sector towards a low-carbon pathway, contributing to the Paris Agreement of limiting the global warming to well below $2^\circ C$ (UNEP, 2020).

The impact of the building and construction industry on the environment goes beyond its direct emissions, as it also contributes to environmental degradation, through for instance habitat destruction, degradation of peatlands and water pollution. An important part of the mission to reduce the industry's impact, is to reduce the use of energy and resources in construction by decarbonizing the industry [equipment, heavy machinery, and transport], increased implementation of renewables, increased use of sustainable materials and practices (UNEP, 2020). The use of concrete, steel, plastics, and other materials have increased globally, however, several basic building materials and low-GHG intense processes have become or are

near-commercial stage, even so, new processes and materials have yet to be established in industrial practice. As an example, low-carbon concrete [the significant contributor being cement] has been available for some years as a more sustainable material option, still it only represents a fraction of the concrete consumption, due to increased production costs (IPCC, 2023; Novakova et al., 2023).

Other factors perceived to drive the increased GHG-emissions, were tied to an increase in floor-area per capita, emission-intensive electricity and population growth, combined with decreased efficiency improvements. The decomposition analysis revealed that developed cities would gain most GHG-emissions savings by, replacing, rehabilitation [retrofitting] and repurposing of the building stock, combined with densification measures and targeted infilling of cities, where area is a scarce resource. Additional measures to tackle and decelerate the rise in GHG-emissions is the compulsory use of building codes, in combination with other regulatory instruments and enhanced storage-and carbon uptake in cities [blue-green roofs, low GHG-emissions material and green spaces], thus helping cities cope with for instance stormwater (IPCC, 2023).

The compulsory use of energy performance codes globally is less common, based on the fact that only 41 countries were reported to have implemented building energy codes mandating the deployment of renewable energy technologies by 2019, and if constructively implemented, energy performance codes could support the uptake of renewables and the implementation of other energy efficiency measures (REN21, 2020). Since electricity distribution is already well developed in many regions compared to essentially non-existent hydrogen infrastructure [as is the case for Norway] (IPCC, 2023), the energy produced from solar PV-systems can easily be transferred into the electrical grid.

According to the UNEP, national governments must further strengthen long-term climate strategies, by prioritizing mandatory energy building codes, certification measures and work towards close collaboration with sub-national government (UNEP, 2020). A growing number of cities are implementing and aligning climate strategies in accordance with national goals and targets, such as net-zero GHG targets and SDG trackers, thus also addressing emissions that reach beyond cities administrative and regulatory boundaries. Given the global reach of national and regional consumption and interconnected supply-chains, the potential for reduction

in consumption patterns, are closely related to a holistic perspective on emissions and its origins (IPCC, 2023).

The European Union estimates that roughly 75 percent of the building stock within the union is energy inefficient, hence meaning that vast amounts of the energy used goes to waste (EU, 2020). The low energy efficiency of building stocks also results in higher peak loads and reduced system efficiency and increased need for capacity improvements of the grids (REN21, 2020). According to a 2014 report of the Norwegian building stock, approximately 1/3 of the building mass was built before 1956, a total of 2/3 before 1981, amounting to 65,5 percent of all buildings and 63 percent of residential buildings. Based on these numbers, there were believed to exist an energy efficiency gap, that could be stagnated by rehabilitating buildings developed and constructed up to and including the year 1980. However, the report did not advice against performing energy-efficiency measures on newer buildings, referring to the need for a cultural change within the population associated to energy and the introduction of new energy sources for electricity production (Brattebø et al., 2014).

The different types of energy efficiency measures that were recommended for different buildings were dependent on when the building was built, building segment and the technology that was installed at the time (Brattebø et al., 2014). When the 2014 report was published, TEK10 – the national building regulation in effect- was the technical standard to meet, and in 2017 it was replaced by TEK17. A comprehensive rehabilitation of buildings built before 2010 would include extensive energy-rehabilitation, with implemented measures for energy efficiency both regarding the construction [roof, windows, floors and outer walls] and the energy system [heating, hot water, ventilation or/and solar PV-system] in order for the building to achieve an improved energy balance (Brattebø et al., 2014), and meet new technical standards.

The building stock is a dynamic flow-stock, depending on [system inflow] the number of buildings built and demolition activity [system out-flow], the system also transforms within itself with rehabilitation, where the goal is to continuously move the threshold value for what an efficient building is, to enhance the standard of the total building stock. However, some researchers argue that the green building strategies that have been put in place, does not really apply to the existing building stock, but mainly

applies to rehabilitation projects which are subject to new building codes, accompanied by high-end office projects where innovation and new technology is tested, leaving the rest of the building stock lagging behind. Figures from 2019 revealed that over 60 percent of the electricity consumed by buildings, was connected to heating and cooling, and of the cooling, nearly all of the consumed energy was provided by electricity, which will increase during the next decades, due to rising average temperatures (REN21, 2020). The rising temperatures will undoubtedly change the consumption pattern also in the northern hemisphere and particularly in Norway, where the need for cooling has been almost non-existent, compared to other countries.

It appears as an almost impossible task to try to understand the dynamics and parameters driving a system, when one can only evaluate short time periods, this is especially true for systems with long lifetimes, such as the building stock [buildings often lasts 80 years, historically much longer]. Parameters could have the ability to influence systems through long time periods and may only become clearer over time (Brattebø et al., 2014).

Taxonomy in the European Union will eventually impact the Norwegian building - and construction sector, but in what manner is still unclear. The energy building codes, are inherently different, the Norwegian standard is based upon delivered energy while the European measurement is based upon total consumed energy. The total consumed energy by a building is what is being measured and subtracted from energy produced by the building itself.

The societal costs of not going green

“What we measure affects what we do; and if our measurements are flawed, decisions may be distorted” - Stiglitz, J., Sen, A. & Fitoussi, J.-P. (2010). (Mazzucato, 2018).

The perception of a company's role determines whether sustainability responsibility and CSR holds a place amongst company operations or not. Some *Friedmanites*, supporters of “Friedmanian Economics” would likely argue that the primary role of a company is to maximize profit for its investors, and not the practice of CSR, by caring for environmental and social concerns, as stated in Friedmans 1970's New

York Times publication “*The social responsibility of business is to increase its profits*”, traditional economics referred to this notion as “*maximizing shareholder value*”. The focus on maximizing shareholder value was shown to strengthen short-sided investment patterns, disregarding long-term views, along with the question of whom the companies should benefit (Mazzucato, 2018).

The question then arises, where does Sustainability and CSR fit into this traditional profit maximizing value system? Although most traditional economic theory describes company success based on value creation for the owners, other aspects have started to become important as well, much due to international treaties and trans-national regulations, such as the *EU taxonomy* regulation and the *Paris Agreement*.

The third principle of the *Paris Agreement* is tied to finance, stating that there should be a joint global effort towards reaching a low-carbon economy, while “*The EU Taxonomy*” aims to establish a universal classification system to differentiate between environmentally sustainable- and unsustainable economic activities. The directives and treaties are based on an effort to move the climate debate and environmental issues into the financial market and thus demand environmental accountability. As Norway is an EEA-EFTA state the EU taxonomy directive will not come into effect [as national law] until the EEA courts have agreed to the terms and delivered its objections, although how this will affect national law is not yet known.

Some researchers may argue that environmental degradation can be interpreted as a symptom of market failure, supporting the idea that intervention is needed to regulate the market economy, arguing that market-based solutions have shown themselves to be unfit for purpose when faced with increased climate challenges and environmental issues (Mazzucato, 2018; Perrini et al., 2006). As stated by Mazzucato, one needs to be critical when discussing value in relation to finance and pay attention to timeframes, such as short-sighted finance and the race for short-time gains and returns, as the practice cripple innovation and the productiveness of the economy. J. Keynes’ idea of the “socialization of finance”, stated that capital development [investment in innovation and infrastructure] should be pursued by public utilities, co-operatives, or public banks to stabilize the economy and directing public funds towards long-term growth, as opposed to short term return (Mazzucato, 2018).

According to Mazzucato there has long been an excess belief in the free markets ability to self-regulate, supported by the fact that the western industry has been able to pollute without much regard for long-term consequences, while contributing to the degradation of the environment and biosphere (Andrew, 2008). Mazzucato also argues that companies have to be rewarded for making decisions that target long-term growth, as opposed to short-term gains, by taking on difficult investments such as training of workers, testing new technology and investment in R&D (Mazzucato, 2018). As an example, Philips joint forces with the United States Department of Energy in order to develop a more energy efficient light bulb, ending up in the mass production of LED, this is an example of a public-private partnership that promoted innovation (Haitz et al., 2000).

