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# Design of procurement strategies for zero emission construction sites from an innovative public procurement perspective

Master's thesis in Global Manufacturing Management

Supervisor: Luitzen de Boer

Co-supervisor: Raymond Stokke

June 2021



Norwegian University of  
Science and Technology



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## Preface

This master thesis is the concluding work of my Master in Science degree at the Norwegian University of Science and Technology (NTNU). The master thesis is written within the specialisation of Strategic Purchasing and Supply Chain Management and is written in the spring semester of 2021 for the Department of Industrial Economics and Technology Management.

The purpose of this thesis has been to explore the relation of the framework of green supplier selection and the use of environmental criteria in practice.

I would like to thank my supervisors Professor Luitzen de Boer and Postdoctoral Researcher Raymond Stokke for guidance and feedback throughout the semester and my family and friends for cheering and supporting through this journey.

Trondheim, 11.06.2021

Jorun Eline Rennan

## Abstract

This thesis investigates the framework of green supplier selection and procurement strategies in practice by a case study of Trondheim municipality.

The study shows that Trondheim municipality has aligned their environmental goals with their tender specifications, with increasing environmental ambitions. However, there is not a full consistency in their work yet. By having these environmental goals, Trondheim municipality is on the pathway of becoming a zero emission contributor by 2030. This transition also impacts the supply chain in their awareness to also contribute to these goals. Trondheim municipality has a momentum as an important procurer in the market and creates a role model to be followed.

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## Abbreviations

|        |   |
|--------|---|
| DOFFIN | Norwegian national notification database for public procurement |
| GPP    | Green public procurement  |
| GSS    | Green supply selection  |
| PP     | Public procurement  |

# 1 Introduction

## 1.1. Background

This master thesis is an extension of the project thesis of Innovative Public Procurement as a Tool to Achieve Zero Emission Construction Sites (Rennan, 2020) and will investigate the design of environmental procurement strategies in Trondheim municipality aiming to become a zero emission contributor by 2030.

Trondheim municipality is seen as the technological capital of Norway and has a vision of being one of the leading cities in the world in regards of developing climate and environmental solutions for the future. This green transformation relies on changing the worlds energy solution and economy to become fossil free. It is important that the change needs are made in the high-income areas of the world, as this will ensure that the living conditions in low-income countries continues to improve. This transition to greener energy important as the United Nations 2-degree goal for global warming requires that the worlds emissions needs to be reduced by 80 percent by year 2050 (Trondheim kommune, 2017b).

## 1.2. Problem statement

The thesis will investigate topics of how to communicate environmental requirements to the supplier market and how to adjust the requirements over time. The study is based on the framework of green supplier selection (GSS) and a case study of Trondheim municipality to investigate connections between the framework and procurement processes in practice.

The aim of the study is to learn more about how environmental procurement strategies are used to reduce the climate impact construction processes has on our environment, as this plays a role in the ongoing climate crisis and the need to reduce carbon emissions.

The following problem statement has been developed:

*How can adaptive innovative procurement strategies be designed and adjusted to achieve zero emission construction sites?*

## 1.3. Scope

This study will be limited to the framework of green supply selection and the study of Trondheim municipality's environmental procurement strategies in the field of construction

over the last ten years. The case study is limited to the information found in the tender specifications from Doffin. The topics of green public procurement and innovative public procurement is seen as common knowledge as it is discussed in the project thesis (Rennan, 2020).

## 2 Literature Review

This chapter aims to present the theory of the concept of green supplier selection.

### 2.1. Green supplier selection

#### 2.1.1 Supplier selection

A supplier selection process is triggered when a need and specification is identified for a desired product or service. This leads to the following process flow; formulation of criteria, call for tenders, qualification, final selection, and evaluation of supplier performance. The evaluation leads to feedback to the steps of formulation of criteria, qualification and final selection. An illustration of the supplier selection process is shown in Figure 1 (Cousins et al., 2008; De Boer et al., 2001; Van Weele, 2010; cited in Igarashi et al., 2013).

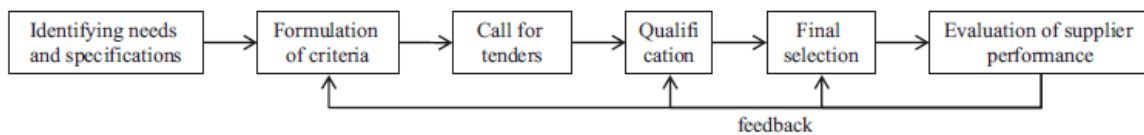


Figure 1: Supplier selection process (Cousins et al., 2008; De Boer et al., 2001; Van Weele, 2010; cited in Igarashi et al., 2013)

#### 2.1.2 Green purchasing

Green purchasing is a term within supply chain management that has received attention and various definitions over the years. Igarashi et al. (2013) has in their literature review discussed a handful of definitions that show relevance. The first example uses the term “environmental purchasing” to describe green purchasing:

...environmental purchasing is defined as purchasing’s involvement in supply chain management activities in order to facilitate recycling, reuse and resource reduction (Carter and Carter, 1998, p. 660, cited in Igarashi et al., 2013)

This definition highlights the importance of using materials efficiently and to reduce the consumption. The definition has some weaknesses as it only has the purchasing perspective in mind when addressing environmental issues and “does not capture the holistic and synergistic impacts that intra- and inter-organizational practices have on the natural environment” (Zsidisin and Sifred, 2001, cited in Igarashi et al., 2013, p. 248). The definition by Min and Galle (2001) supports this definition by saying:

...green purchasing is an environmentally-conscious purchasing practice that reduces sources of waste and promotes recycling and reclamation of purchased materials without adversely affecting performance requirements of such material (Min and Galle, 2001, p. 1223, cited in Igarashi et al., 2013).

Another definition of green purchasing is made by Zsidisin and Siferd (2001), this definition includes the relationship between suppliers and purchasers when defining the potential environmental impact. Involvement of supplier selection and evaluation is also mentioned in regards of green purchasing (Zsidisin and Siferd, 2001, cited in Igarashi et al., 2013), hence this definition is chosen as the most relevant by Igarashi et al. (2013):

Environmental purchasing for an individual firm is the set of purchasing policies held, actions taken, and relationships formed in response to concerns associated with the natural environment. These concerns relate to the acquisition of raw materials, including supplier selection, evaluation and development; suppliers' operations; resource reduction; and final disposal of the firm's products (Zsidisin and Siferd, 2001, p. 69, cited in Igarashi et al., 2013).

### 2.1.3 Four dimensions of green supplier selection

Igarashi et al. (2013) has identified four key dimensions of green supplier selection (GSS):

- Aligning supplier selection with an organisation's overall green strategy
- The role of decision-making tools and models in GSS
- GSS as a series of interrelated divisions and information processing activities
- The wider supply chain context in which GSS takes place.

These dimensions create a conceptual model of GSS, as shown in Figure 2. This framework will be used as a basis to discuss important aspects of GSS, including other important aspects neglected by Igarashi et al. (2013).

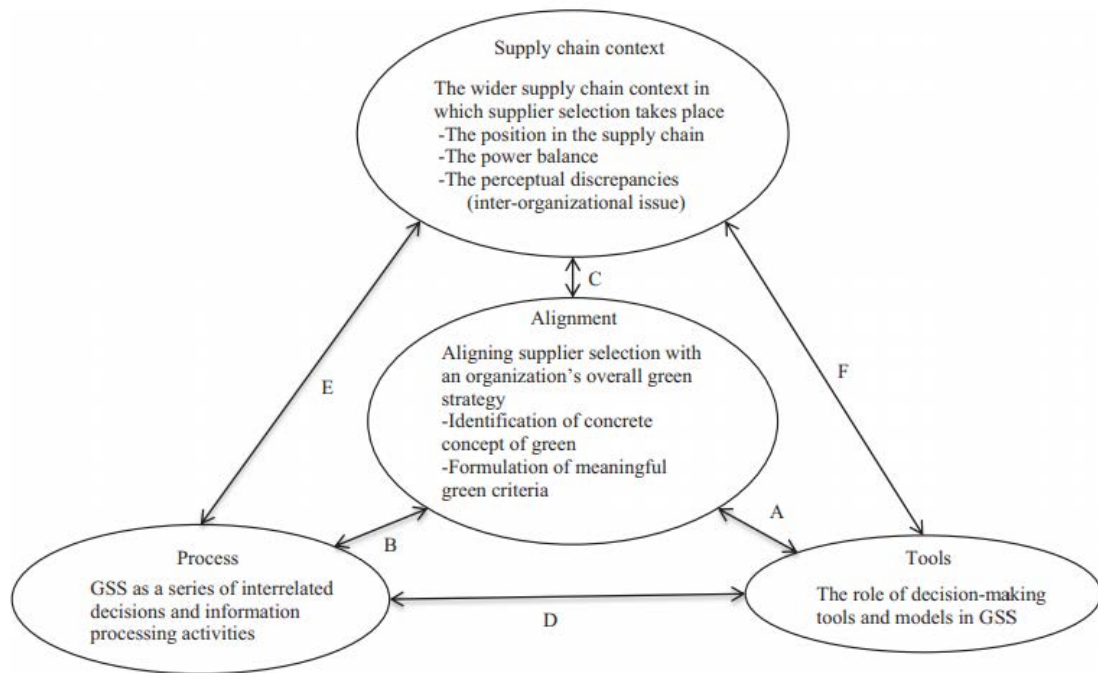


Figure 2: Conceptual framework of GSS (Igarashi et al., 2013, p. 255)

### *Aligning supplier selection with an organisation's overall green strategy*

To be able to align green supplier selection in the organisation's strategy it is important create a concrete understanding within the company as of what green means for the organisation. This way it is possible to create green selection criteria that is understood. The consequences of not doing so may lead to an endless list of environmental criteria in the decision model and difficulties for purchasers to communicate the criteria to its suppliers. Thus, the green dimension in the selection process may lose its significance (Igarashi et al., 2013).

However, this alignment is not easily achieved. Rather, it is a gradual process in all levels of the organisation to include "green" as a measure in the selection criteria. This way, the most suited solutions can be found in all levels, including both green and other relevant selection criteria (Igarashi et al., 2013). Hence, "effective and aligned GSS criteria are criteria that both contribute to overall green objectives of the firm and enable the selection of suppliers that satisfy other constraints as well" (Igarashi et al., 2013, p. 256). This means that the green criteria need to be chosen specifically, as it is not sure that any given green criteria will make sense for the chosen case. Hence, GSS comprehends more than just adding green selection criteria to already established criteria in the supplier selection process (Igarashi et al., 2013).

