Taking Climate into Account

Carbon Management Tools for Investment Decisions and Progress Tracking at an Energy Company

Rebecca Ahlin and Anna Malmberg

DIVISION OF PRODUCT DEVELOPMENT | DEPARTMENT OF DESIGN SCIENCES
FACULTY OF ENGINEERING LTH | LUND UNIVERSITY
2022

MASTER THESIS

ÖRESUNDS KRAFT

Taking Climate into Account

Carbon Management Tools for Investment Decisions and Progress Tracking at an Energy Company

Rebecca Ahlin and Anna Malmberg

LUND
UNIVERSITY

Taking Climate into Account

Carbon Management Tools for Investment Decisions and Progress Tracking at an Energy Company

Published by

Department of Design Sciences
Faculty of Engineering LTH, Lund University
P.O. Box 118, SE-221 00 Lund, Sweden

Publicerad av
Institutionen för designvetenskaper
Lunds Tekniska Högskola, Lunds universitet
Box 118, 221 00 Lund

Subject: Innovation Engineering (INTM01), Product Development (MMKM05)
Division: Product development
Supervisor: Lars Bengtsson
Examiner: Kajsa Ahlgren Ode

Ämne: innovationsteknik (INTM01), produktutveckling (MMKM05),
Avdelning: Produktutveckling
Huvudhandledare: Lars Bengtsson
Examinator: Kajsa Ahlgren Ode

Abstract

Title
Taking Climate into Account – Carbon Management Tools for Investment Decisions and Progress Tracking at an Energy Company

Authors
Rebecca Ahlin and Anna Malmberg

Supervisor
Lars Bengtsson, Dept. of Design Sciences, Faculty of Engineering, Lund University

Background
Climate change is becoming a more urgent issue, where global agreements and regulations are putting pressure on companies to calculate and disclose their greenhouse gas emissions to combat the problem. Other driving forces of carbon disclosure for companies include social, economic, and financial pressure, as well as firm specific internal factors. Carbon calculations within companies are increasing in frequency and importance, both in practice and as a research topic. However, there is a lack of research regarding how companies can use their carbon emission calculations for internal steering.

Purpose
This thesis aims to identify different carbon management tools and analyze them from the perspective of their relevance for an energy company. Both tools for investment decision-making and progress tracking will be assessed. Additionally, this thesis aims to describe different aspects of implementation of carbon management tools within companies.

Research questions

R1: What is a suitable tool for energy companies to use for integration of climate impact into decision making?
R2: What is a suitable tool for energy companies to use for progress tracking of total carbon emissions?
R3: What are important aspects to consider when implementing these tools?

Method

To initially address the research questions, information was gathered through a study of previous research around carbon accounting. Current methods and standards for carbon emission calculations were also investigated, as well as theory around change management. Through the literature study three potential tools were identified, and in two cases modified.

The Swedish energy company Öresundskraft was used as a case company to answer the research questions. Interviews and a workshop were held with employees at Öresundskraft to understand their desires, needs and thoughts about the selected tools. Also, external interviews were held to gain an understanding around for instance carbon calculations and the owner Helsingborgs Stad's perspective.

A selection of the results from interviews and a workshop that was considered relevant was then compiled. Together with the literature study this provided the basis for the evaluation of the selected tools which resulted in the final recommendations.

Conclusions

Conclusions regarding research questions:

- **R1:** An internal shadow price on carbon is a suitable tool for energy companies to use when integrating climate impact into investment decision-making. This since it
    - has a clear connection to economic figures and provides strong steering capabilities
    - can take long-term climate benefits on system level into account by relying on carbon emission calculations
    - has a clear focus on climate effects

- **R2**: A Carbon Intensity Ratio is a suitable tool for energy companies to use for progress tracking of total emissions. An appropriate denominator for the metric is capital employed.
- **R3**: Aspects to consider when implementing the suggested carbon management tools are presented through a 7-step roadmap. The identified steps are: 1) Communicate the change 2) Establish a responsible project group 3) Hire additional employees or making sure sufficient resources exist 4) Establish structures for carbon emission calculations if these does not already exist 5) Report Carbon Intensity Ratios 6) Implement an internal carbon price 7) Evaluate the process and adjust thereafter. Additional insights are:
    - Additional resources might be needed to implement the carbon accounting tools.
    - Top management commitment and dialogue with the owner about economic pressure enable implementation.