It will be difficult to reform the problems related to “market failure”, where the costs of pollution have been externalized, where industries have failed to bear the full cost of their production, by minimizing the cost of business and passing the pollution cost onto society. This case of structured market failure might suggest that a market-based solution might not be the best way to deal with market-failures and industrial activities considered unsustainable (Andrew, 2008). Governments have an important role and must play their part, by favoring the projects and corporations that contributes more broadly to societies, through subsidies and the granting of green loans (Mazzucato, 2018).

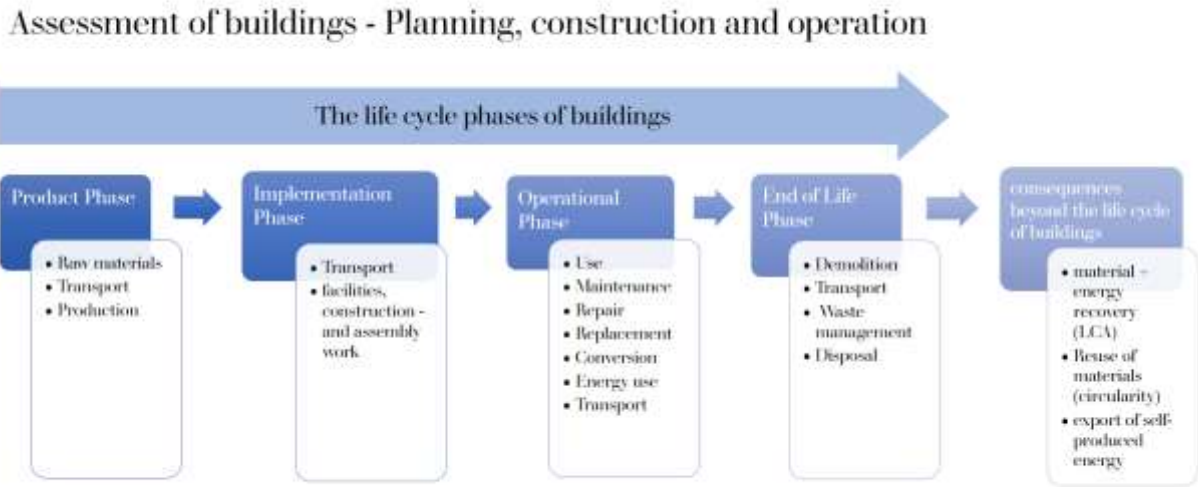


Figure 2. Assessment of buildings, Life Cycle Phases.

The construction and building sectors are exposed, perhaps more than ever, to global consumption patterns and complex supply chains, demonstrating the importance for cities and regions to define and implement their own climate targets that corresponds to the ones set on a national level, in accordance with other international agreements and GHG-targets tied to climate change mitigation. In other words, the interconnectedness of value chains demands that emissions beyond municipalities are addressed and targeted, through cooperation between nations, governments, and industries. Cities have the opportunity to affect strategies and priorities, by practicing a conscious relationship with their value chains and their role when purchasing, by renewing building codes and choice of construction materials (IPCC, 2022).

As described by the 2022 IPCC report, the largest potential for reaching net zero GHG emissions in 2050, is tied to the retrofitting and renovation of the existing building mass, and the fact that new builds are based on sufficiency, efficiency, in combination with renewable energy measures, in addition to the removal of barriers to decarbonisation. The report stresses that ambitious policies have the ability to strengthen the path towards achieving the SDGs in all regions, while simultaneously the building construction is adapted to tackle future climate risks. Hence, implying that policies lacking ambitious environmental and climate policies increase the risk of “locking-in” carbon for decades [referring to the life span of buildings].

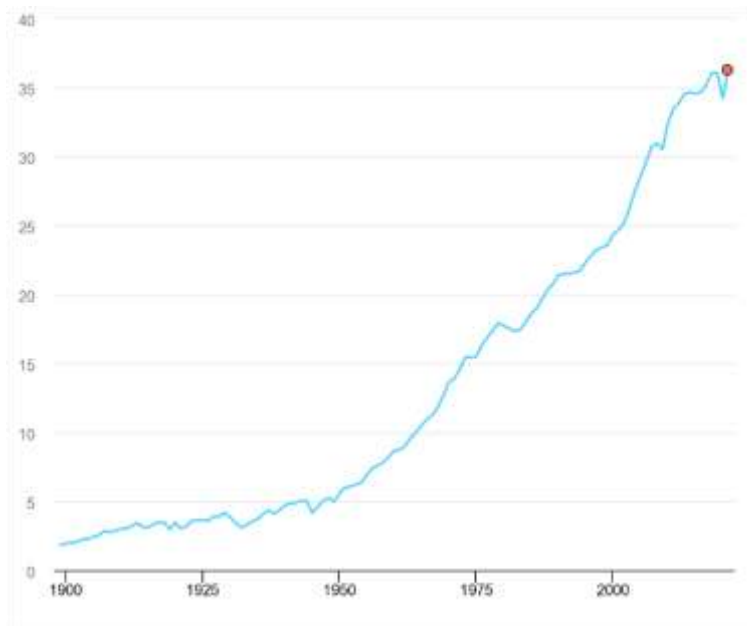


Figure 3. IEA, CO₂ emissions from energy combustion and industrial processes [Gt CO₂], 1900-2021, IEA, Paris. <https://www.iea.org/data-and-statistics/charts/co2-emissions-from-energy-combustion-and-industrial-processes-1900-2021>

As depicted in Figure 3, the CO₂ emissions from 1900 have increased significantly. According to 2019 estimates provided by the 2022 IPCC report, the direct and indirect global GHG emissions from buildings, cement -and steel used in building construction and renovation were estimated to be 12 Gt. CO₂ -equivalents. This includes indirect emissions from electricity and heat generated off-site, direct emissions on-site and cement- and steel emissions both connected to renovation and new builds. According to the report both direct and indirect emissions from non-residential buildings increased by approximately 55 percent while emissions from residential buildings increased by 50 percent compared to the base year 1990. The increase seen in later years have mainly been attributed to the increase in floor area per capita, escalated use of emission-intensive electricity and heat, in combination with population growth. Although, there has been great efficiency improvements that have in turn led to a decrease in emissions, the efficiency improvements have not been able to level out the increase in energy consumption and demand globally, but there will be regional differences tied to the different drivers (IPCC, 2022). In Norway most of the consumed electricity comes from renewable energy sources and the nation have experienced a continuous population de-growth the last decades.

The focus on development and construction of green retrofitted buildings and zero energy or carbon buildings [passive-builds, NZEB-builds], have led to innovative

example buildings in the construction industry, but there are still much to suggest that ambitions are still too low for renovation and retrofitting of buildings today. Studies reveal that the design teams and consultants have more influence in the early stages of a new-build or renovation project, hence, implying that mitigation intervention at the design and early planning phases are important to secure true sustainability measures. This includes the buildings disposition and layout, multiuse-functionality, re-assembling design, use [re-use of GHG-intensive materials] of low-emissions materials, integration of renewable energy solutions and building efficiency. At the operational Phase [user-phase], the focus should be on efficient equipment, the optimization of the use of buildings and low-emissions energy supply. At end-of-life phase [disposal phase], the recycling of materials re-use and repurpose of building materials should be in focus (IPCC, 2022).

The report estimates that up to 61 percent of all global emissions from buildings could be mitigated by the year 2050 if a combination of measures presented by IPCC are implemented. The largest mitigation potential for new-builds is tied to developing countries, while the largest GHG-mitigation potential for developed countries lies within the retrofit and renovation segment for the existing building mass. The years between 2020-2030 are deemed crucial by the IPCC to initiate and accelerate the industries knowledge base, increasing the technical and institutional capacity, pursuing the needed changes in government policies, securing finance of green projects and work towards reaching the full potential for GHG-mitigation in the building and construction sector (IPCC, 2022).

Methods Chapter

Interdisciplinarity in studies

To decipher complex and interconnected problems, intellectual border crossings could be a helpful way to broaden perspectives and gain new influences. When dealing with issues such as climate change, degradation of biodiversity and area efficient land use, there is no such thing as one truth. The researcher's knowledge-base and principal discipline perspectives, work as the starting point for framing questions and guides the interpretation of scope. When researchers investigate such social-ecological phenomenon as the ones mentioned above, they often draw upon disciplinary theories, due to the repeatedly disciplinary origins of sustainability researchers (Schlüter et al., 2022), moreover Öberg argues that all research is and must be, conducted from a given perspective, seeing that it is impossible to take all aspects in to account (Öberg, 2011).