Another aspect when developing a green supplier selection process is the many uncertainties in the numerous of external factors that a decision-maker needs to meet. These factors could for example be development of new technologies, climate change, population growth and economic developments. The traditional decision-making processes are made with the assumption that the future can be predicted. However, if the future does not turn out to be as predicted, the plan will most likely fail (Kwakkel et al., 2015).

It has been found difficult to predict the future accurately, as the forecasts are limited by the complex uncertainties of chaotic dynamics, limits in the knowledge base, non-stationarity data, and future actions by decision-makers (Hallegatte et al. 2012; Kwakkel et al. 2010b; Dessai et al., cited in Kwakkel et al., 2015). Societal preferences and perspectives may also change over time, hence the challenge is to develop plans that performs even when meeting uncertainties (Dessai et al., 2009, cited in Kwakkel et al., 2015).

To meet the uncertainties of the future, a planning paradigm could be used. Using adaptive plans to meet the uncertainties that will follow a project as it is emerging. The strategy is to design plans that can be adapted as it meets the future and therefore respond to the new challenges. This paradigm replaces static optimal plans with dynamically robust plans, by choosing plans that will succeed in numerous of possible futures and facilitating for the plans to dynamically adopt as it unfolds (Kwakkel et al., 2015). A challenge this paradigm meets it to understand how to support the design of dynamic adaptive plans (Walker et al. 2010; Lempert et al. 2009; Lempert and Schlesinger 2000, cited in Kwakkel et al., 2015), as the paradigm signify endless scenarios that should be considered (Lempert et al., 2009, cited in Kwakkel et al., 2015). With endless of scenarios to consider, there are also many actions that can be taken to handle the scenarios that are met. This is complicated, as the plans should be adapted over time, which makes it necessary to analyse the scenarios over time (Haasnoot et al., 2012, cited in Kwakkel et al., 2015). By doing so, it is possible to understand the interplay between the different scenarios.

Lastly, the different stakeholders have different perspectives which also needs to be considered together with the development of the society. This should create a robust plan to meet the future (Offermans, 2012, cited in Kwakkel et al., 2015). It is said that “Analyzing climate adaptation in this way results in the ‘curse of dimensionality’ and is severely limited in practice by the necessary computational burden” (Webster et al., 2011, cited in Kwakkel et al., 2015, p.374).

By combining the alignment of the supplier selection with an organisation's overall green strategy and the planning paradigm it is possible to understand the needs of the green criteria. This will make it possible to achieve the organisation's goals and plan for the challenges they will meet on their journey to achieve these.

#### *The role of decision-making tools and models in GSS*

As GSS is more likely to need a longer time perspective to be able to consider the consequences of which supplier to choose, it is important to have the right tools to make the best decision. "Kaufmann et al. (2012) suggests a clear positive relationship between highly analytical approach to a supplier selecting and the quality of the decision outcome, measured in terms of financial and non-financial supplier performance" (Igarashi et al., 2013, p. 256). However, there are a vast of different supplier selection situations, which are likely to have different needs in their decision model (De Boer and Van der Wegen, 2003, cited in Igarashi et al., 2013). Hence, there are no obvious solution to a selection model in GSS as it is needed to be seen in relation to the detentions in the conceptional model (Igarashi et al., 2013).

However, the goal of any procurement situation is to achieve the best fitted solution to the lowest price possible. To choose the optimal timing for of an investment Arve and Zwart (2014) states that an optimal procurement contract should give room to hold the investment decision to reduce the uncertainty of the future cost evolution to be as resolved as possible. This supports the idea of needing a longer time perspective in GSS to consider the consequences. The contracts for the participating firms should at the same time be structured in a way where it is possible to use incentives to reveal the true cost of the evolutions. The incentives should provide the firms with fees at investment and severance payments if rival technology is chosen to increase the participation of firms developing new technology (Arve and Zwart, 2014).

#### *GSS as a series of interrelated decisions and information processing activities.*

The remaining question of GSS considers how and to what extent the understanding of what green means should be used in the different stages of the supplier selection process. This stage, where the criteria is defined, is the key to connect the supplier selection with the firm's green strategy. There are two ways of directing GSS criteria, specifically to the supplier as an organisation or by addressing the product or service to be purchased from the supplier. Addressing the supplier as an organisation is more important in the stage of qualifying suppliers and the final stage of the selection process focuses more on the product related selection



criteria. The goal is to create a logical and consistent set of selection criteria that is in line with the overall green strategy. This could be challenging as it is normal for multiple people, with different functions, to be involved in the different stages during the selection process, whereas the purchasers are normally involved in the late stages (Igarashi et al., 2013). Hence, “Effective GSS involves becoming aware of the fragmented nature and aiming at achieving coherence throughout the process” (Igarashi et al., 2013, p. 256).

*The wider supply chain context which GSS takes place.*

The final dimension is to consider GSS in a wider context. As most organisations are both supplier and customer in their supply chain, they are taking a part of the role of passing environmental requirements in every part of the supply chain. Unfortunately, suppliers are not always willing to share environmental information (Walker et al., 2008, cited in Igarashi et al., 2013). Igarashi et al. (2013) argue that for a GSS to be effective, it needs to include an assessment of the extensive organisational and inter-organisational factors. By doing so, “the focal organisations can become aware of its limitations and possibilities when it comes to greening the supplier selection process” (Igarashi et al., 2013, p. 257). To investigate these factors Igarashi et al. (2013) has developed a set of questions to answer which will lead to one or more implications of the three other dimensions (Igarashi et al., 2013, p. 257):

- Is the purchasing organization aware of the power balance in the supply chain?
- Do suppliers understand and accept the green criteria put forward by the purchasing organisation?
- Do the suppliers understand why the purchasing organization uses these criteria?
- Do they understand the connection (alignment) between the green selection criteria and the overall green strategy of the purchasing organization?
- How much pressure can or should the purchasing organization exert on the different suppliers to adapt to demands for more sustainability?
- Does the purchasing organization really understand the supplier’s strategic view on “green”, and how the supplier has aligned its functional strategies with this view?
- Is the purchasing organization aware of possible supplier initiatives?

Another way to become more aware of the bigger picture of GSS is to look at business ecosystems. Ecosystems have in general developed flexibility, resiliency, and resistance to catastrophes when continuously being exposed to new waves of settlers. Unlikely, ecosystems

which have developed in isolation, who are more vulnerable to ecological disasters and mass extinction. Moore (1996) argues that biological analogies applied in the study of business are often applied too narrowly (Moore, 1996, cited in de Wit, 2017). The focus lays in the evolution of species, by for example, arguing that a Darwinian selection takes place where the fittest products and companies survive the market economy. In the more modern business models, where the quality and reengineering movements have shaped the businesses, there is still a mindset where the fittest processes and systems drive out the weak. “In either instance, the ‘species’ are seen to be subject to genetic mutation and selection that gradually transforms them” (Moore, 1996, cited in de Wit, 2017, p. 332).

Moore (1996) is convinced that there is more complexity to the world and that there is a need to think in grander terms. He acknowledges that the species-level improvements of business processes are crucial for companies to stay successful and to create value for the society, but also emphasises that there are interrelated evolutions that are underrated whom play a vital role in biology and business (Moore, 1996, cited in de Wit, 2017). The companies with leaders understanding these dimensions of ecology and evolution will be prepared with new strategy models and new critical options to shape their future.

In biological ecosystems there are two time scales where changes occur: the ecological changes do normally take place within the individual lifetime of the organism, while evolutionary changes emerge over several generations. The two time scales emerge to one in business ecosystems as the business can influence its own evolution resulting in evolutionary changes in its lifetime. The leader of the business ecosystem should have the competence to see the bigger picture to understand the whole ecosystem and its dynamics. This will allow a business to change its characteristics to adopt in its ecosystem as well as to foresee future changes and therefore develop to meet the new demands (Moore, 1996, cited in de Wit, 2017).

Coevolution can be seen as a process where species depending on each other develop in an endless reciprocal cycle, whereas the coevolution evolves the system becomes more robust (Batson, 1979, cited in Moore, 1996, cited in de Wit, 2017). Some of the most effective firms in the world, such as Intel and Shell have developed new business advantages by using economic coevolution to guide their way in the prosperous and dynamic environment of opportunities. “The job of the top management is to seek out potential centres of innovation

where, by orchestrating the contributions of network of players, they can bring powerful benefits to bear for customers and producers alike”(Moore, 1996, cited in de Wit, 2017. p. 333).

To understand the strategy of coevolution it is crucial to understand the evolutionary patterns of the factors that are constant in every business; coevolution and the complex interaction between cooperative and competitive business strategies. When management starts to embrace the ecological approach more commonly as the awareness of coevolution the momentum of business changes are seen to intensify at an exponential rate. This will enable to provide a wider understanding of GSS and embrace the possibilities of providing a greener selection process (Moore, 1996, cited in Wit, 2017).

## 3 Methodology

This chapter will provide discussion of what research methods that is used in this thesis.

### 3.1. Literature review

A literature review will provide an understanding of what the knowledge on a chosen topic and provide a platform for further research. The narrative and systematic approach are the two methods normally used in literature reviews. The narrative, being the method to examine the research and theory within a research area, with purpose is to create an overview of the selected topic by evaluating the literature. The purpose of this approach is to establish what is already know in addition to provide justification for the research question. The systematic approach creates a comprehensive review by using specific procedures to ensure transparency. This way, the selected and analysed topics are articulated and replaceable (Bryman, 2012).

As this study is based on the framework of green supply selection, which can be seen as a narrative approach. However, the systematic approach was also used to find any theory that could be related to the framework. This method is known as a systematic combining approach, where the researcher actively go “back and forth” between the research activities (Dubois and Gadde, 2002). The keywords in the research was Green public procurement, adaptive strategies, coevolution, construction sites and zero emission construction sites. A research matrix can be found in Appendix 8.6

### 3.2. Case study

By using the method of a *case study* to examine a case in detail it is possible to achieve an in-depth analysis of the chosen topic, hence revealing important characteristics about its nature. This design is often used if there is little knowledge on the topic (Bryman, 2012). A case is normally associated with a location (Bryman, 2012), in this thesis, Trondheim municipality will be the case studied.

A case study can be structured in different ways. Five types of cases are distinguished, the *critical case*, *extreme or unique case*, *representative or typical case*, *revelatory case* and the *longitudinal case* (Yin, 2009, cited in Bryman, 2012).

This case could be looked at as more of a representative or typical case, where the municipality can play an exemplifying role of how public procurement is used to pursue zero emission

construction sites, where “the objective is to capture the circumstances and conditions of an everyday or commonplace situation” (Yin, 2009, cited in Bryman, 2012, p. 70)

The external validity or the generalisability of the case study research is important to notice. A single case cannot represent the area of interest alone, therefore it could be beneficial to use a comparative study to try to understand the underlying causes better.