Conclusions regarding carbon emission calculations:

- The consequence perspective should be used for carbon emission calculations for decision-making.
- Both the accounting perspective and the consequence perspective can be used for progress tracking of carbon emission.
- The calculations that will be required by the EU directive CSRD will not be sufficient for decision-making.

Keywords: Carbon accounting, carbon disclosure, carbon management, carbon management tools, environmental change management, internal carbon price

Sammanfattning

Bakgrund

Klimatförändringarna blir mer och mer akuta. Globala överenskommelser sätter press på företag att beräkna och rapportera koldioxidutsläpp för att minska den globala uppvärmningen. Andra drivkrafter för att rapportera utsläpp för bolag inkluderar social, ekonomisk och finansiell press, såväl som företagsspecifika interna faktorer. Beräkning av koldioxidutsläpp inom företag ökar i frekvens och betydelse, både i praktiken och som forskningsämne. Det saknas dock forskning kring hur företag kan använda sina utsläppsberäkningar till intern styrning.

Syfte

Denna rapport syftar till att identifiera olika koldioxidhanteringsverktyg och analysera dem utifrån deras relevans för ett energibolag. Både verktyg för investeringsbeslut och uppföljning kommer att utvärderas. Dessutom syftar arbetet till att beskriva olika aspekter av implementering av koldioxidhanteringsverktyg inom företag.

Frågeställningar

F1: Vad är ett lämpligt verktyg för energibolag att använda för integrering av klimatpåverkan i beslutsfattande?
F2: Vad är ett lämpligt verktyg för energibolag att använda för uppföljning av totala utsläpp?
F3: Vad är viktiga aspekter att överväga vid implementering av dessa verktyg?

Metod

För att besvara examensarbetets frågeställningar samlades information in genom en litteraturstudie kring koldioxidredovisning (*climate accounting).* Den innefattade både forskning och material från icke-akademiska källor kring beräkningsmetoder och standarder. Genom litteraturstudien identifierades potentiella koldioxidmanagementverktyg.

Det svenska energibolaget Öresundskraft användes som ett fallföretag för att besvara frågeställningarna. Intervjuer och en workshop med anställda på Öresundskraft hölls för att förstå företagets förutsättningar och behov samt de anställdas önskemål och åsikter kring utvalda verktyg. Även externa intervjuer genomfördes för att bidra till förståelse av koldioxidberäkningar och ägarperspektivet från Helsingborgs Stad.

Det material från intervjuer och en workshop som ansågs relevant sammanställdes. Tillsammans med litteraturen utgjorde detta grunden för analysen av verktygen som sedan resulterade i slutsatser för rapporten.

Slutsatser

Slutsatser med avseende på frågeställningarna:

- **F1:** Ett internt koldioxidskuggpris är ett lämpligt verktyg för energibolag att använda för integration av klimatpåverkan i beslutsfattande. Detta eftersom verktyget:
    - Har tydlig koppling till ekonomi och ger stora möjligheter att styra beslut
    - Tar långsiktiga konsekvenser för klimatet på systemnivå i beaktande om det bygger på väl utförda utsläppsberäkningar
    - Och har tydligt klimatfokus
- **F2**: Ett koldioxidratio är ett lämpligt verktyg för energibolag för att följa upp totala utsläpp över tid. En lämplig nämnare för måttet anses vara sysselsatt kapital.
- **F3**: Aspekter att överväga vid implementering av dessa verktyg presenteras genom en 7-stegs roadmap. De identifierade stegen är: 1) Kommunikation av förändringen 2) Etablera en ansvarig projektgrupp 3) Anställa fler eller se till att nödvändiga resurser finns tillgängliga 4) Etablera strukturer för utsläppsberäkningar om dessa inte redan finns 5) Rapportera koldioxidratio 6) Implementera ett internt kolodioxidpris 7) Utvärdera processen och göra justeringar. Ytterligare slutsatser kring implementeringen är att:
    - Mer resurser kan krävas för att implementera koldioxidhanteringsverktyg
    - Ledningsgruppens engagemang och en dialog med ägaren möjliggör implementering

Slutsatser angående koldioxidberäkningar:

- Konsekvensperspektivet ska användas för att göra koldioxidberäkningar för investeringsbeslut.

- Både konsekvensperspektivet och bokföringsperspektivet kan användas för att följa upp koldioxidutsläpp.
- De koldioxidberäkningar som kommer krävas av EU direktivet CSRD kommer inte att vara tillräckliga för att ligga till grund för investeringsbedömningar.