The strengths and weaknesses tied to different perspectives, adds different benefits and insights into different questions, also benefitting a research project. The strength of using multiple perspectives when dealing with wicked problems, comes to light in interdisciplinary work. However, the unknown character and vast landscape of an emerging research field, might make it demanding to see where the study fits as compared to disciplinary research situated within a well-known field of research. While interdisciplinary studies might lack the same ability as disciplinary studies to dig deep into a specific field, an interdisciplinary research approach offers a holistic perspective, while deriving its strength from the use of methodology and theory obtained across disciplines (Öberg, 2011).

Researchers that “strictly” cultivate their knowledge within their discipline's borders, are referred to as *monodisciplinary* academics, as depicted in the figure below, without any connections. As described by Öberg, there are two main research approaches used to structure collaboration between different disciplines:

Multidisciplinary and *interdisciplinary* work. Academics that are *multidisciplinary* collaborate with academics from other disciplines, while specialized within the borders of their own disciplines. Whereas most disciplines operate enclosed within

their own framework, interdisciplinarity signifies that there is some deeper integration of disciplines, as depicted in figure 3 below (Öberg, 2011).

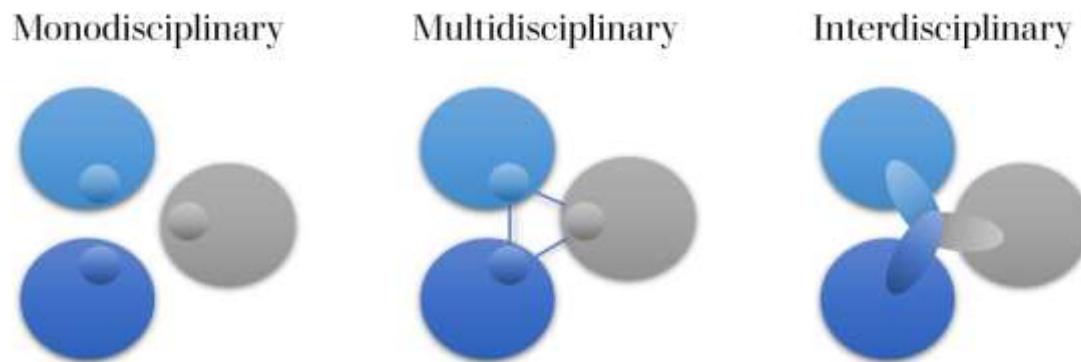


Figure 3. The figure illustrating the difference between monodisciplinary, multidisciplinary, and interdisciplinary work. Adapted from (Öberg, 2011).

As described earlier, sustainability issues are complex and can be described as wicked problems, hence implying that a holistic approach is best suited to tackle such problems. An interdisciplinary approach offers a holistic understanding of questions and acts as a tool for researchers who strive to apply knowledge from more than one discipline, whether the research was carried out with or without interaction with society outside academia. Research conducted in close interaction with the broader society can also be referred to as *issue-driven interdisciplinarity*, *transdisciplinary*, or *truly interdisciplinary* (Öberg, 2011).

It is extremely time consuming to strive towards becoming sufficiently knowledgeable within a discipline. The first boundary is that there are usually no sharp borders clearly dividing disciplines, the second boundary is knowledge insufficiency, in the sense that it is impossible to be an expert in “everything”. In relation to interdisciplinarity, the aim is not to become an expert in numerous disciplines, but to become an expert with respect to the study at hand (Öberg, 2011).

Internship and Reflexivity Chapter

When entering a site [company] as a researcher and an outsider, there are certain aspects that need to be considered and some of these aspects will be discussed in this

chapter. When the research takes place in a natural setting, the researcher becomes an important instrument for the data collecting process, in an open environment where human behaviours and events occur (Creswell et al., 2018), in contrast to enclosed and controlled environments like laboratories. The on-site researcher becomes an information sieve. All data must be filtered through interpretation, analysis, and contextualization. The data that emerges from qualitative research is descriptive [inductive and deductive] (Creswell et al., 2018). As a researcher, I was very aware that it was vital to establish some form of mutual trust and respect with the employees in order to get them engaged in conversations and interviews, because my research methodology aimed to access the intuitive and felt knowledge [tacit knowledge] of my informants, which requires a social connection to obtain.

Since the research took place at a division in a consulting firm, most of the informants and interviewees were consultants, working on tight schedules. This made it challenging to get the informants to participate in planned/scheduled conversations or interviews. The constant time pressure the consultants faced from different projects, made it clear early in the research that surveys would be difficult to conduct, efforts were rather allocated to a systematic selection of a few informants, focusing on background, experience, and project references. Many of the research participants were recommended by other informants or suggested based on the themes I mentioned that I would like to investigate further. Thereafter, the informants were screened through the internal CV portal, where previous project experiences and expert fields were listed [although not all profiles were equally comprehensive]. The recruitment to interviews and conversation through mail invitations yielded some success and potential sources seemed more prone to accept scheduled talks when they were framed as “sustainability talks”, rather than a formal interview setting. After spending some time around the employees and observing, it became more apparent who was open to have conversations.

The presence of a researcher on-site was undoubtedly an unnerving experience for many of the employees. It was evident that some employees were skeptical of my presence and became even more wary when the term sustainability and master thesis was mentioned. Consequently, the first weeks were mostly spent observing and getting to know people in a casual way, aiming to gain some level of trust before inviting sources to longer conversations of interviews. Efforts were also made to

establish contact with employees outside of the department. Some sources were more inclined to engage in conversation when they had become more accustomed to my presence at the company office, while others were open to have conversation and attend interviews when coworkers referred them to me.

In order for informants to feel comfortable sharing information honestly, there needs to be some level of trust between interviewer and interviewee. Due to the time limit of the internship, it was essential to get a feel for the culture quickly. The extensive use of technical abbreviations and typical industry language during meetings, showed a growing need to familiarize myself with the work language. Hence, an extensive amount of time was used learning the company's "work- and industry" language. The work entailed making glossaries, reading technical dictionaries, industry newsletters and discussing terms and concepts with department members willing to explain. A lot of time was also spent reading internal documents and asking for advice on which internal pages I should keep an eye on and a crash course in how to navigate through the internal database. Although it was a time-consuming activity, these measures made me more proficient in the professional language and made it easier to ask more professionally relevant questions in later conversations and interviews. In addition, time was spent gaining insight into the different projects that were in process or planning, while locating the company's *gatekeepers*, that could grant access to certain projects and informants (Creswell et al., 2018).

In fear of scaring off potential informants and interviewees, a choice was made to invite informants to a "sustainability talk", in an effort to disarm the situation. It had proven difficult to conduct interviews as planned and of the depth and length that was desirable in a research perspective, and as a consequence, I decided to not push the limits [comfort zone] of the participants by asking for consent to record the conversation. However, the informants were informed that I would be taking notes during the conversation and interviews.

Participants in the research were presented with information regarding my presence at the company, I presented my educational background, the master program in which I was writing a master thesis and what I was aiming to achieve during the internship. I was clear in the fact that I would take notes during the conversations and read some prepared questions or present some findings I hoped they would elaborate on. I

decided to mainly ask open questions, stimulating the informant to elaborate on and describe further.

Being a researcher not native to the building and construction industry, made it challenging, especially early on, to formulate branch specific questions, the process of learning about the industry yielded a lot of insight and allowed for a deeper understanding of branch specific issues. However, it was difficult to ask very branch specific questions, making it essential to practice a flexible research approach which left room for revising the project outline on a regular basis (Öberg, 2011).

Research Methodology

This Thesis is written based on a broad definition and understanding of the grounded theory, accompanied by qualitative inquiry as part of the research approach to investigate and describe complex social phenomena, that is neither easily measured nor quantified. The open-ended and flexible approach to data collection and analyses allows for a more interpretive and explorational approach to research material and empirical data, rather than the testing of preconceived hypothesis. In qualitative research studies the principal question often demands an explanation of the core concept or phenomenon in the study (Creswell et al., 2018). Although most qualitative studies aim at answering the questions like “how” and “why”, often dealing with issues where quantification has no meaning, it is important to add that quantitative tools are often used to describe qualitative concepts and features (Öberg, 2011).

Qualitative research aims to develop a complex and holistic picture of the issues and problems being studied, and through the exploration of different factors centred around a main phenomenon, by presenting broad perspectives and views provided by research participants. The broad lens that is used helps the researcher to describe a larger picture that emerges. These pictures often describe something other than a linear model of cause and effect, but instead focuses on the interaction between different factors, and how they operate in real life (Creswell et al., 2018).