### 3.3. Comparative or longitudinal study

A comparative design studies two or more contrasting cases while using as identical methods as possible. This is suited to understand a phenomenon better, since it will enable comparisons of situations. In this thesis the different tender specifications in Trondheim municipality can be looked at as unique cases. By investigating them with as equal methods as possible to understand the challenges of public procurement in zero emission construction sites. However, by using a time frame of ten years and one organisation, Trondheim municipality it is more accurate to see the study as a longitudinal case (Bryman, 2012).

### 3.4. Qualitative and quantitative method

It is important to choose the approach of the study, which is commonly either qualitative or quantitative. The differences in the approaches are whether the focus of the study is structured by surveys – qualitative or fixed data – quantitative. Qualitative research makes it possible to study questions in depth to find the underlying causes, while quantitative research may be useful to identify where there is a need to find the underlying causes (Bryman, 2012). As this study aims to fixed data, by collecting and studying tender specifications, this study will be a quantitative study.

## 4 Case: Trondheim Municipality

This chapter will present Trondheim municipality's environmental goals, strategy, and a longitudinal case study of the environmental criteria in a selection of tender specification relating to construction sites.

### 4.1. Trondheim municipality's energy and climate plan

To become one of the leading environmental-friendly cities in the world, Trondheim municipality developed a set of ambitious goals leading to Trondheim municipality being a zero emission contributor in 2030 (Trondheim kommune, 2021):

#### *Energy and climate goals for the city of Trondheim:*

- In 2020 Trondheim is a role model and a contributor for green value creation and development of environmental friendly technology and ways of living.
- In 2020 the direct climate gas emissions in Trondheim are reduced by 10% compared to 2009.
- In 2023 the direct climate gas emissions in Trondheim are reduced by 30% compared to 2009
- In 2025 Trondheim is robust to meet the future climate changes.
- In 2030 is the stationary energy consumption in construction at the same levels as in 2013 (approximately 3.5 TWh). This represents a 20% reduction of consumption per person.
- In 2030 the direct climate gas emissions are reduced by 80% compared to 2009.

#### *Energy and climate goals in Trondheim municipality's business:*

- Trondheim municipality must start to introduce a climate neutral vehicle park for heavy duty vehicles as soon as they are available.
- In 2020 the energy consumption in projects is reduced by 7% compared to 2017.
- The plan for 2020 should provide numbers for indirect emission reductions.
- All investment projects in Trondheim municipality must reduce their climate footprint by at least 30% compared to relatable references in construction and technical facilities from 2009.
- In 2030 Trondheim municipality is a zero emission contributor.

The climate emissions in Trondheim has been slowly increasing from 1991 to 2013. Statistics Norway (SSB) has made an illustration of this and two estimates for the future, leading to 2030

found in Figure 3 (Statistisk sentralbyrå, cited in Trondheim kommune, 2017b). The red line, being the reference of the emissions in Trondheim if they were to follow and implement the directives and laws that are already approved. The blue line, illustrates the emissions if the climate goals for Trondheim municipality are achieved.

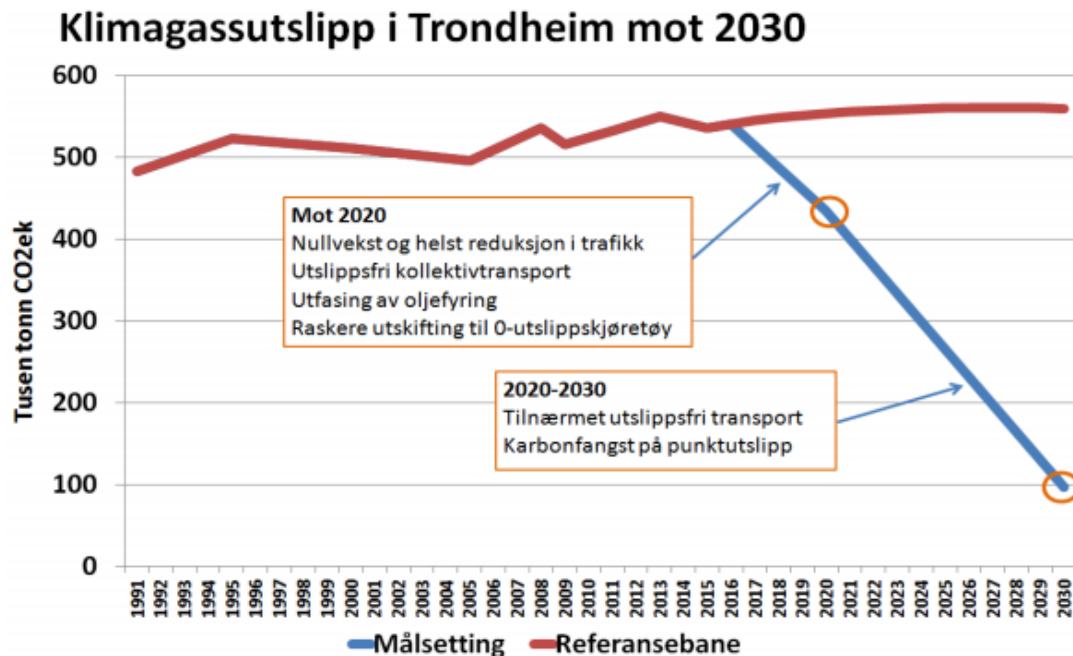


Figure 3 - Carbon emission equivalents in Trondheim (Trondheim kommune, 2017b, p. 3)

There are many instances that needs to collaborate for Trondheim municipality to able to reach their ambitious climate goal of becoming a zero emission contributor by 2030. These parties are demonstrated in Figure 4. As this thesis scope investigates the topic of public procurement, this is the topic that will be further discussed. In the figure the it is enlightened that public procurement is responsible for 15% of the Norwegian GDP and that this scale could be used to reduce the climate emissions in the value chain by being “a demanding customer”. The municipality could demand strict environmental criteria in their procurements. This will both reduce the carbon emissions within the municipality and boost the market with more environmental friendly construction sites (Trondheim kommune, 2017b).

| Virkemiddel   | Kommentar  |
|---|--|
| <b>Stat</b>   |  |
| Kvotestystem (European Union Emission Trading Scheme (ETS)) | I Trondheim er ca. 10 % av utslipp omfattet av kvotestystemet. På landsbasis er det nærmere halvparten   |
| Avgifter  | For eksempel CO <sub>2</sub> -avgiften introdusert i 1993, samordning med ETS  |
| Avgiftsfritak   | For eksempel på elbiler  |
| Støtteordninger   | For eksempel ENOVA   |
| Statlige planretningslinjer                                 | For eksempel statlig planretningslinje for klima- og energiplanlegging og areal- og transportplanlegging i kommunene                                       |
| Plan- og bygningsloven                                      | Gir hjemmel for arealplanlegging i kommunene   |
| Sivilbeskyttelsesloven                                      | Plasserer ansvar for klimatilpasning i kommunene   |
| Teknisk forskrift   | Setter krav til energibruk i bygg  |
| <b>Kommune/region</b>                                       |  |
| Planmyndighet   | Fortetting, tilrettelegging for klimavennlig transport, energi, klimatilpasning  |
| Kollektivtransport  | Fylkeskommunen er ansvarlig for kollektivtransporten i fylket.   |
| Transport infrastruktur                                     | Miljøpakken er det viktigste virkemiddelet i Trondheim når det gjelder infrastruktur for klimavennlig transport.   |
| Forvaltning av vann og avløp                                | Et viktig virkemiddel for klimatilpasning  |
| Offentlige innkjøp  | Offentlig innkjøp utgjør 15 % av norske BNP. Ved å være en "krevende kunde" har offentlige aktører muligheten til å påvirke klimagassutslipp i verdikjeden |
| Byggeier og -forvalter                                      | Ansvarlig for energieffektivitet og klimafotavtrykk  |

Figure 4 - Contributors to reduce emissions for a municipality (Trondheim kommune, 2017b, p. 6)

Trondheim municipality has developed a set of main strategies to reduce emissions for the different fields they play an active role. Their business development and innovation strategy, aims to facilitate the change into more environmentally friendly solutions within construction, transportation and energy production (Trondheim kommune, 2017b). To do so, they plan to collaborate with businesses and institutions and seek funding in national and international research projects. The strategy of success as standard supports the business development and innovation strategy by focusing on Trondheim municipality's participation in pilot projects. The city aims to create and participate in projects that develop climate and energy efficient technology and solutions and implement the successful parts into the municipality's construction standards (Trondheim kommune, 2017b).

#### 4.1.1 Greenhouse gas emissions in Trondheim

The direct greenhouse gas emissions in Trondheim was estimated to be approximately 550 000-ton CO<sub>2</sub> equivalents in 2013. More than half of the emissions (52%) came from the transportation sector, where heavy duty vehicles and construction machines were responsible for 10% and 13 % respectively (Figure 5) (Trondheim kommune, 2017b).



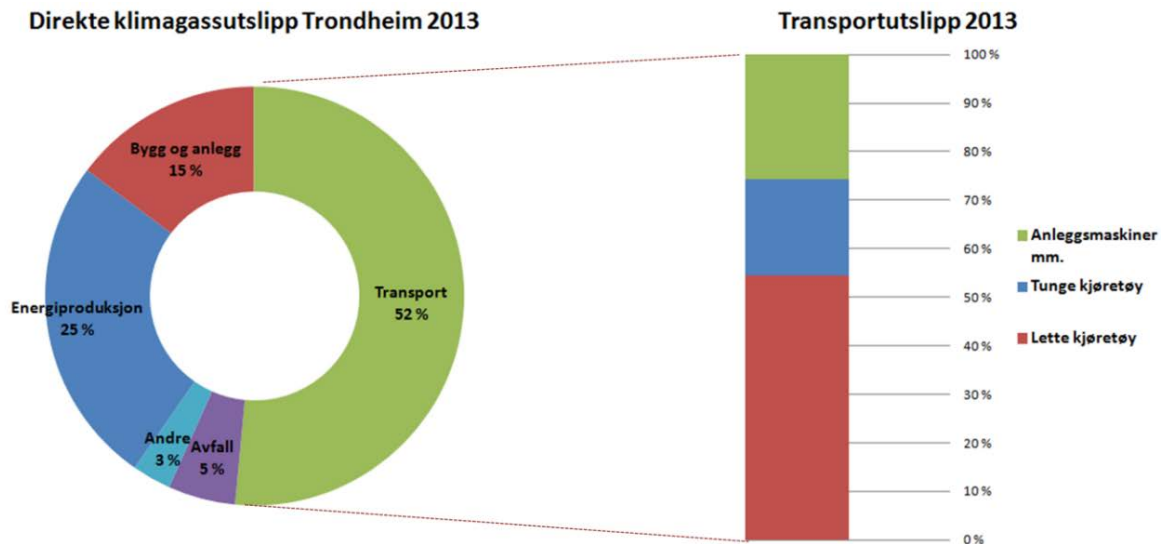


Figure 5 - Direct greenhouse gas emissions in Trondheim (2013) (Trondheim kommune, 2017b, p. 18)

Trondheim municipality has set the goal that by 2030 the direct greenhouse emissions from transportation must be less than 85% of the emissions released in 1991. This is an ambitious goal, especially since there has been an increase of emissions by 15% from 1991 to 2013. Hence, drastic changes need to be seen, both in terms of reducing private use of vehicles and all vehicles and machines found in the construction sector. To reach their goal, Trondheim municipality has set two strategies to structure their work:

1. Reduce transportation by car by area planning and facilitating more for pedestrians, bikes and public transportation.
2. Accelerate the establishment of climate friendly vehicles and fuel technology.