Nyckelord: Koldioxidredovisning, klimatbokslut, koldioxidmanagement, koldioxidmanagementverktyg, miljöförändringsarbete, internt koldioxidpris

Acknowledgments

This master thesis within Industrial Engineering and Management was conducted at Lund University at the Faculty of Engineering at the department of Design Sciences, on behalf of Öresundskraft AB and Sustainlink.

We are grateful to Öresundskraft AB for providing the opportunity to conduct this research through their advertisement seeking master's students to explore the challenge of weighing climate benefits against profit. We would especially like to thank our supervisor at Öresundskraft, Anna Sundberg. In addition to assisting us in setting up interviews with other employees at Öresundskraft, Anna has been a true inspiration with her knowledge and experience, together with her positive energy and strong engagement for sustainability.

We would also like to thank our academic supervisor, Lars Bengtsson, for his valuable guidance and support throughout the process of writing this thesis. His expertise and insights have been valuable for structuring the research and keeping a steady course.

We would also like to extend our gratitude to the interviewees, both internally at Öresundskraft and externally, for their time, knowledge, and opinions. Their input has made this thesis possible.

Lund, January 2023

Anna Malmberg and Rebecca Ahlin

Table of contents

Acronyms, abbreviations and terminology

CCS	Carbon Capture & Storage
CDP	Carbon Disclosure Project
CIR	Carbon Intensity Ratio
CSR	Corporate Social Responsibility
CSRD	Corporate Sustainability Reporting Directive
ETS	Emission Trading System
EU	European Union
GHG	Greenhouse Gas
GRI	Global Initiative Institute
ICP	Internal Carbon Price
LCA	Life Cycle Assessment
MQS	Management Quality Score
NFRD	Non-Financial Reporting Directive
NGO	Non-Governmental Organization
R&D	Research and Development
SDG	Sustainable Development Goal
TPI	Transition Pathway Initiative
UN	United Nations
WBCSD	World Business for Sustainable Development
WRI	World Resources Institute
ÖKAB	Öresundskraft

Besides these abbreviations, clarification of terminology is needed. In this thesis, the term investment primarily refers to expenditures that results in fixed assets, but the findings can also be transferred to other kinds of long-term expenditures, e.g., establishing new service offerings and R&D. Besides this, when referring to carbon, e.g., for emissions, accounting, management tools etc, the authors imply all greenhouse gases that might influence global warming. If there are any uncertainties regarding which emissions to include in this group, the greenhouse gas protocol should be used as reference.

1 Introduction

This section will serve as an introduction to the thesis, starting with a background, followed by a description of the problem, the thesis' purpose and research questions, delimitations and focus, target audience and the section will end with an outline of the thesis.

1.1 Background

Sea levels are rising, glaciers are melting, the temperature of oceans are increasing and drought, storms as well as heat waves are becoming more frequent and intense. The effects of climate change and global warming are clear (WWF, 2022). Due to human activities, the concentration of greenhouse gases in the earth's atmosphere is steadily rising and with that earth's mean temperature. Through the UN Paris Agreement on Climate Change 175 nations agreed in December 2015 to limit the temperature rise to a maximum of 2 degrees. However, as of now, this target does not seem to be met (UNEP, n.d.; UN, 2016, n.d.).

Another global agreement targeting climate change is the UN 17 Sustainable Development Goals, SDGs, that were adopted by all member states in September 2015. Climate Action is one of these goals, stating that urgent action should be taken to combat climate change and its impacts. (UN, n.d.). Besides global agreements, there are regulations targeting climate impact. One example of this is the new proposed EU directive Corporate Sustainability Reporting Directive (CSRD) (Finansinspektionen, 2022). The directive will, among other things, include a requirement for large companies to report their emissions (Andersson, 2022).

Global agreements and regulations like these are putting pressure on companies to calculate and disclose their greenhouse gas emissions to combat climate change. Other driving forces of carbon disclosure for companies include social, economic, and financial pressure, as well as firm

specific internal factors. Carbon calculations within companies are increasing in frequency and importance, both in practice and as a research topic. (He et al., 2021)

The research field covering this is called Carbon Accounting. The field covers everything from carbon emission calculations to disclosure of carbon emissions, to how these calculations can be used to steer companies. The latter is categorized as carbon management and is seen as an underlying research area within Carbon Accounting (He et al., 2021). A full categorization of the research field can be seen in Figure 1.