One of the main factors that differentiate the qualitative research from quantitative research, is the process of collecting and examining research data. When writing

qualitative research, the process of writing, examining and analysing data are constant and simultaneous procedures. Another characteristic is that all data is not revealed and presented in the research, as opposed to quantitative research, this act of withholding research data is called *Winnowing* the data. The reason for winnowing data is tied to the fact that text data is a very dense and rich data source, making it hard to fit all the collected data material into a qualitative study. The winnowing of data, by compacting the data into fewer themes also sharpens the research by focusing on some parts of the data and disregarding less relevant data material (Creswell et al., 2018). Other factors such as confidentiality, privacy, or sensitivity issues, could determine whether research material should be withheld from the research.

Data Collection

Interviews/conversations: Semi structured interviews, informal interviews, and informal conversations:

Although some sources were reluctant to engage in an interview, the sources whom I was able to speak too were extremely open, willing to share and discuss sustainability issues they experienced in their daily work, including issues and frictions they observed in the industry. Measures were taken to ensure against one group overrepresentation in the research, hence excluding other opinions that might exist. It was important to talk to as many employees as possible, preferably within different age groups and departments to uncover work-cultural differences [if any] and to uncover any age gaps in differing opinions and knowledge silos. Although the sample group can be classified as small, the sample group represent a diverse group both in age, gender, and experience, both within the company and the industry.

It was a concern that if the questions where to defined and narrow, a lot of important information would be lost in the interactions. An informant would likely not feel free to elaborate on other issues or deviate from the specific question, hence, possibly holding back on important information. Through the research project interesting information was revealed when the informants were able to reflect more freely on

different sustainability issues or systemic bottlenecks as they experienced them in their daily work and through interactions with employees, customers, and business collaborations. As mentioned by Öberg, it is important to structure the conversations in a way that made the data researchable and made the answers suitable as source material later in the research project (Öberg, 2011).

The main interview strategy was to let the conversation flow freely without veering too much of the main topic. The role of the interviewer was to intervene as little as possible, ask follow-up questions and ask for explanations and elaborations when necessary. The objective was always to get a holistic view, by getting to talk to as many informants as possible and to gain an understanding of issues and problems from the lens of the participants.

It was more difficult than expected to get employees in the company to donate part of their time to the research project. It was challenging to get employees to talk about sustainability issues related to the industry and even more so in relation to the company.

Participatory and non-participatory observations

The first participatory observation of the research was a department meeting. These department meetings occurred weekly, and I was present at many of them during the internship period.

- Monthly division meetings
- Weekly group meetings.
- Industry seminars (“Klimapartnere Vestland”).
- Sustainability Conference hosted by the Norwegian competition Authority (2022).
- Green Loan in-house seminar by DNB.
- Entelios energy conference (2023)

Field work and field observations

BREAM-NOR interview and other project interviews.

Observations were mainly of short-term events, where observations of both participatory and non-participatory character were made. The empirical data from the observations were usually collected by field notes. The empirical material as a whole was comprised by self-produced text, field notes and memory of observations. The observations made during the field work Examples of participatory and non-participatory observations that were obtained during the internship was for instance the Norwegian Competition Authority's sustainability conference 2022, visiting construction sites and participating in site inspections (Öberg, 2011).

Document research

An extensive document evaluation was conducted, where I read up on documents such as legislations, directives, industry newsletters and building codes and BREEAM – manuals [in use], in order to familiarize myself with the industry and project procedures.

The experiment

As outlined by Öberg, an open experiment can be the act of provoking a response by asking questions where the answer becomes the response, that must be observed and interpreted, which in turn becomes a part of the empirical researchable material. The strategy was to approach potential sources at the coffee machine and then evaluate if they were interested in engaging in a longer conversation. If the result was that a source seemed uninterested or otherwise inclined that they were not interested, they were no longer pursued to further participate in the research. This was a typical “coffee machine experiment”, to test if the conversation was quickly cut short when I presented myself and the research project, or if they were interested in having a longer talk. This “coffee machine experiment” can be defined as a qualitative experiment (Öberg, 2011).

Collecting, Analysing and Coding of Data

Boundaries to overcome in the research

There were some boundaries in this study that was hard to overcome, one of them as mentioned being some sources generally reluctant to participate in interviews. The second boundary was the fact that internal interviewees and informants were a largely homogenic group, in this case meaning that they mostly had the same educational background and work experience mostly tied to the building and construction sector.

When selecting the company for an internship, I had no prior affiliation with the company nor the project participants, this allowed for multiple perspectives to flourish without many predetermined views/biases. The participants had little power to influence the research project or otherwise use the power imbalance in the work/research relationship to influence my research questions and observations.

Avoid “*going native*” – by embracing the perspectives of participants in the research (Öberg, 2011). I evaluated carefully which activities I should participate in and which I should avoid, to keep a healthy distance and remind the project participants that I was first and foremost conducting research and just substituting as a coworker in different projects. I had to frequently take a back seat in discussions to keep a professional distance and avoid getting too engaged in company issues and internal subjects that was not relevant to my research. I avoided going to several social events to keep my professional status when conducting interviews.

Early on I took an active choice to not participate in some of the more frequent gatherings to give the participants some common after-hours activities where they could relax and as it became apparent that my presence made some employees nervous. As explained by Creswell, I was cognizant of my presence and tried to the best of my ability to minimize my impact on physical and social settings, while respecting the site and the workflow (Creswell et al., 2018). If the environment had been more “inviting” it might have been interesting to interact more closely with the

research participants, as it might have granted more opportunities to investigate different topics.

As described by Creswell et al., I made effort to disclose and include all relevant findings, both favorable and unfavorable findings, while critically assessing information and avoid going native. There were however some findings that could not be disclosed in this thesis due to privacy and other ethical issues. When conducting interviews and collecting research material, I was mindful of the fact that as a researcher I would probably be subjected to stealth issue advocacy (Öberg, 2011) and presented with narratives that would convey the corporate values the company wanted to present, whether this was done consciously or unconsciously.

The privacy of participants

It was important for the research that the participants were always aware of my role, and I always started a conversation/interview with an introduction of myself, my research, background, and my reason for being at the company. This openness resulted in the fact that several people actively avoided me or did not want to talk to me. However, those informants and interviewees who were open for a conversation, where usually open for a second and third conversation to clarify questions or to answer new questions that were raised throughout the internship.

It is an essential part in any research to protect the anonymity and privacy of informants and interviewees. It was important to ensure the anonymity to get interviewees and informants to talk, a big part of this work consisted of ensuring that no informant experienced any retaliation from the company or management, due to their participation in this research, due to the fact that some statements and opinions may differ from the official company statements. A choice was made to anonymize key information about company roles, division affiliation, and gender. The different divisions were simply too small and even minor key information would make the informants and interviewees too easily recognizable in this context.

Due to the openness of certain sources and willingness to share their personal experiences and difficulties in project work, a choice was made to put in place

further precautionary measures to anonymise research participants, extending to also include the company name. The reason for this is that the findings suggest that the name of the company was not essential for the understanding of the phenomena described and discussed in this research paper. However, this helps respect the privacy of the participants.

Coding of Data

The codes that are generated from the research material usually follow into one of three categories (Creswell et al., 2018):

- Expected codes.
- Surprising codes.
- Codes of unusual or conceptual interest.

Our worldview does affect our mental images, determining how and where we see connections and how we interpret different systems. Our views influence our way of conducting research and what we observe and later describe (Öberg, 2011). Since all data must be interpreted these are codes and links that were most obvious to myself, while another researcher might have ended up with different codes based on the same research material.

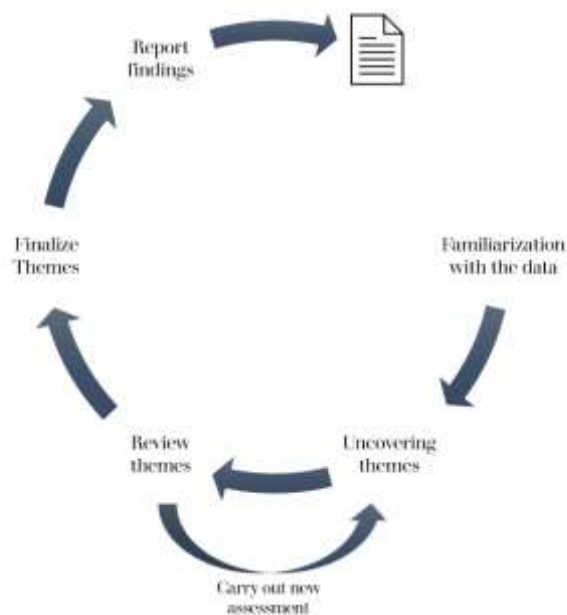


Figure 4. Describes the Qualitative-Thematic analysis method that was used to uncover themes in the research material and code the themes to later be finalized and reported in the discussion section of the thesis.