In 2013 emissions from construction machines and other machines using toll free diesel was in charge of approximately 25 % of the total transportation emissions. These emissions needs to decrease if the greenhouse gas emissions reduction goals are to be met (Trondheim kommune, 2017b).

#### 4.1.2 Climate friendly vehicles and fuel technology

Norway has become the top nation in the world when it comes to the use of electric cars, 54 percent of all new cars are now electric (SSB, 2021). This is a result of national policies to reduce tolls and fees for electric cars, making it more lucrative for Norwegians to choose these options rather than a fossil fuel car. Similar means for construction machines and other machines using toll free diesel is not in place (2013) (Trondheim kommune, 2017b). Development of national policies demanding more environmentally friendly solutions could

contribute to change the demands in the market and making producers develop new technology to meet the demands. This enables Trondheim municipality to develop stricter emission demands for their construction projects as the technology becomes available (Trondheim kommune, 2017b).

## 4.2. Trondheim municipality's procurement strategies

To ensure progress in Trondheim municipality's climate goals, procurement regulations and strategies have been developed. Trondheim municipality has published two versions, one in 2017 and another in the end of 2018 relating to this. Main findings will be provided, which will be compared to the case study to investigate how the strategies take place in practice.

### 4.2.1 Trondheim municipality's procurement strategy 2017

In 2017 Trondheim municipality states that they should be a visible contributor to ensure sustainable public procurement processes by influencing the suppliers and the research and development in a sustainable direction and demand customised environmental criteria for each project in their procurements (Trondheim kommune, 2017a). A list of environmental demands is provided below:

1. When planning a procurement, life cycle costs and environmental consequences should be considered.
  - a. All procurement processes must demand a set of qualifications regarding environmental quality. This should be provided by a third-party environmental management system or an environmental acknowledgement form.
  - b. Environmental considerations shall, when relevant to the procurement, when feasible and does not cause obvious disadvantages, be included in the tender specifications. The environmental specification should count at least 30% of the total.
  - c. Environmental requirements shall, where relevant to the procurement, be incorporated into requirements specifications, norms and descriptions. Products with positive environmental labelling, environmental declarations or the like shall be described where relevant
2. Environmental requirements shall be developing for supplier and give clear signals to the market that environmental adaptation is a customer requirement

- a. Trondheim Municipality sets requirements for suppliers' environmental qualifications and performance.
  - b. environmental requirements shall be adapted to the industry in question, and the industry is given the opportunity to comment
  - c. Trondheim Municipality offers Eco-Lighthouse certification for suppliers who wish to do so.
3. Trondheim Municipality will strive to make cost- and environmentally efficient procurements. That is, procurements that provide a high degree of demand satisfaction and at the same time low environmental impact throughout the life cycle. In cases where environmental considerations are not incorporated due to budgetary conditions, this shall be justified and consequences for the unit's fulfilment of its own environmental goals shall be described.
4. The effect of environmentally adapted procurement can be followed up and measured. This shall be done through periodic reporting of key figures for environmentally adapted procurement and by evaluating selected procurements.
5. Fossil-free construction sites and electric construction machinery where available and feasible within reasonable, practical and economical frameworks shall be required.
6. Where practical and economically feasible, zero-emission solutions and renewable materials must be used.
7. As a general rule, planning and investments shall be based on Trondheim's goal of being a zero-emission city in 2050.

#### 4.2.2 Trondheim municipality's procurement regulation for 2018-2023

In the procurement regulation for 2018 to 2023 Trondheim municipality aims to ensure that their procurements contribute to efficient use of the municipality's resources, innovative solutions, a committed work environment and that the social responsibility is taken into account (Trondheim kommune, 2018). To meet Trondheim municipality's ambitions in the environmental and climate plan the municipality should use sustainable procurement to ensure that smart climate solutions are demanded:

- Environmental benefits shall be considered when planning procurements. Life cycle costs shall come into account in order to find the solution that provides the lowest possible environmental impact in the lifetime of the product.

To reach this goal, the following focus areas are made:

1. Procurement must be organised efficiently, with clarified roles and the right expertise
2. Needs to be a visible driving force in the public sector to ensure sustainable procurement and
3. Affect supplier and product development in an environmentally friendly direction.
4. Show corporate social responsibility through their procurements
5. Procurement shall contribute to innovation and market development
6. Good and efficient contract follow-up

To contribute to Trondheim municipality's main environmental goals the measures in two of the reports sub-goals are relevant (Trondheim kommune, 2018):

*Measures sub-goal 2:*

- Objectives and measures for the procurement area are coordinated with the municipality's environmental goals.
- The individual procurement environment shall develop an overall strategy for upcoming procurements to determine which competitions and contracts will bring the greatest environmental benefits.
- The individual procurement environment shall be responsible for facilitating cuts of plastic products and alternatives to plastic in procurement and contracts.
- In cooperation with the Norwegian Environment Agency, the procurement service shall prepare standardised indicators for tender competitions and contract follow-up for the environmental area.
- In cooperation with the Environmental Unit, the procurement service shall create measurement indicators to measure the environmental impact of procurements for goods transport.
- Through its procurements, the Municipality of Trondheim will develop and use tools to calculate the life cycle costs of the acquisition.

*Measures sub-goal 4:*

- Trondheim Municipality participates in the National Programme for Supplier Development (NHO, KS, and KS) to gain increased expertise in the implementation of innovative public procurement.

- The individual purchasing environment will increasingly choose procurement procedures and contract forms that promote innovation, including competition with negotiation, competitive dialogue, innovation partnerships, planning and design competitions and interaction models.
- The individual purchasing environment shall facilitate assignments to entrepreneurial enterprises, the SME market or companies that have not previously delivered to the public sector or Trondheim municipality. Consideration shall be given to whether the division of contracts may contribute to this purpose.

### 4.3. Case study

To investigate how Trondheim municipality has used environmental criteria in their procurement processes over time, this thesis has collected a selection of tender specifications from Doffin (Norwegian national notification database for public procurement).

The selection process was conducted by choosing a selection criteria relating to construction, where it was expected that zero emission construction could be possible to achieve (CPV code 4521000) and restrict the search to Trondheim municipality. Further, two projects from each year of the study (2011-2021) was drawn to see a selection of the environmental criteria represented in the public procurements. The main findings are presented in Table 1 below, where the environmental criteria used in the different projects are specified, showing the changes over time. A full description of the various of environmental criteria used in the tender specification is presented in Appendix 8.1.

*Table 1 - Selection of tender specifications in Trondheim municipality*

| Year | Cases found | Case 1  | Criteria used | Case 2   | Criteria used |
|------|-------------|---|---------------|--|---------------|
| 2011 | 0           | No results  |               |  |               |
| 2012 | 8           | <b>Ilsvika bhg: 2012-701058</b><br>Procedures to work in an environmentally friendly matter<br>Environmental acknowledgment for | 1             | <b>Grilstadsfjæra bhg: 2012-907225</b><br>Procedures to work in an environmentally friendly matter | 1             |

|      |    |   |     |  |     |
|------|----|---|-----|--|-----|
|      |    |   |     | Environmental acknowledgment form  |     |
| 2013 | 29 | <p><b>Osloveien 155 – Omsorgsboliger: 2013-270762</b></p> <p>Procedures to work in an environmentally friendly matter</p> <p>Environmental acknowledgment form</p>  | 1   | <p><b>Leangen idrettsanlegg helårsanlegg - hurtigløpsbane inklusive grunnarbeid: 2013-795155</b></p> <p>Procedures to work in an environmentally friendly matter</p> <p>Environmental acknowledgment form</p>  | 1   |
| 2014 | 0  | No results  |     |  |     |
| 2015 | 18 | <p><b>Berg skole: 2015-606526</b></p> <p>Procedures to work in an environmentally friendly matter</p> <p>Environmental acknowledgment form</p> <p>Miljøkrav i byggeprosjekt ver 1.2:</p> <p>Reduce energy usage both when constructing and using the building, referring to the municipality's climate plan for 2010-2020.</p> <p>Report energy consumption in the construction process for all sources of energy.</p> <p>When drying/heating the building during the construction process energy efficient methods should be used.</p> <p>Domestic heating oils should be avoided.</p> <p>All construction machines and vehicles should be turned off when not in use.</p> | 1,2 | <p><b>Stavsetsvingen 1 – totalentreprise: 2015-055973</b></p> <p>Procedures to work in an environmentally friendly matter</p> <p>Environmental acknowledgment form</p> <p>MILJØKRAV I BYGGEPROSJEKT Ver 1.3:</p> <p>Enviromental and energy efficient heating of building during construction</p> <p>Report energy consumption in the construction process for all sources of energy.</p> <p>When drying/heating the building during the construction process energy efficient methods should be used.</p> <p>Domestic heating oils should be avoided.</p> | 1,3 |

|      |    |  |      |  |      |
|------|----|--|------|--|------|
|      |    |  |      | <p>Lights should be turned off when not in use.</p> <p>All construction machines and vehicles should be turned off when not in use.</p>  |      |
| 2016 | 0  | No results   |      |  |      |
| 2017 | 7  | <p><b>Dalgård skole – arbeidsplasser: 2017-042215</b></p> <p>Procedures to work in an environmentally friendly matter</p> <p>Environmental acknowledgment form</p>   | 1    | <p><b>Totalentreprise - garasje Olav Duuns veg 16: 2017-353151</b></p> <p>An environmental impact plan should be made for the project.</p>   | 4    |
| 2018 | 12 | <p><b>Sivert Thonstads veg'' Metrobuss, stasjon og reguleringsareal : 2018-890585</b></p> <p>Procedures to work in an environmentally friendly matter</p> <p>Environmental plan for the business</p> <p>Reduce fuel consumption</p> <p>Use biofuels if fuel is needed, diesel with 5% biofuels during winter</p> <p>Use renewable energy sources and reduce energy usage</p> <p>Reduce the needs of transportation</p> <p>Report energy consumption on machines used.</p> <p>Use particle filters in construction machines to fulfill the EURO-III standard</p> <p>New vehicles should comply with Euro-V standard</p> | 5, 6 | <p><b>Ombygging av Flatåsen brannstasjon 2018-589913</b></p> <p>Environmental acknowledgment form , MILJØKRAV I BYGGEPROSJEKT Ver 1.3:</p> <p>Environmental and energy efficient heating of building during construction</p> <p>Report energy consumption in the construction process for all sources of energy.</p> <p>Domestic heating oils should be avoided.</p> <p>Lights should be turned off when not in use.</p> <p>All construction machines and vehicles should be turned off when not in use.</p> | 7, 3 |