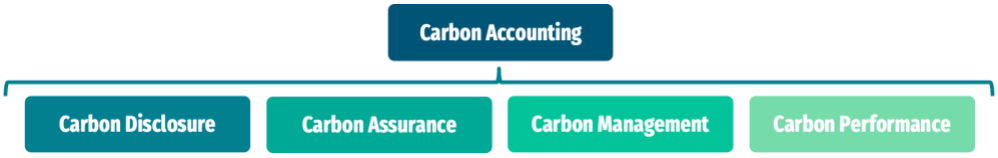


Figure 1: Different research areas within Carbon Accounting (He et al., 2021).

1.2 Problem description

The field of Carbon Accounting is still in its formative stage of development with many limitations (He et al., 2021). Clarke & Marlowe (2022) have identified a specific research gap related to Carbon Management, where there is a lack of research about companies' integration of carbon calculations into systems, e.g. decision-making and disclosure (Clarke and Marlowe, 2022).

A gap regarding integration of carbon calculations into decision-making and financial disclosure can also found within companies, for instance within the Swedish energy company Öresundskraft. Öresundskraft has set a target to become carbon neutral in 2030, however, the company currently lacks structures to integrate climate impact into decision-making and as well as structures for progress tracking of total emissions. (Sundberg and Hermansson, 2022)

Interviews with employees, and public statements from Öresundskraft, which will be further explored in this report, show that the problem is not a lack of ambition. Neither is it a complete absence of initiatives to reduce

emissions. There are several examples of how Öresundskraft has made strategic choices to prioritize climate action.

However, there is currently a lack of alignment within the organization regarding when, where and to what cost climate benefits should be prioritized. As of now, prioritization of emission reductions is generally made ad-hoc, driven by individual employees' engagement and demand from customers. Besides this, Öresundskraft does not currently calculate and track total emissions on an organizational level. (Sundberg and Hermansson, 2022)

1.3 Purpose

This thesis aims to identify different carbon management tools and analyze them from the perspective of their relevance for an energy company. Both tools for investment decision-making and progress tracking will be assessed. Additionally, this thesis aims to describe different aspects of implementation of carbon management tools within companies.

1.4 Research Questions

The investigated research questions are:

- What is a suitable tool for energy companies to use for integration of climate impact into decision making?
- What is a suitable tool for energy companies to use for progress tracking of total carbon emissions?
- What are important aspects to consider when implementing these tools?

To answer the research questions and fulfill the purpose of this thesis the company Öresundskraft will be used as a case company. Therefore, the recommendations and conclusions will be customized in accordance with their processes and needs. However, the authors hope that the thesis also can serve as inspiration for other companies with similar objectives, and especially for other Swedish energy companies that share similar characteristics and operate under similar conditions as Öresundskraft.

1.5 Delimitations and focus

A delimitation of this thesis is that it does not investigate other initiatives, besides carbon management tools for investment decision-making and progress tracking, to lower carbon emissions. As an example, this thesis does not cover how companies' business models can be innovated to support reduction of emissions or how switching materials, contractors or using less energy can lead to lowered emissions. Neither does the thesis cover how daily operations are run to reduce emissions.

Another delimitation is the focus on Grow and Transform investments within Öresundskraft. As this thesis will explain further, Öresundskraft divides their investments into Grow, Transform and Run investments, where Grow and Transform investments follow the same investment process. This thesis aims to find an appropriate tool for decision-making that can be used for all these types of investments. However, focus is put on the Grow/Transform process. This is due to time constraints. Insights into the Run investments were gained late in the process.

Besides this, one delimitation relates to the effect of introducing carbon management tools, where the thesis focuses on how emissions can be reduced. There might be other positive aspects of introducing carbon management tools, such as strengthening the company brand or attracting new talents through being an innovative company. There might also be potential negative aspects not covered in this thesis.

Another consideration is the economic effects of introducing a carbon management tool, which is briefly touched upon in this thesis through stating that it will have an effect. The effect generated is throughout this thesis generally described as negative, i.e., that introducing a tool will decrease profit. However, the exact effects and potential positive economic aspects are not discussed.

1.6 Target audience

The target audience of this thesis is management teams of organizations that are interested in how climate benefits can be considered in decision-making as well as how to track their companies' progress in reducing carbon emissions. Additionally, the thesis can provide inspiration and insights for researchers, students and other companies that are interested in sustainable governance.

1.7 Thesis outline

An overview of the thesis 7 chapters and a summary of each's content can be found in Table 1 below.

Table 1: An overview of the content of each chapter.