Reliability and Validity

If other informants and research participants had been interviewed during the study, one has to acknowledge the fact that there would probably have been different responses and findings in the research. That is just a fact when conducting interviews and selecting interviewees. Every participant has their own unique experience and interpretations of their environment and surroundings, since everyone carry their own images of how the world is composed (Öberg, 2011). This is not a liability that can be eliminated completely; however, the researcher can strive to recruit participants with diverse backgrounds, work experience, diverse demographic, age ranges and aim for gender balance amongst the participants.

Potential Ethical Issues

Anticipated and Non-anticipated ethical issues

It is almost impossible to preserve total confidentiality when working with participants, but I strived to preserve the privacy of informants and interviewees to the best of my abilities. I anticipated that this would be difficult when working on-site, but not to the extent that it turned out to be. I also anticipated that it would be difficult to get people to participate in the research project and that it would be difficult to keep the role as researcher at the same time as I was substituting as a co-worker on different projects.

During the four months I spent on-site [at the company office], I was assigned a workstation [with two large screens and a laptop-docking station], in an open office environment. Initially this was a nice place to be situated because it was easy to keep track of informants, by observing and listening to different discussions in the division. This placement also served as easy access to some key informants and other employees if there were a need to discuss something or ask for advice. The downside to this placement that I had not anticipated, was the fact that all my research work was open for prying eyes and conversations could easily be overheard. This made

working conditions extremely difficult at times. I could not transcribe interviews, process sensitive or personal information, nor conduct interviews at the workstation.

I avoided working on sensitive research material at my desk, but in special cases, I wrote down short sentences on the laptop and changed the text colour to a very light grey, that made it difficult for people passing my desk or looking over my shoulder to read. By not using the stationary twin-screens I had more control over document visibility. I made it a practise to carry pen and paper to write down key findings during the workday, closed my computer whenever I left my desk and stowed away any handwritten notes. I also made it a habit to always book conference rooms when I was conducting interviews in-house, taking zoom calls, or conducting phone interviews. If I had to write on something sensitive, I worked from a cubical. The downside of this practice was that the advantage of being on-site, somewhat disappeared when I was working isolated. Having access to my participants, sometimes became a disadvantage in this sense and a constant balancing act. A consequence of conducting interviews on-site, was the fact that some interviewees were seen leaving conference rooms I had occupied for longer periods of time, which consequently lead to some questions and speculations.

Analysis of Results & Discussion

The Findings Section

This section of the thesis covers the empirical data collected during the internship, through interviews, conversation, observations, and field work. The aim of the internship was to investigate how sustainability is handled in practice, as opposed to how sustainability is talked about as a concept and theory. The outcome of the thematic analysis (Fig. 4) provides the structure of the findings section and describe the main themes from the collected research material. An overarching finding was that many of the employees were not comfortable with the sustainability term. It was a term that was used a lot by management and had been thrown around by department leaders and division managers for years, while the average worker seemed to have little personal connection to the term. This coincides with the fact that a lot of terms

that have a theoretical meaning and understanding, could be hard to grasp from a business perspective and demanding to operationalize in day-to-day business activities. There was one exception the rule, which was the division of energy, environment and climate, a group that had a very clear idea of what sustainability meant for the division and the customer projects they worked on. However, the company seemed to be lacking a universal understanding of sustainability and a value system anchored to sustainability. [The interview guide in the Appendix show project participants, table 1].

An internal employee survey conducted by the company, uncovered some bottlenecks connected to the integration of sustainability practices into the company (Interviewee I, VII). Those employees with a conscious relationship to the term, had their own definition of what sustainability meant to them in a working context, but the majority did not. It was just assumed that when the term sustainability was used, everybody had the same definition and understanding of what it meant, to the company, department or what it meant for the customers. As explained by **interviewee I**, *the employees must feel professionally confident [referring to sustainability as concept and practice] and we have to familiarize ourselves with the customers sustainability ambitions and connect our advice with those ambitions.*

To overcome this sustainability vacuum, the company employed a sustainability director, anchoring the sustainability role at management level. The director would have the operational freedom to implement changes and follow up department leaders and divisions across the country in their work. For example, **interviewee I** explained that *it was a strategic choice from the company, lifting the sustainability work to a more strategic level, as a statement showing that this is something we are actually going for.* This example shows the performative function of the sustainability director role. Even though, the company was trying to elevate the status and importance of sustainability, by lifting it to a higher level within the organization, the concept was not fully embraced as a working strategy within the different departments. An example of this practice was described by **Interviewee VI**, *when there are no energy calculations in a project, sustainability in general often disappears from the project as a whole, without any set goals nor a desire/ability from the Project Manager (PM) to put a sustainable touch on the project.* This claim

was supported by interviewee XI stating that, *the “holistic environmental focus” is not really present in many projects, it often becomes an afterthought.*

Interviewee I explicitly mentioned that there had been a lot of people working with sustainability for many years prior to his/her arrival to the company, but the fact that this work was tied to their role as consultants, thus making it *hard for them to succeed in this work.* **Interviewee I** further described that, *when I take a show of hands and ask the consultants how many of them know their client’s sustainability aspirations, surprisingly few actually do.* **Interviewee III** described another dimension to the problem of practising sustainability, *as many consultants are so used to think in terms of energy savings, consumption, and sustainable material use in construction and retrofitting projects that they fail to communicate the sustainability aspect of this work to customers.* **Interviewee III** also added that, *we need to learn and practice to speak and think in sustainability terms and not just in technical terms.*

The implementation of sustainability into the business model and making in part of the core activities of the business is however not an easy task as stated by **interviewee I**, *we can control it [the sustainability footprint in projects] partly by not going for all customers but choosing a bit more which customers we work with, so that we work with the most forward-looking. There is competition for those customers..., but we can take a far more active stand and focus on the customers we want, because they supply us with most opportunities to test sun on roofs [PV/PVT-systems] or whatever it may be.* As an example of the gap between management, and some of the consultant’s [Interviewee II, III, IX, XI] **interviewee XI** stated that, *I have personally never heard of a project that got turned down by the company, due to its lack of environmental focus and sustainability measures and I do not see this practise changing any time soon, if it means that the company has to say no to potential income.*

Making time for the future

It was uncovered through several interviews and conversations, that a lot of the time sustainability work in projects were hampered by tight schedules and project deadlines. Interviewee I explained the difficulties tied to development and trans-divisional co-operations in a consulting company, were all activities need to be invoiced, *I do not have a department or a group of employees working with me, meaning that I don't have a dedicated department budget. In effect, this means that I do not have the opportunity to release people from other assignments by "buying hours" for internal projects.*

The difficulties surrounding the invoicing regime is not a company issue, but a branch issue. Putting some form of restrictions on all consultancy businesses, operating within this regime and by this practice. However, Interviewee I, described this as a potential boundary by stating that, *the model we have is not well equipped to deal with central functions [referring to national and regional top-down management]. I think the model the company have succeeded with for so long and in many contexts does not fit so well [referring to the need for sustainability issues to be adapted in every department, division, and region].* The company model is at its core a decentralised model, with a lean staff, making top-down management decisions hard to implement, in addition to the autonomy of the departments and regional-offices, they are expected to prioritize their own activities. The flip side to this de-attached company structure is that the divisions are "forced" to prioritise the projects that provide the most invoice opportunities, thus leading to the reprioritisation of R&D and project related to the enhancement of competence regarding sustainability issues.