|      |    |  |        |   |    |
|------|----|--|--------|---|----|
| 2019 | 12 | <p><b>Entreprise 260711 Snarvegpakke 5 del 1: 2019-377179</b></p> <p>environmental plan for the business</p> <p>environmental demands by the municipality</p> <p>Reduce fuel consumption</p> <p>Use biofuels if fuel is needed, diesel with 5% biofuels during winter</p> <p>Use renewable energy sources and reduce energy usage</p> <p>Reduce the needs of transportation</p> <p>Report energy consumption on machines used.</p> <p>Use particle filters in construction machines to fulfill the EURO-III standard</p> <p>New vehicles should comply with Euro-V standard</p> <p>Comply with the environmental management standards</p> <p>Environmental certificates</p> <p>Environmental acknowledgment form 2</p> | 6, 8   | <p><b>Ranheimsveien 211 - Gamle Ranheim skole/Jakobsli skole - ombygging barnehage til skole: 2019-366972</b></p> <p>Comply with the environmental management standards</p> <p>Environmental certificates</p> <p>Procedures to work in an environmentally friendly matter</p> <p>environmental plan for the business</p> <p>Environmental acknowledgment form 2</p> | 9  |
| 2020 | 18 | <p><b>Øvre Bakklandet 52- ombygging og tilbygg – totalentreprise: 2020-384493</b></p> <p>Comply with the environmental management standards</p> <p>Environmental certificates</p> <p>Procedures to work in an environmentally friendly matter</p> <p>environmental plan for the business</p> <p>Environmental acknowledgment form 3</p>  | 10, 11 | <p><b>Romolslia barnehage - Oppgradering av uteområde: 2020-393068</b></p> <p>Comply with the environmental management standards</p> <p>Environmental certificates</p> <p>Procedures to work in an environmentally friendly matter</p>  | 10 |



|      |   |   |       |   |    |
|------|---|---|-------|---|----|
|      |   | <p>Zero emission construction site: all construction machines and heating/drying of the building should be emission free (electric or district heating)</p> <p>Other machines and equipment should be electric if possible</p> <p>If biofuels are used, sustainable certificates are required.</p> <p>All energy usage needs to be documented.</p>  |       | <p>environmental plan for the business</p> <p>Environmental acknowledgment form 3</p>   |    |
| 2021 | 2 | <p><b>Entreprise 260437 Klæbuveien fortau og VA-anlegg: 2021-336771</b></p> <p>Comply with the environmental management standards</p> <p>Environmental certificates</p> <p>Procedures to work in an environmentally friendly matter</p> <p>environmental plan for the business</p> <p>Environmental acknowledgment form 3</p> <p>Reduce fuel consumption</p> <p>Use biofuels if fuel is needed, diesel with 5% biofuels during winter</p> <p>Use renewable energy sources and reduce energy usage</p> <p>Reduce the needs of transportation</p> <p>Report energy usage on machines used.</p> <p>Use particle filters in construction machines to fulfill the EURO-III standard</p> <p>New vehicles should comply with Euro-V standard</p> | 10, 6 | <p><b>Tempe hvs- ombygging hjemmehjelpstjenesten – totalentreprise: 2021-308219</b></p> <p>Comply with the environmental management standards</p> <p>Environmental certificates</p> <p>Procedures to work in an environmentally friendly matter</p> <p>environmental plan for the business</p> <p>Environmental acknowledgment form 3</p> | 10 |

#### 4.4. Results of case study

As Table 1 presents, the environmental criteria is not very visible in the years until 2013. However, an environmental acknowledgment form is being used, where the constructing company needs to elaborate about their routines and skills regarding environmental impact. In 2015 Trondheim municipality's climate plan for 2010-2020 is mentioned in case 1 and a set of environmental requirements are presented. The requirements focus on reducing the energy usage in the building, both under construction and when in use. This should be done by using efficient construction heating, avoid using domestic heating oils, prohibiting engines running in machines when not in use and by documenting all use of any energy sources throughout the project. In case 2 presented in 2015 the environmental requirements are extended to include that unnecessary use of light should be avoided.

After 2015, there is a gap in the results as no cases were found with the chosen selection criteria in 2016. Moving on to 2017, the elected cases has degraded their environmental ambitions to the first findings or lower, as case 2 only demands an environmental impact plan for the project.

In the cases drawn from 2018, the focus on zero emission construction sites is more visible. An environmental plan for transportation and energy consumption is used in case 1. This is the most ambitious document found in the study, demanding reduced fuel consumption, use of biofuels if fuel is needed, use of renewable energy sources and reduced energy consumption, reduce the needs of transportation, report of energy usage on machines used, use of particle filters in construction machines to fulfill the EURO-III standard and that new vehicles should comply with Euro-V standard. The second case in 2018 presents revised version of the environmental acknowledgement form and the same set of environmental requirements presented in case 2 in 2015.

The first case investigated in 2019 follows the previous year's ambitions to reduce emissions by using the same environmental plan for transportation and energy consumption found in 2018 and the second version of the environmental acknowledgement form. In contrast, case 2 does not follow the same ambitions seen in the last cases. More vague formulations of environmental criteria are used in the tender specification, such as stating that the project has to comply with the environmental management standards, procedures to work in an environmentally friendly

matter and provide information in the second version of the environmental acknowledgment form.

In 2020 case 2 follows the vague ambitions of the last case in the previous year, is used in the tender specification, but introduces a third version of the environmental acknowledgement form. Case 1 follows with the same vague formulations, however there is also added a document where they demand a fossil or emission free construction site for all construction machines and drying and heating of the building. Other machines used should be electric if possible, documentation of energy consumption is requested and if biofuels are used its required to provide sustainable certificates.

The last year studied, 2021, both cases follow with the same vague formulation in their tender specification as seen in the previous years followed by the third version of the environmental acknowledgement form. However, case 1 also links to the ambitious environmental plan for energy and transportation, found in 2018 and 2019.

In the selection of cases the environmental focus has been very diverse. Trending to more environmental consciousness in the more recent years with some projects being zero emission construction sites. However, this is not consistent as there are found cases with less ambitious environmental goals in 2019, 2020 and 2021. The tender specifications have used many different ways to formulate the environmental goals, some more definitive than others as zero emission construction criteria was defined in some of the cases. In the selection of cases, none of them had any form of environmental award criteria in the tender specification.

## 5 Discussion

The aim for this chapter is to connect the literature review with the case of Trondheim municipality to investigate synergies. The structure is based on the four key dimensions in conceptual model of GSS to help discuss the different aspects of the study.

### 5.1. Aligning supplier selection with Trondheim municipality's overall strategy

The alignment of GSS is about understanding what green means for the organisation, in our case Trondheim municipality. This is a time-consuming change that can contribute to the overall green strategy of Trondheim municipality and enable the suppliers to fulfil other constraints as well. The green criteria need to be carefully selected to make sure it is relevant for the case. However, it is found difficult to plan for the future. Therefore, a planning paradigm could be used where adaptive plans are made to meet the uncertainties that will follow the project when its emerging, by analysing possible scenarios over time. This way, the plan can be adapted to respond to the challenges that are met.

In Trondheim municipality's energy and climate plan (Trondheim kommune, 2017b) the municipality presents how changing the world's energy solutions and economy is a part of the solution to reach UN's goal for global warming. Trondheim municipality wants to be a role model in this change, as they have the means and measures being a high-income region in the technology capital in Norway. Further, the plan presents a set of goals leading to how Trondheim municipality will become a zero-emission contributor in 2030.

Following the climate and energy plan, Trondheim municipality has developed procurement strategies (Trondheim kommune, 2017a, Trondheim kommune, 2018) to ensure progress in the climate goals. These strategies emphasise that different environmental criteria should be considered in every project, which follows the theory of aligning the supplier selection to be relevant for each cause.

The case study showed a very diverse environmental focus. The trend was showing more environmental focus in the later years of the study. The cases showing higher environmental ambitions are aligned with the climate goals for Trondheim municipality to be a zero emissions contributor by 2030. However, it was found cases with less ambitious goals in the study, even in the later years. The reason behind these less ambitious goals has not been investigated but leads to wonder if Trondheim municipality has aligned these projects with what is reasonable in the market, uncertainties that are to come, or budget restrictions. Other reasons behind it

could also be that they have lowered their ambitions or that it is poor work done by the purchaser.

### 5.2. The role of decision-making tools and models in Trondheim municipality's GSS

GSS is likely to need a longer time perspective to be able to consider the consequences of which supplier to choose. This will also help to achieve optimal timing, as it reduces the uncertainty of the future cost evolution to be as resolved as possible. The contracts for the participating firms should at the same time be structured in a way where it is possible to use incentives to reveal the true cost of the evolutions. These incentives should provide the firms with fees at investment and severance payments if rival technology is chosen to ensure wider participation. The needs are likely to be different as there is a vast of different supplier selection situations and therefore no obvious solution to a selection model in GSS as it is needed to be seen in relation to the detentions in the conceptual model.

This thesis has not investigated the timing Trondheim municipality uses to consider the suppliers in their procurement processes. However, the procurement regulation for 2018-2023 emphasise that the individual procurement environment is responsible of developing an overall strategy for the upcoming procurements to determine where the greatest environmental benefits can be achieved.

### 5.3. Selection process as a series of decisions

In this stage of the GSS process we want to see if the supplier selection process connects with Trondheim municipality's green strategy when the selection criteria is defined. The purpose of this is to create a logical and consistent set of selection criteria that is in line with the overall green strategy of the municipality. This could either be done by directing the GSS criteria directly to the supplier as an organisation or by addressing the product or service to be purchased from the supplier. Normally there are multiple people with different functions involved in the various stages of the selection process and purchasers are normally the last ones to be involved, which makes it a challenging. Therefore, "Effective GSS involves becoming aware of the fragmented nature and aiming at achieving coherence throughout the process" (Igarashi et al., 2013, p. 256).