Another informant described the invoice regime in consultancy companies as a type of straitjacket, in the sense that consultants are denied the time needed to investigate and analyse viable options through the project definitions or contracts. Interviewee XI offered an explanation, *we rarely have time to investigate the environmental goals of the customers we deliver projects to, its not part of the official project description, hence not an activity we usually get paid to do. [referring to the fact that the activity cannot be invoiced to a customer or project].* This description seemed to resonate

with many of the interviewees. Several of the informants described working from a place of some level of frustration, being limited by different factors from allocating the time and resources they wanted, to deliver the best result [especially related to sustainability issues]. Interviewee XI further explained that *the bottom line is that the company serves the customer, and if the customer lacks an environmental focus the project will usually not have much of it either, that's just how it is.*

As described by Interviewee I, *the company's work concept: "The way we do things" has been the paradigm framing work structures for several decades and is often offered and seen as a viable explanation for why work strategies and activities are the way they are. A strategy that undoubtedly has served the company well, so far.*

Anchoring the SDGs to the core business operations, does not happen without intervention and it takes time, this could either be seen as an investment or simply an added expense, depending on the time horizon. As mentioned by Interviewee V, *sustainability should be higher on the company agenda than what it is ...sustainability should not be weighted in the same way as economic incentives.*

Locating the responsibility

Inside the organization

In contrast to initial expectations, there was almost as much internal blame going around in the company as external factors being singled out as the sources of stagnation and effectiveness related to sustainability issues in the building- and construction industry, and within the company itself. Some informants and interviewees also criticised the working structure and the burden of invoicing as consultants.

The internal frictions within the company were mainly tied to blame amongst the departments themselves. No department was absolved in this sense, but some fields of expertise were known to be slow movers in the industry [also related to sustainability], such as the HVAC -and Electricity department. As stated by

(Interviewee II, XIV) **interviewee II**, *we all have a lot of room for improvement related to sustainability, but especially the Electrical group*, the interviewee also believed that many consultants struggled to connect sustainability to their everyday work, thus making it something intangible and floating.

Interviewee II also mentioned that there was a lack of understanding as to how decisions made by one division would affect the workload and conditions of another. As explained by **interviewee II**, *it's easy for the energy and environment group to set project conditions, then leaving it to the electrical group and HVAC to figure out how this should be carried out in a detailed project [design phase], which then is to be put to practice and developed in real life*, highlighting some of the difficulties between the divisions. **Interviewee V** described the friction in other terms “all departments must own the problem [referring to sustainability issues] and each subject area should know their own possibilities and limitations.” According to other informants the problem is not that consultants don't want to deliver on sustainability in projects, but it is not always clear how according to [Interviewee II, III].

Interviewee II, *we are not able to give good sustainability advice, because we do not have the needed competence nor experience, we should enhance our competence on reuse and recycling, then practice and reinforce*. Other informants shared the need for competence enhancement, as stated by **Interviewee III**, *we can deliver better advice by increased competence, asking the right questions and pulling in the right direction*. The company itself states that they are “no better than their last project delivery”, aiming for continuous improvement. **Interviewee III** also explained that a part of increasing the competence is to deliver the right information to customers, *when we add up all the cost in a project, it is equally important to present all of the potential and actual savings tied to a decision, to paint the whole picture and help the customer prioritize different measures*.

When it comes to how high sustainability issues were on the consultant's agenda, most of the informants agreed that sustainability should be a greater priority in project work, in general. As described by **Interviewee V**, *it is important for everyone to get engaged in the matter [sustainability] and for every employee to be aware of their ability to influence and develop more as a group and individuals*. However, interviewee III, was focused on the general conditions for design and building

contracts stating that, *“Enterprise-form” in a project is alpha omega in our industry. The format that is chosen affects the company’s ability to influence the decisions, design, and the sustainability footprint of the project. The choice of building contract impacts the construction client’s [byggherre]incentives for thinking about sustainability issues. The sooner we get to enter a project as consultants EP “early partnering”, the more bargaining power we have.*

The interviewee explained that an early entry made it possible to define and set the guiding principles and preliminary guidelines for the project. Interviewee III further also explained that the company could opt for projects that gave them a better position in the project organization where they could practice sustainability from a stronger leverage point and more weight by virtue of the position. *Unfortunately, the focus is often to sell as many hours as possible on as many subject areas as possible [invoicing on many separate divisions on a single project], instead of prioritizing the position as EC “executive contractor” or TC “total contract” builder. The focus is always on volume [referring to number of hours], that’s just how it is in the consultant industry.*

As explained by interviewee II *there is a lot of unfulfilled potential, I believe that consultants underestimate their own influence much of the time [referring to project work].*

Outside the organization

Interviewee II provided an example to the struggle surrounding suppliers in the industry connected to sustainability issues *Consultants have informed other industry insiders and sub-contractors of their system lag and how damaging this is for the entire industry, hardly any HVAC industry suppliers offer EPDs on their products such EPDs will eventually become a requirement in public and private projects alike [in contractor offerings and tenders]. As described by the **interviewee II**, they [contractors and suppliers] are simply not prepared and it’s not the consultant’s job to inform them on such matters, but many consultants feel they have a duty to educate the rest of the industry.*

Another conflict that was addressed by Informant IX, *it is not unusual for a project to suffer due to conflicts associated with differing goals and agendas between the different stakeholders in building project.* The informant described what he/she described as a classic conflict between esthetical interest of architects and interests regarding energy efficiency and energy production possibilities valued by engineering consultants.

An industry waiting to be regulated

Interviewee XIII stated that, *we are going backwards into the future; we must change and develop if we want different results and a different industry in the future. The perceived costs of choosing a greener product are often higher than the actual costs, and we need the backing of the local authorities in this transition too, to change regulations and set standards for more sustainable products in PPP-projects.*

Informant IX also described a lack of regional and national leadership when the old technical regulations for the industry were revised, *many of the paragraphs in TEK17 are effectively dead, meaning that they are not always followed in project work in the industry.* This statement was also supported by External Informant XII who claimed that, *the lack of “green policies” and the soft environmental regulations described in TEK17, is a huge part of the reason why many senior employees and consultants in the industry see sustainability issues as a passing-hype that eventually will blow over.*

Informant IX also stressed the fact that a lot of colleagues in the industry and within the company had been extremely upset by the new TEK17 building regulation. *A lot of consultants had high hopes for this new version,* and further explained that the consultants opted for stricter regulation that conserved and shielded the environment more than the previous TEK10, while also prioritising renewable energy systems to a higher degree. Informant IX also stated that, *it is difficult to argue for sustainable measures that cost the customer more money in projects, without authority in law to value nature in building projects and construction work more than we do today.*

Earlier a distinction was made between the external environment and the building site, where the project owners were only responsible for the emissions that happened

within the plot boundary, as Informant IX explained, *this is fortunately no longer the case, but we still have a long way to go.*

Several of the informants and interviewees argued that the building and construction industry wanted to be regulated more than it currently is, but there seems to be a reluctance from local governments and national authorities to clarify and develop a common pathway in the green shift. An external interviewee explained this frustration over not being heard in discussions with the local authorities and Bergen municipality. *The whole industry is waiting to be regulated, we have asked time and time again for clarifications and direction in the transitional work we are trying to engage in, without any clear answers. If businesses are willing to make large investments in new machinery and development of more sustainable building material, we also must know that this will become a criterion, it not we are just pricing ourselves out of business.* The building and construction industry as a whole wants to be regulated and have some common guiding principles to follow in this extensive transition, but many actors want to level the playing field, meaning that they ask to compete on equal terms.

Another external interviewee X stated that, *larger companies have the power to influence society and the authorities in a more sustainable direction, but they rarely use this bargaining power, what is really needed is stronger regulations and legislation.* The interviewee argued that history has shown us that it is naive to think that companies and big corporations will take losses willingly, even in a short term-perspective, to achieve long term gains for society.

Old Convictions Die Hard

Some common myths were circulating amongst the engineers working at the company, framing their knowledgebase for decisions made in different projects [ignorance]. When I asked questions regarding solar PV-systems and if this technology had a central role, if any, of the building -and construction projects the company was working on, I often got a puzzled look in return or a detailed lectures in terminal runaway fires, as explained by interviewee VIII.

I was told that the batteries for energy storage was so dangerous that they should not be put on public buildings and especially not residential roofs. I also got the comment that it was really no point in investigating the energy potential for PV-systems, because they were ineffective in Norway by default, due to the lack of sunlight.

Other employees told me that they did not understand why I was interested in investigating the company's sustainability work and look into the industry practice because this was something the company had been working on for years, hence arguing that the practice was well established within the company activities and work structures.

Mind the green gap

As it has been discussed through the Findings chapter, there are a lot of good incentives and good will among the actors and stakeholders in the Norwegian building and construction industry, although they are dealing with a lot of constraints and bottlenecks, many recognize that there is a need for a deep systemic change within the industry. Saying that something is a priority does not make it so, there needs to be some integration into the daily working routines.

The focus on circularity have led the society astray by believing that “everything” we put into the system will have eternal life and provide society with value. The fact is that there is a need for degrowth and there has to be put less materials into the system, by using what we have smarter, developing products to last longer and use less energy while doing so. have in the age of the *anthropocene*, as long as everything gets put back into the “circle of life”.

There is a difference between sustaining a system that is not sustainable and reinventing the system. Not everything should be put into a system, products of poor quality and with short life spans should be taken out of the loop and discarded. We cannot circulate our way out of the climate and environmental crisis that we are up against. Circularity is not humanities golden ticket, and it is not the answer to every sustainability problem. This circularity focus has drowned a more important issue, it

has created an idea that we can produce and consume as we have in the age of the *anthropocene*, as long as everything gets put back into the perpetual “circle of life”.

Concluding Remarks

The thesis work revealed that there is still a substantial disconnect between the theory of sustainability and the practice. The actors involved with practicing sustainability have difficulties to recognize the interconnectedness of sustainability issues, that spills over to affect their operational decisions, also affected by ignorance and the negligence to recognise the wickedness of sustainability issues. This practice has been sustained much due to the sustaining of an industry practice that has shown itself to be unsustainable, instead of reinventing the system, the industry has fallen in to a path dependency of conducting operations and solving problems in a particular way, that also makes it prone to lock-in effects, therefore also an industry that is perceived to be a slow mover in the path to reach the SDGs and Paris Agreement.

The attempts that have been made to develop standardized assessment tools has shown itself to be an enormous hurdle and the system has gone off track also due to the introduction of new definitions and phenomena, that has in many ways distracted the debate and led industries into a new world of complexity, the building and construction industry, is currently overwhelmed with building codes, legislations, technical requirements that does not fully embrace the holistic environment and climate problems facing the industry.

Many of the incentives today are merely treating the symptoms rather than dealing with the underlying systemic and socio-cultural problems that have led us into this reality of systemic incapacity and has instead become a development arena where companies try to internalize the externalities. The industry is unable to find a way out of this path-dependency itself, which requires targeted measures and intervention from the international, national and local authorities combined to strengthen the cooperation to keep below the 2-degree scenario as described by the IPCC.

A lot of sustainability issues and problems are manifesting itself on a local level and the solutions should also be anchored to local strategies and values. However, the

world is an interconnected place and the climate and environmental issues facing all societies know no borders. It is easier to change systems than to change minds, but there needs to be some level of commitment and belief in the ability to transform societies and industries alike by acting locally and thinking globally.

Interview guide

With 6 weeks left of the internship, I was asked to withstand from having further interviews. I could talk to the consultants that I had a working project relationship with, in this way the company could invoice different projects for the time they spent talking to me. In effect, this meant that I had little or no opportunity to talk to the consultants that struggled with sustainability issues in their day-to-day activities and project work, unless we were on the same project, but only talk to people in management roles. This affected the opportunities for secondary interviews and follow up questions and this will undoubtedly also have affected the knowledge base after the internship and the answers. I would have liked to have done some more interviews, but this was not feasible within the limitations I was presented by the company.

Source Object	Experience In Years			Source Origin	Expertise
	< 5	≤ 15	> 15		
I	▪			Internal	Sustainability Director
II		▪		Internal	Civil-Engineer
III		▪		Internal	Civil-Engineer
IV	▪			Internal	Engineer
V		▪		Internal	Regional Manager
VI		▪		Internal	Civil-Architect
VII		▪		Internal	Manager
VIII		▪		Internal	Engineer
IX	▪			Internal	Engineer
X			▪	External	Climate Professor
XI	▪			Internal	Civil-Engineer
XII		▪		External	MSc Renewable Energy
XIII			▪	External	Regional Manager
XIV		▪		Internal	Engineer

Table 1. List of Source objects include interviewees and informants, both from the company and external. The Sources are listed with years of company or industry experience, although some of the sources have longer careers.

Appendix



Figure 5 - Displaying the seasonal variations for solar- and wind power production on land. Wind power is depicted in the graph to the left, while sun variations are on the right. Collected from Solenergi Klyngen Report (Hjelme et al., 2022, p. 11). In relation to the average as well as observed historical maximum and minimum level in the period 1979-2019. The dashed lines show historical max and minimum level in the same period.

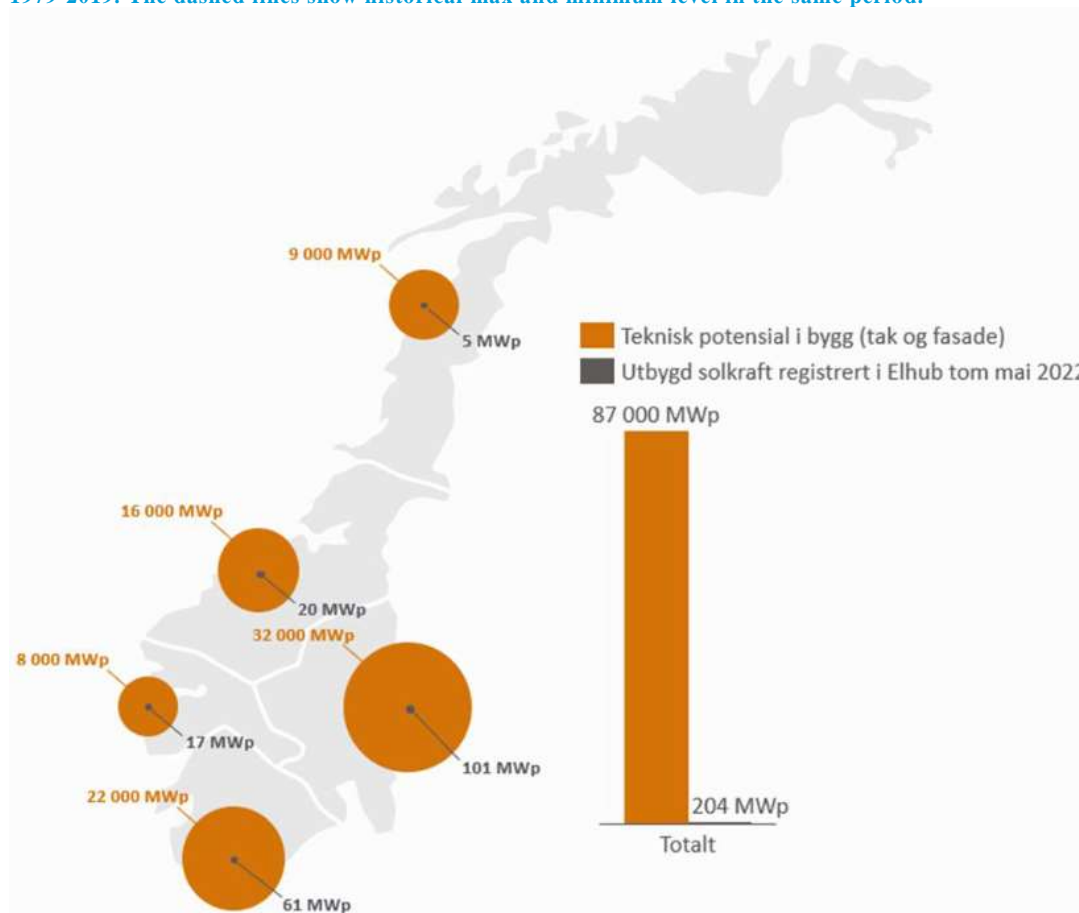


Figure 6. Displaying the solar-power production potential on land in Norway, divided into five energy producing regions. Collected from Solenergi Klyngen Report (Hjelme et al., 2022, p. 25).

(a) Global surface temperature change
Increase relative to the period 1850–1900

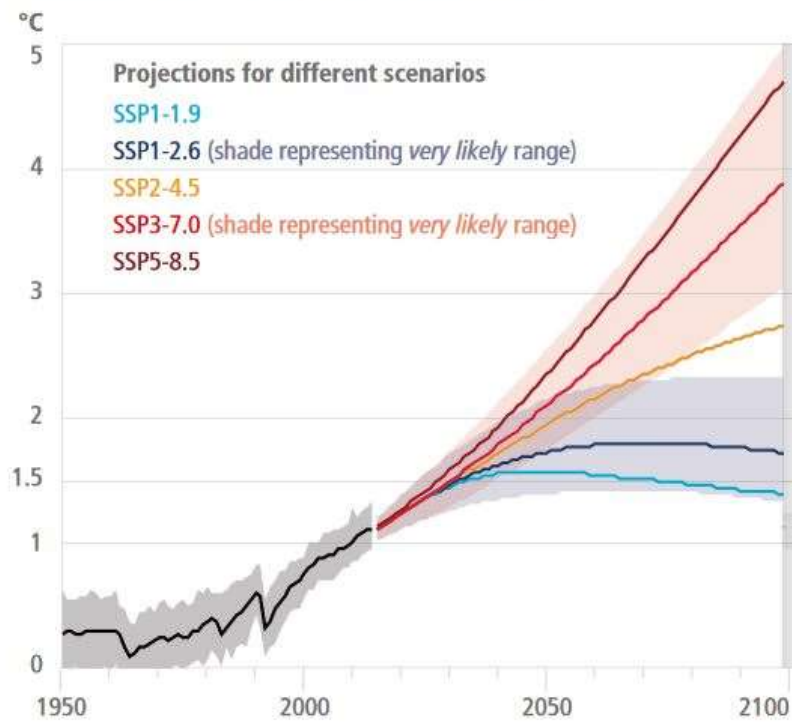


Figure 7 - The graph predicts the different scenarios for temperature increase until 2100 (IPCC, 2022).