Trondheim municipality has a set of energy and climate goals, with increasing ambitions over the years leading to the goal of becoming a zero emission contributor by 2030. As stated earlier in the discussion, the trend of the cases studied is that there is more environmental focus in the

later years. This reflects that the change of reducing emissions is in progress and intensified as we are getting closer to the deadline decided. However, not all measures communicated by Trondheim municipality has been found in the selection of cases in the case study.

In the procurement strategy from 2017 Trondheim municipality states that environmental specifications should count for at least 30% of the total award criteria in the tender specification when, feasible, relevant for the procurement, and does not cause any obvious disadvantage. However, neither of the cases had any tender specifications regarding environmental criteria.

It is also relevant to discuss the consistency of the criteria found in the case. The literature states that consistent criteria should be developed, whereas the case study found 11 different twists in the formulations of environmental specifications in the 16 cases studied. Without consistency in the specifications the suppliers will have higher risks to investigate in the technologies, such as zero emission construction machines. Where they do not win any award criteria and the procurement process is not always demanding these costlier solutions. This could be that Trondheim municipality is meeting the challenges of the fragmented selection process that the purchasers take place in and that the GSS could become more efficient if they were more aware of the situation.

#### 5.4. The Supply Chain Management context of Trondheim Municipality

The final dimension of the GSS framework is to look at the wider supply chain context it takes place in. This will help Trondheim municipality to be aware of the possibilities and limits in the GSS process. By doing so, Trondheim municipality can become the leader of its business ecosystem and understand the bigger picture and hence the whole ecosystem and its dynamics. This will allow Trondheim municipality to change its characteristics to adopt in its ecosystem as well as to foresee future changes and therefore develop to meet the new demands.

Trondheim municipality has chosen to strive to become one of the leading environmentally friendly cities in the world and is aware of the power they have as a public actor to set new standards for climate impact in their activities. As the case study showed increasing environmental demands in the tender specifications, it can be assumed that the suppliers are able to meet the criteria that is made and that change is happening. With the municipality's energy and climate plan and the public attention of the climate crisis it can be assumed that the suppliers should have enough knowledge to see why GSS is chosen in new procurement projects and that they see alignment in the selection criteria. The thesis has not investigated

how much pressure Trondheim municipality can use to demand more sustainable solutions. However, if too much pressure is used, no qualified offers will be given and Trondheim municipality will have to readjust their tender specifications to get the work done.

## 6 Conclusion

The purpose of this master thesis is to investigate the problem statement:

*How can adaptive innovative procurement strategies be designed and adjusted to achieve zero emission construction sites?*

However, the project thesis has not investigated design methods of adaptive innovative procurement strategies, but rather what kind of procurement strategies used in Trondheim municipality and how they relate to the framework of green supplier selection. Therefore, it is not known if Trondheim municipality applies adaptive strategies in their procurement processes.

Trondheim municipality has an energy and climate plan that state their climate ambitions and procurement measures ensuring minimum standards, requirements and goals. When investigating Trondheim municipality's tender specifications, a very diverse environmental focus was found. The trend was showing more environmental focus in the later years of the study, which is aligned with the pathway of becoming a zero emission contributor by 2030. Findings showed that there were variations in the quality of the projects which is not in line with an improving trend.

As stated in chapter 5.3 this reflects that the change of reducing emissions is in progress and intensified as we are getting closer to the deadline decided. However, not all measures communicated by Trondheim municipality has been found in the selection of cases in the case study. It is also relevant to discuss the consistency of the criteria found in the case. The literature states that consistent criteria should be developed, whereas the case study found 11 different twists in the formulations of environmental specifications in the 16 cases studied. Without consistency in the specifications the suppliers will have higher risks to investigate in the technologies, such as zero emission construction machines. Where they do not win any award criteria and the procurement process is not always demanding these costlier solutions. This could be that Trondheim municipality is meeting the challenges of the fragmented selection process that the purchasers take place in and that the GSS could become more efficient if they were more aware of the situation.

In order to see the broader perspective the supply chain management context (Chapter 5.4) showed that Trondheim municipality has chosen to strive to become one of the leading



environmentally friendly cities in the world and is aware of the power they have as a public actor to set new standards for climate impact in their activities. As the case study showed increasing environmental demands in the tender specifications, it can be assumed that the suppliers are able to meet the criteria that is made and that change is happening. With the municipality's energy and climate plan and the public attention of the climate crisis it can be assumed that the suppliers should have enough knowledge to see why GSS is chosen in new procurement projects and that they see alignment in the selection criteria. The thesis has not investigated how much pressure Trondheim municipality can use to demand more sustainable solutions. However, if too much pressure is used, no qualified offers will be given and Trondheim municipality will have to readjust their tender specifications to get the work done.

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## 8 Appendix

### 8.1. Environmental requirements found in cases

|   |  |
|---|--|
| 1 | Leverandøren skal ha prosedyrer for å utføre oppdraget på en miljømessig forsvarlig måte<br><br>Redegjørelse for eksisterende rutiner eller gyldig sertifikat fra tredjepartsverifisert system (eks. Miljøfyrtårn, ISO 14001, EMAS). Bruk eventuelt egenerklæring, jf dette dokumentets vedlegg 4. |
| 2 | Miljøkrav i byggeprosjekt ver 1.2 Dato: 07.03.2013<br><b>3.1 Energi</b>  |

|   |   |
|---|---|
|   | <p>Prosjektering og utførelse skal utføres med tanke på å redusere energiforbruket, både i byggefasen og i byggets driftsfase. Intensjonen i kommunens energi- og klimahandlingsplan 2010 – 2020 er veiledende for energibruket.</p> <p><i>3.1.1 Energi byggefasen</i></p> <p>For byggefasen innebærer dette spesielt at det skal velges miljøvennlig og energieffektiv byggoppvarming. I alle byggeprosjekter dokumenteres/rapporteres brukt energi i byggefasen, dette gjelder alle energikilder. Bruk av fyringsolje til oppvarming/uttørking i byggefasen skal hvis mulig unngås. (S. 5)</p> <p>3.5 Trafikk interesser.</p> <p>Ryggning ut fra byggeplass er ikke tillatt. Det er ikke tillatt med tomgangskjøring på eller i nærheten av byggeplassen. Bestemmelsen gjelder både biler og anleggsmaskiner/-utstyr og gjelder også i forbindelse med pauser, hviletid m.m. (s. 7)</p>   |
| 3 | <p><b>MILJØKRAV I BYGGEPROSJEKT</b> Ver 1.3 Dato: 02.04.2014</p> <p><i>3.2.1 Energi byggefasen</i></p> <p>For byggefasen innebærer dette spesielt at det skal velges miljøvennlig og energieffektiv byggoppvarming. I alle byggeprosjekter dokumenteres/rapporteres brukt energi i byggefasen, dette gjelder alle energikilder. Bruk av fyringsolje til oppvarming/uttørking i byggefasen skal hvis mulig unngås. Unødvendig bruk av lys skal unngås.(s. 5)</p> <p><b>3.5 Trafikk</b></p> <p>Det er ikke tillatt med tomgangskjøring på eller i nærheten av byggeplassen. Bestemmelsen gjelder både biler og anleggsmaskiner/-utstyr og gjelder også i forbindelse med pauser, hviletid m.m.</p> <p>Det lokale veinettet skal settes i stand som følge av skader påført av anleggstrafikken og om nødvendig rengjøres. Entreprenøren skal iverksette nødvendige tiltak for å hindre støvutslipp til omgivelsene ved transport. (s. 6)</p> |
| 4 | <p>C.5 Ytre miljø</p> <p>Totalentreprenøren, evt. hans rådgiver skal utarbeide miljøplan for prosjektet.</p> <p>Avfallsplan skal utarbeides av totalentreprenør. Deponering av bygningsavfall, emballasje, etc. skal skje på en forskriftsmessig måte og i henhold til avfallsplanen.</p> <p>Totalentreprenøren har ansvaret for bortkjøring til godkjent fyllplass i henhold til gjeldende retningslinjer for behandling av avfall I området.</p>  |
| 5 | <p>Aktivt styringssystem for å sikre at leverandør er egnet til å oppfylle kvalitet og miljøkrav stilt i konkurransegrunnlaget og kontraktsvilkårene</p>  |

|   |   |
|---|---|
|   | <p>Leverandøren må kort redegjøre for kvalitetssikringssystem og uttalte miljømål, status for miljøarbeid i egen virksomhet og planlagte tiltak, av relevans for denne kontrakt. Alternativt kan det vedlegges dokumentasjon på relevant miljøsertifisering, som ISO 14001 eller EMAS 1, Miljøfyrtårn eller annen dokumentasjon.</p>  |
| 6 | <p><a href="http://www.trondheim.kommune.no/miljoplan">http://www.trondheim.kommune.no/miljoplan</a></p> <p>Veileder til miljøplan tema 14 transport og energiforbruk, Appendix 8.5</p>   |
| 7 | <p><i>MILJØKRAV I BYGGEPROSJEKTET April 2016:</i></p> <p><i>3.2.1 Energi byggefasen</i></p> <p>For byggefasen innebærer dette spesielt at det skal velges miljøvennlig og energieffektiv byggeoppvarming.</p> <p>I alle byggeprosjekter dokumenteres/rapporteres brukt energi i byggefasen, dette gjelder alle energikilder. Bruk av fyringsolje til oppvarming/uttørking i byggefasen skal hvis mulig unngås. Uønsket bruk av lys skal unngås.</p> <p><b>3.5 Trafikk</b></p> <p>Det er ikke tillatt med tomgangskjøring på eller i nærheten av byggeplassen. Bestemmelsen gjelder både biler og anleggsmaskiner/-utstyr og gjelder også i forbindelse med pauser, hviletid m.m.</p> <p>Det lokale veinettet skal settes i stand som følge av skader påført av anleggstrafikken og om nødvendig rengjøres.</p> <p>Entreprenøren skal iverksette nødvendige tiltak for å hindre støvutslipp til omgivelsene ved transport.</p> |
| 8 | <p><b>Certificates by independent bodies about environmental management systems or standards</b></p> <p>Will the economic operator be able to produce certificates drawn up by independent bodies attesting that the economic operator complies with the required environmental management systems or standards?</p> <p>Minimum level(s) of standards possibly required</p> <p>Leverandøren skal ha prosedyrer for å utføre oppdraget på en miljømessig forsvarlig måte.</p> <p>Dokumentasjonskrav: Tilbyder skal fremlegge attester utstedt av uavhengige organer som dokumentasjon for at leverandøren oppfyller visse miljøledelsessystemer eller –standarder. Eksempelsvis EU-ordningen for miljøstyring og miljørevisjon (EMAS), andre anerkjente miljøledelsessystemer i forordningen (EF) nr. 1221/2009 artikkel 45 eller andre miljøledelsessystemer basert på relevante europeiske eller internasjonale</p>          |