References

Books:

Creswell, J. W. & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th edition). SAGE Publications, Inc.

Davenport, G. (1979). *Herakleitos & Diogenes: Translated from the Greek by Guy Davenport*. (5th edition). Grey Fox Press.

<https://blogs.baruch.cuny.edu/authenticityandastonishment2/files/2013/02/Guy-Davenport-The-Fragments-of-Heraclitus-and-Diogenes.pdf>

Grober, U. (2010). *Sustainability: A cultural history*. Green Books.

Leach, M., Scoones, I. & Stirling, A. (2010) *Dynamic Sustainabilities: Technology, Environment, Social Justice*. Earthscan.

Mazzucato, M. (2018). *The value of everything: Making and taking in the global economy*. Penguin Books Ltd.

Meadows, D. H. (2008). *Thinking in systems: A primer*. Chelsea Green Publishing.

Perrini, F. & Tencati, A. (2006). *The Sustainability Perspective: a New Governance Model*. In: Kakabadse, A., Morsing, M. (eds) *Corporate Social Responsibility*. Palgrave Macmillan, London, 94-111. https://doi.org/10.1057/9780230599574_7

Thiele, L. P. (2016). *Sustainability* (2nd edition). Polity Press.

The MAGIC Consortium (2020). *The Nexus Times*. Bergen: Megaloceros Press.

Öberg, G. (2011). *Interdisciplinary environmental studies: A primer*. Wiley-Blackwell.

Papers:

Andrew, B. (2008). Market failure, government failure and externalities in climate change mitigation: The case for a carbon tax. *Public administration and development*, (28), 393-401. <https://doi.org/10.1002/pad.517>

Baldassarre, B. Keskin, D. Diehl, C, J. Bocken, N. Calabretta, G. (2020). Implementing sustainable design theory in business practice: A call to action. *Journal of cleaner production*, 2020(273).

Novakova, I., Perumal, P., Cwirzen, A. & Wallevik, O.H. (2023) Low Carbon Concrete Possibilities: EPD and Regulations in Northern Periphery and Arctic. *Mater. Proc.* (13)(14) <https://doi.org/10.3390/materproc2023013014>

Rittel, H. W. J & Webber, M. M. (1973). Dilemmas in a General Theory of Planning. *Policy sciences*, 4(2), 155-169. <https://www.jstor.org/stable/4531523>

Schlüter, M., Caniglia, G., Orach, K., Bodin, Ö., Magliocca, N., Meyfroidt, P. & Reyes, B. (2022). Why care about theories? Innovative ways of theorizing in sustainability science. *Current Opinion in Environmental Sustainability*, 54, 101154. <https://doi.org/10.1016/j.cosust.2022.101154>

Shashi,k., Centobelli, P., Cerchione, R., Ertz, M. & Oropallo, E. (2023). What we learn is what we earn from sustainable and circular construction. *Journal of Cleaner Production*, 382(135183). <https://doi.org/10.1016/j.jclepro.2022.135183>

Wynne, B. (1992). Uncertainty and environmental learning: Reconceiving science and policy in the preventive paradigm. *Butterworth-Heinemann Ltd.*

Reports:

Bergen Kommune. (2023). *Grønn Strategi: Klimastrategi for Bergen 2022-2030*. Klimaetaten i Bergen Kommune. <https://www.bergen.kommune.no/politikere/utvalg/api/fil/bk360/7186170/Gronn-strategi-Klimastrategi-for-Bergen-2022-2030>

Brattebø, H., O’Born, R. J., Sandberg, N. H., Storrø, R. K., Baltruszewics, M., Folstad, M. & Skaran, A. M. (2014). Fremtidig utvikling i energiforbruk og CO₂-utslipp for Norges boligmasse. EC/H2020 / IEE/12/695/SI2.644739. EPISCOPE. <https://www.sintef.no/publikasjoner/publikasjon/1482062/>

Brundtland, G. H. (1987). Report of the World Commission on Environment and Development: Our Common Future. (Report No. A/42/427) *The World Commission on Environment and Development*. <http://www.un-documents.net/our-common-future.pdf>

Christiansen, L., Korneliussen, R. Gunnerød, J., Kringstad, A. (2023). *Forbruksutvikling i Norge 2022-2050* (Delrapport til Langsiktig Markedsanalyse 2022-2050). Statnett. <https://www.statnett.no/globalassets/for-aktorer-i-kraftsystemet/planer-og-analyser/lma/forbruksutvikling-i-norge-2022-2050---delrapport-til-lma-2022-2050.pdf>

EU, (2020). Energy efficiency in buildings, Department: Energy- In Focus. The European Commission. https://commission.europa.eu/system/files/2020-03/in_focus_energy_efficiency_in_buildings_en.pdf

Global Climate Highlights. (2022). <https://climate.copernicus.eu/global-climate-highlights-2022>

Haitz, R., Kish, F., Tsao, J. & Nelson, J. (2000). THE CASE FOR A NATIONAL RESEARCH PROGRAM ON SEMICONDUCTOR LIGHTING (SAND2000-1612). Sandia National Laboratories, operated for the United States Department of Energy by Sandia Corporation. http://www.haitzs-law.com/uploads/7/6/3/6/76362633/1999-national_research_report_same_as_2000_sarndia_nrp.pdf

Hjelme, O. A., Thorud, B., Evensen, T., Rendall, C. G., Holm, Ø., Gholami, H., Kanestrøm, M. K., Bøhn, T. I., Dalen, H. Ø., Flesjø, J. R., Nagoth, S., Kampel, W., Sevaldsen, M. B., Berentsen, T. K. & Kilde, L.-T. (2022). Markedsrapport for Solenergiklyngen: Norsk solkraft 2022 – innenlands og eksport. Solenergiklyngen. DOC: 10227618-01-RISol-RAP 001. <https://www.solenergiklyngen.no/wp-content/uploads/2022/08/220815-markedsrapport-solenergiklyngen-final-.pdf>

IPCC. (2022). Summary for Policymakers. In: *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, doi: 10.1017/9781009157926.001

https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf

IPCC, (2023). Summary for Policymakers. Synthesis Report (SYR) of the IPCC Sixth Assessment Report (AR6).

https://report.ipcc.ch/ar6syr/pdf/IPCC_AR6_SYR_SPM.pdf

Pörtner, H.-O., Roberts, D.C., Adams, H., Adelekan, I., Adler, C., Adrian, R., Aldunce, P., Ali, P., Ara, B. R., Bednar-Friedl, B., Bezner, K. R., Biesbroek, R., Birkmann, J., Bowen, K., Caretta, A. M., Carnicer, J., Castellanos, E., Cheong, S. T., Chow, W., . . . Okem, A. (2022). *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Lössche, V. Möller, A. Okem, B. Rama (eds.)]. *Cambridge University Press*, 37-118, doi:10.1017/9781009325844.002.

https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_TechnicalSummary.pdf

REN21, (2020). *Renewables 2020 Global Status Report*. REN21. Paris.

<https://www.ren21.net/gsr-2020/>

UN, (2022). *World Population Prospects 2022: Summary of Results*. United Nations Department of Economic and Social Affairs, Population Division (2022).

https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/wpp2022_summary_of_results.pdf

UNEP, (2020). *GLOBAL STATUS REPORT FOR BUILDINGS AND CONSTRUCTION: Towards a zero-emissions, efficient and resilient buildings and construction sector*. *United Nations Environment Programme*.

https://globalabc.org/sites/default/files/inlinefiles/Buildings%20GSR_Executive_Summary%20FINAL_0.pdf

Webpages:

IEA, (2023). Global Energy Crisis: *How the energy crisis started, how global energy markets are impacting our daily life, and what governments are doing about it.*

<https://www.iea.org/topics/global-energy-crisis>