|    |  |
|----|--|
|    | <p>standarder fra akkrediterte organer. Oppdragsgiver godtar tilsvarende attester utstedt av organer i andre EØSstater (for eksempel Miljøfyrtårn, ISO 14001). Annen dokumentasjon som viser at leverandøren har prosedyrer for å utføre oppdraget på en miljømessig forsvarlig måte.</p>  |
| 9  | <p><b>Certificates by independent bodies about quality assurance standards</b></p> <p>Will the economic operator be able to produce certificates drawn up by independent bodies attesting that the economic operator complies with the required quality assurance standards, including accessibility for disabled persons?</p> <p>Minimum level(s) of standards possibly required</p> <p>Dokumentasjon:</p> <ul style="list-style-type: none"> <li>- Attest for firmaets kvalitetssystem/styringssystem utstedt av uavhengige organer som bekrefter at leverandøren oppfyller visse kvalitetssikringsstandarder, eksempelvis ISO 9001:2002.</li> <li>- Annen dokumentasjon som viser at leverandøren har et kvalitetssikringssystem.</li> </ul> <p><b>Certificates by independent bodies about environmental management systems or standards</b></p> <p>Will the economic operator be able to produce certificates drawn up by independent bodies attesting that the economic operator complies with the required environmental management systems or standards?</p> <p>Minimum level(s) of standards possibly required</p> <p>Krav: Leverandøren skal ha prosedyrer for å utføre oppdraget på en miljømessig forsvarlig måte</p> <p>Dokumentasjon:</p> <ul style="list-style-type: none"> <li>- Attester utstedt av uavhengige organer som dokumentasjon for at leverandøren oppfyller visse miljøledelsessystemer eller –standarder. Eksempelsvis EU-ordningen for miljøstyring og miljørevisjon (EMAS) eller andre anerkjente miljøledelsessystemer.</li> </ul> <p>Annen dokumentasjon som viser at leverandøren har prosedyrer for å utføre oppdraget på en miljømessig forsvarlig måte. Vedlegg for miljøerklæring kan også benyttes.</p> |
| 10 | <p><b>Quality assurance schemes and environmental management standards</b></p> <p><b>Certificates by independent bodies about quality assurance standards</b></p> <p>Will the economic operator be able to produce certificates drawn up by independent bodies attesting that the economic operator complies with the required quality assurance standards, including accessibility for disabled persons?</p> <p>Minimum level(s) of standards possibly required</p> <p>Krav: Leverandøren skal ha et kvalitetssystem tilpasset kontraktens innhold.</p> <p>Dokumentasjonskrav: Attest for</p> <p>firmaets kvalitetssystem/styringssystem utstedt av uavhengige organer som bekrefter at leverandøren oppfyller visse kvalitetssikringsstandarder, eksempelvis ISO 9001:2002. Kvalitetsstandarden skal være basert på relevante europeiske standardserier som er</p>   |

sertifisert av akkrediterte organer. Oppdragsgiver godtar også annen dokumentasjon for tilsvarende kvalitetssikringstiltak dersom leverandøren ikke har mulighet til å få slike attester innen fristen, og dette ikke skyldes leverandøren selv. Dette forutsetter at leverandøren dokumenterer at disse tiltakene tilsvarer de etterspurte kvalitetssikringsstandardene. Her må det minimum fremlegges en overordnet beskrivelse av innholdet i systemet herunder en oversikt over kontrollplaner og sjekklister som er relevant for denne kontrakten.

**Certificates by independent bodies about environmental management systems or standards**

Will the economic operator be able to produce certificates drawn up by independent bodies attesting that the economic operator complies with the required environmental management systems or standards?

Minimum level(s) of standards possibly required

Krav: Leverandøren skal ha prosedyrer for å utføre oppdraget på en miljømessig forsvarlig måte.

Dokumentasjonskrav: Tilbyder skal fremlegge attester utstedt av uavhengige organer som dokumentasjon for at leverandøren oppfyller visse miljøledelsessystemer eller –standarder. Eksempelsvis EU-ordningen for miljøstyring og miljørevisjon (EMAS), andre anerkjente miljøledelsessystemer i forordningen (EF) nr. 1221/2009 artikkel 45 eller andre miljøledelsesstandarder basert på relevante europeiske eller internasjonale standarder fra akkrediterte organer. Oppdragsgiver godtar tilsvarende attester utstedt av organer i andre EØSstater (for eksempel Miljøfyrtårn, ISO 14001). Annen dokumentasjon som viser at leverandøren har prosedyrer for å utføre oppdraget på en miljømessig forsvarlig måte. Vedlegg 3 miljøerklæring kan også benyttes.

|        |            |  |  |
|--------|------------|--|--|
| 1<br>1 | <b>1.6</b> | <b>Fossilfri/utslippsfri byggeplass</b>  |  |
|        |            | <p>Prosjektet skal gjennomføres med fossilfri byggeplass og gjelder minimum:</p> <ul style="list-style-type: none"> <li>• Alle anleggsmaskiner</li> <li>• Oppvarming og byggtørk (fjernvarme eller elektrisitet)</li> </ul> <p>Maskiner og utstyr skal være elektrisk drevet så langt det er mulig. Det tillates ikke tomgangskjøring på eller i nærheten av byggeplassen. Bestemmelsen gjelder biler, anleggsmaskiner og utstyr og gjelder også i forbindelse med pauser og hviletid.</p> <p>Hvis Leverandøren har forpliktet seg til å benytte biodrivstoff skal EUs bærekraftskriterier* for biodrivstoff oppfylles. Det skal ikke benyttes biodrivstoff basert på palmeolje eller biprodukter fra palmeoljeproduksjon.</p> | <p>Det skal utarbeides en plan for ivaretagelse av fossilfri byggeplass, inkludert plan for hvordan tomgangskjøring kan unngås som overleveres byggherre før byggestart. Avvik på dette registreres som uønsket hendelse (RUH).</p> <p>Leverandøren skal til enhver tid kunne fremlegge dokumentasjon på at biodrivstoffet er produsert bærekraftig og palmeoljefritt. Dokumentasjonen skal eksempelvis inneholde følgende informasjon: drivstoffprodusent, drivstoffleverandør, mengde, opprinnelse og sertifisering.</p> <p>* § 3-6 til § 3-9 i Forskrift om begrensning i bruk av helse- og miljøfarlige kjemikalier og andre produkter (produktforskriften).</p> |
|        | <b>1.7</b> | <b>Energiforbruk på byggeplass</b>   |  |
|        |            | <p>Energiforbruk på byggeplass, herunder forbruk av elektrisitet og drivstoff, skal registreres.</p> <p>Belysningen på byggeplassen skal være energieffektiv og styrt for å unngå belysning når det ikke foregår arbeid.</p> <p>Brakkerigg skal være iht. krav i TEK 17 og skal ha system for senking av temperatur om natten, i helger og i ferier.</p>   | <p>Leverandør skal via månedsrapporteringen rapportere energiforbruk samt hvilke type modeller og maskiner som benyttes. Samlet energiforbruk fra byggeplass skal legges ved sammen med FDV dokumentasjonen.</p> <p>Drivstofforbruk dokumenteres med kvittering fra drivstoffleverandør.</p>   |

1a

## 8.2. Environmental acknowledgment form

### FORMÅL

Miljøerklæringen skal dokumentere at kvalifikasjonskrav i forhold til miljø er oppfylt hos entreprenører og håndverkere som tar oppdrag for Trondheim kommune.

| Spørsmål nr.  | Tema  | Ja | Nei |
|---|---|----|-----|
| 1.  | Har bedriften/virksomheten (videre kalt bedriften) rutiner/prosedyrer og kompetanse knyttet til håndtering av miljøpåvirkninger ved utførelse av de aktuelle oppdrag/fag, og kan i så fall dette dokumenteres ved at bedriften er Miljøfyrtårnssertifisert iht. aktuelle bransjekrav, ISO 14001-sertifisert, EMAS-godkjent eller har annen tilsvarende 3.parts godkjenning? Oppgi bransje og type godkjenning:<br>..... |    |     |
| <p><b>Hvis nei på spørsmål nr 1, besvares spørsmålene 2 til og med 9.<br/>Disse kan ved positiv bekreftelse evt aksepteres som relevant alternativ dokumentasjon.</b></p> |   |    |     |
| 2.  | Følger bedriften Rent Tørt Bygg-konseptet, og kan eventuelt rutiner/beskrivelser forevises ?  |    |     |
| 3.  | Utarbeider bedriften en årlig miljørapport for egen virksomhet, og kan denne eventuelt forevises?   |    |     |
| 4.  | Har bedriften årlige miljømål og miljøhandlingsplan / miljøforbedrings-program for virksomhetens kjerneprosesser, og kan denne eventuelt forevises?   |    |     |
| 5.  | Har bedriften rutiner som følges for kildesortering og avfallsreduksjon, og kan eventuelt eksempel på avfallsregnskap eller rutine for slikt forevises?   |    |     |
| 6.  | Vektlegger bedriften miljø ved valg av materialer, og har man eksempelvis beskrevne miljøkriterier for innkjøp/valg av materialer?  |    |     |
| 7.  | Stiller bedriften miljøkrav til sine underentreprenører og leverandører?  |    |     |
| 8.  | Har bedriftens utpekt en person som er miljøansvarlig/miljøkoordinator?   |    |     |
| 9.  | Har bedriften personell med relevant utdanning og praksis iht. miljø?   |    |     |

Evt supplerende kommentarer:

Hvis bedriften verken oppfylder punkt 1 eller punktene 2 til og med 9, forplikter bedriften seg til å oppfylle enten punkt 1 eller punktene 2 til og med 9 i løpet av 6 måneder fra kontraktsinngåelse. Evt kan det avtales konkrete krav i forhold til punktene 2 - 9 innen de tema spørsmålene omhandler.

Bedriften vil selv ha ansvar for at denne forpliktelsen dokumenteres rettidig. Dette vil kunne bli knyttet opp mot en dagmultbelagt milepæl.

|            |           |
|------------|-----------|
| Sted/dato: | Signatur: |
|------------|-----------|



### 8.3. Environmental acknowledgment form 2

Trondheim kommune – Trondheim eiendom  
Anskaffelses navn

Side 1 av 1

**KONKURRANSEREGLER (TILBUDSFØRESPØRSEL)**

Dato: 20.11.2017

#### **Vedlegg 3 - Miljøerklæring:**

1. Miljøerklæringen skal dokumentere at kvalifikasjonskrav i forhold til miljø er oppfylt hos leverandør som tar oppdrag for Trondheim kommune. Leverandøren skal ha rutiner og kompetanse knyttet til håndtering av miljøpåvirkninger ved utførelse av de aktuelle oppdrag/fag.
2. Erklæringen skal vedlegges tilbudet og omfatter også underleverandører knyttet til oppdraget.
3. Alle spørsmålene fra nummer 1-11 skal besvares.

| Spørsmål | Tema   | Ja | Nei |
|----------|--|----|-----|
| 1.       | Er leverandør miljøsertifisert etter kravene i Miljøfyrtårn, ISO 14001, EMAS-godkjent eller har annen tilsvarende 3.parts godkjenning? Oppgi hvilken sertifisering:<br>..... |    |     |
| 2.       | Har leverandøren årlige miljømål og miljøhandlingsplan?  |    |     |
| 3.       | Utarbeider leverandøren en årlig miljørapport som viser måloppnåelse?  |    |     |
| 4.       | Har leverandøren utpekt en person som er miljøansvarlig/miljøkoordinator?  |    |     |
| 5.       | Har ansatte hos leverandøren fått opplæring i å utføre oppdrag etter miljømessige metoder?   |    |     |
| 6.       | Har leverandøren utarbeidet miljøkriterier for innkjøp og valg av materialer?  |    |     |
| 7.       | Har leverandøren rutiner for å oppnå avfallsreduksjon (eksempelvis utnytte materialene, rett kappelengde, hindre materialskader osv.)?                                       |    |     |
| 8.       | Har leverandøren rutiner for riktig avfallssortering?  |    |     |
| 9.       | Har leverandøren fokus på miljøvennlige transportløsninger?  |    |     |
| 10.      | Følger leverandøren Rent Tørt Bygg- konseptet?   |    |     |
| 11.      | Stiller leverandøren tilsvarende miljøkrav til sine underleverandører?   |    |     |

Kommentarer:

## 8.4. Environmental acknowledgment form 3

KG - vedlegg  
16.06.2020

Revidert

### MILJØERKLÆRING

1. Miljøerklæringen skal alltid fylles ut, og alle spørsmål fra 1-9 skal besvares, selv om leverandøren er miljøsertifisert.
2. Miljøerklæringen skal dokumentere at kvalifikasjonskrav i forhold til miljø er oppfylt hos leverandør som tar oppdrag for Trondheim kommune. Leverandøren skal ha rutiner og kompetanse knyttet til håndtering av miljøpåvirkninger ved utførelse av de aktuelle oppdrag/fag.
3. Erklæringen skal fremlegges straks på oppdragsgivers forespørsel.
4. Miljøerklæringen gjelder også underleverandører knyttet til oppdraget.
5. Dokumentasjon knyttet til de ulike spørsmålene skal fremlegges ved forespørsel.

| Spørsmål | Tema   | Ja | Nei |
|----------|--|----|-----|
| 1.       | Har leverandøren en miljøsertifisering som er relevant for kontraktens leveranse etter kravene i Miljøfyrtårn, ISO 14001, EMAS-godkjent eller har annen tilsvarende 3.parts godkjenning? Oppgi hvilken sertifisering:<br>..... |    |     |
| 2.       | Har leverandøren årlige miljømål, miljøoppfølgingsplan og årlig miljørapport som viser måloppnåelse?   |    |     |
| 3.       | Har leverandøren utpekt en person som er miljøansvarlig for denne leveransen?  |    |     |
| 4.       | Har ansatte hos leverandøren fått opplæring i å utføre arbeid knyttet til leveransen etter miljømessige metoder og løsninger?  |    |     |
| 5.       | Har leverandøren utarbeidet miljøkriterier for innkjøp av materialer?  |    |     |
| 6.       | Har leverandøren rutiner for å oppnå avfallsreduksjon, for eksempel god materialutnyttelse samt å hindre materialskader og lignende?   |    |     |
| 7.       | Har leverandøren rutiner for riktig avfallssortering?  |    |     |
| 8.       | Har leverandøren en plan for klimareduserende tiltak for leveransen, for eksempel bruk av klimavennlige maskiner og kjøretøy, fossilfritt drivstoff, redusert tomgangskjøring og lignende?                                     |    |     |

|    |   |  |  |
|----|---|--|--|
| 9. | Kontrollerer leverandøren at alle underleverandører knyttet til leveransen følger kravene til miljøstyring? |  |  |
|----|---|--|--|

Kommentarer:

**Konsekvens ved manglende oppfyllelse av krav.** Leverandøren har ansvar for at forpliktelsen dokumenteres i rett tid. Dette vil kunne bli knyttet opp mot en dagmulktbelagt milepæl eller bli betraktet som et vesentlig mislighold av kontrakten.

**Jeg bekrefter opplysningene gitt i dette skjemaet. Jeg er kjent med at feilaktige opplysninger kan medføre at avtalen heves.**

Sted/dato:..... Signatur fra leverandør:.....

**Hvis leverandør svarer nei på et eller flere spørsmål fra 2 til 10, forplikter leverandøren å oppfylle kravene innen 3 måneder fra kontraktsinngåelse.**

Dato for oppfyllelse av punkt 2-10: ..... Signatur fra leverandør:.....

## 8.5. Environmental plan for transportation and energy consumption



# TRONDHEIM KOMMUNE

### Veileder til miljøplan<sup>1</sup> tema 14: Transport og energiforbruk

#### Miljømål

- Reduksjon av støy og drivstofforbruk og dermed klimagassutslipp.
- Redusere klimagassutslipp ved reduksjon av energiforbruk og miljøvennlig energibruk.
- Massetransport skal minimaliseres.

#### Sjekkpunkt for miljøkrav

14.1 Stilt krav til anleggsarbeidet med sikte på vern av mark og vegetasjon mot transportskader.

14.2 Stilt krav om bruk av miljøvennlig drivstoff og brensel og om tiltak til reduksjon av klimagassutslipp, jfr "Miljøerklæring drivstoff og brensel" og "Miljøerklæring transport"

14.3 Stilt krav til minimalisert energi og transportbehov i anleggs- og driftsfasen.

14.4 Stilt krav om rapportering på transport og energiforbruk og om at maskiner skal spesifiseres på type og modell.

#### Når er temaet relevant?

Ved alle anleggsarbeider

#### Tiltak

##### Tiltak for å redusere utslipp fra tunge kjøretøy og maskiner (>7500 kg)

<http://www.trondheim.kommune.no/content.ap?thisId=1117627368&language=0>

- 100 % biodiesel i vår-, sommer- og høstsesongen (B100)
- Diesel med 5 % biodieselinnblanding i vintersesongen (B5)
- Ettermontering av partikkelfilter på kjøretøy med motorer som tilsvarende EURO III-utslippsstandard eller eldre
- Nye kjøretøy som kjøpes tilfredsstillende EURO V-kravene til dieselmotorer
- Kurs i myk kjørestil til alle sjåfører

##### Tiltak for å redusere transportbehovet

Optimalisert transportlogistikk f.eks:

- Tomgangskjøring reduseres til et minimum: Det er ikke tillatt med tomgangskjøring på eller i nærheten av byggeplassen. Bestemmelsen gjelder både biler og anleggsmaskiner/-utstyr og gjelder også i forbindelse med pauser, hviletid m.m.
- begrense inn og uttransport av masser
- foretrekke lokale produkter med kort transportveg
- gjenbruk av masser på stedet

<sup>1</sup> Mer informasjon om miljøplanen finner du på denne Internettssiden: <http://www.trondheim.kommune.no/miljoplan>. For å aktivere lenker i dette dokumentet, holdt Ctrl-tasten ned mens du klikker på lenken.

## Tiltak for å redusere energiforbruket på anleggsområdet og i driftsfasen

Krav om effektiv bruk av energi i anleggsfasen:

- energivennlig byggoppvarming: Lukk bygget ved byggtørkning,
- godt isolerte anleggsbrakker, med energieffektivt bad- og kjøkkenutstyret
- bruk energieffektive strømaggregater
- Stillet krav om oppvarmingssystem med vannbåren varme f.eks fortauer innenfor konsesjonsområdet for fjernvarme.
- Alle nye bygg skal tilfredsstillе minimumskravene i TEK 09. I tillegg skal det gjøres alternativsanalyser som viser tekniske og økonomiske konsekvenser ved å legge til grunn krav om henholdsvis 10 % og 20 % lavere energiforbruk enn TEK 09. (kilde: Trondheim eiendom)

### Forskrifter / retningslinjer lovverk

- Funksjonskrav i henhold til forurensningsforskrift om lokal luftkvalitet for PM<sub>10</sub> (døgn) og NO<sub>2</sub> (time). (Miljøenheten): <http://www.trondheim.kommune.no/luft/>
- Husk søknadsplikt og spesielle betingelser ved motorferdsel i markaområdet – rettes til Miljøenheten
- [TA 1442](#) Retningslinje for behandling av støy i arealplanlegging

### Kart

- [Konsesjonsområde for fjernvarme](#)
- Hovedvegnett > [se på kommunens kartverktøy i Internett](#)

### Veiledere / rapporter

- [Energiforbruk og klimagassutslipp i Trondheim \(Program for Industriell økologi ved NTNU\)-Hovedrapport](#) Report no.2/2007 ISBN 978-82-79-48063-1 (pdf)
- [Hvordan redusere CO2-utslipp fra tjenestekjøring i Trondheim kommune med 40%?](#) Rapport pdf
- [Fjernvarme i Trondheim](#)
- [Reduksjon i klimagassutslipp fra kommunens tunge kjøretøy](#) Faktaark 2007
- [Reduksjon i klimagassutslipp fra kommunens lette kjøretøy](#) Faktaark 2007
- [Ny energi- og klimahandlingsplan for Trondheim kommune](#) (vedtatt jun2010)
- [Miljøpakke for transport fra kommunen](#)
- [Informasjon om miljøpakken på kommunens hjemmesider](#)

### Eksempler / Nettlink

- [Kommunens Internettside om Klima og Energi](#)
- [Miljøstatus i Trondheim om Energi](#)

### Kontakt

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08. oktober 2010

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## 8.6. Literature research

|                                  | Green public procurement | Adaptive Strategies                            | Coevolution                            | Construction sites                            | Zero emission construction sites                            |
|----------------------------------|--------------------------|--|--|---|---|
| Green public procurement         | Green public procurement | Green public procurement + Adaptive Strategies | Green public procurement + Coevolution | Green public procurement + Construction sites | Green public procurement + Zero emission construction sites |
| Adaptive Strategies              |                          |  | Adaptive Strategies + Coevolution      | Adaptive Strategies + Construction sites      | Adaptive Strategies + Zero emission construction sites      |
| Coevolution                      |                          |  |  | Coevolution + Construction sites              | Coevolution+ Zero emission construction sites               |
| Construction sites               |                          |  |  | Construction sites                            | Construction sites + Zero emission construction sites       |
| Zero emission construction sites |                          |  |  |   | Zero emission construction sites                            |