Chapter	Content
1. Introduction	Introducing the background for the thesis, the problem description, purpose, and research questions. The chapter also includes focus and delimitations, target audience and thesis outline.
2. Method	The research approach and process are described and motivated, as well as the data gathering and how tools were selected. Lastly the validity and reliability of the thesis are discussed.
3. Theory	Theory for the research area carbon accounting and carbon emission calculations is presented, as well as for change management.
4. Öresundskraft and the energy industry	Öresundskraft's company structure, strategy, sustainability work and decision-making processes are presented, as well as the trends and challenges in the context that Öresundskraft operates in: the Swedish energy industry.
5. Results	First, the five selected tools that will be evaluated to answer the first two research questions are presented. Second, the results from the interviews and from the workshop with employees are presented. This includes general input on the tools categorized in three ways: according to identified reoccurring themes, specific input for each tool and input regarding implementation.
6. Discussion	The findings are discussed to answer the research questions, and the thesis is reflected upon.
7. Conclusions	The research questions are answered, key-take aways are listed and contribution to the research area is described.

2 Method

This chapter starts with a description of the research approach which gives an overview of the development of the thesis and its findings. Then the literature study is described, followed by a presentation of how interviews and a workshop were conducted. This includes a description of how interviewees where selected. Finally, the validity and reliability of the thesis are discussed.

2.1 Research approach

Throughout this thesis Öresundskraft has been used as a case company to answer the research questions. To fulfill the purpose of the thesis and to answer its research questions a research approach with many similarities to an iterative design thinking approach has been used. Using a design thinking approach was not an intentional decision from the authors, but when describing the process in hindsight the authors' approach matches the design thinking approach. Therefore, the design thinking method will be used to describe the process of this thesis.

Design thinking can be described as a "process that facilitates the understanding and framing of problems, enables creative solutions, and may provide fresh perspectives on our physical and social landscapes" (Pressman 2018). Design thinking includes the following components:

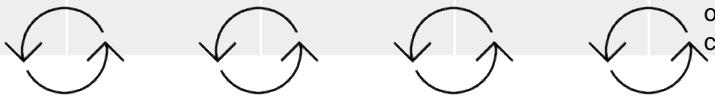
- Problem analysis and definition
- Information gathering
- Idea generation
- Synthesis through modelling
- Critical evaluation

(Pressman, 2018)

These components are interconnected and overlapping throughout a design thinking process (Pressman, 2018). For this thesis, this means that activities have been performed alongside one and other, looping back and forth. This was especially prominent for the last four steps. Activities within the approach include a literature review, interviews, a workshop, and prototyping of tools, which have been further illustrated in Table 2.

Table 2: Research Approach

Problem analysis and definition	Information gathering	Idea generation	Synthesis through modelling	Critical Evaluation
• Advert • Problem further defined from initial interviews • Creation of research questions	• Literature study • Internal interviews with employees • External interviews about e.g. climate accounting • Workshop	• Identify needs and wants within the company • List potential tools from literature and modify • Modification of tools found in literature to fit the identified tools.	• Selection of tools to investigate more thoroughly • Receive feedback on tools from workshop and further interviews • Further iteration to improve tools	• Identify pros and cons of tools based on literature and input from employees • Present tools in workshop • Analyze how tools fit into the current capabilities of the company



2.1.1 **Problem analysis and definition**

The starting point for this thesis was that Öresundskraft identified a problem: The company lacked structured ways to weigh profit against climate benefits within decision-making, and ways to track performance of carbon emissions over time. Through meetings with employees at Öresundskraft the problem was further described and defined, which is summarized in the problem description of this thesis.

2.1.2 **Information gathering**

The literature study, idea generation, synthesis through modelling and critical evaluation was done side by side through an iterative process.

The aim of information gathering is to further understand both the problem and potential solutions (Pressman, 2018). For this thesis that included understanding three main areas better: Carbon accounting, Change management and Öresundskraft as a company. This information was gained through literature studies, internal and external interviews, and an internal workshop with employees at Öresundskraft, which all are further described in their own sections below.

2.1.3 **Idea generation**

The literature study, idea generation, synthesis through modelling and critical evaluation was done side by side through an iterative process.

All ideas of different tools are either taken directly from or inspired by the literature on carbon management tools. The tools that are directly taken from literature, without modifications, are 1) Internal Carbon Price – Shadow 2) Internal Carbon Price – Fee and 3) Carbon Intensity Ratio. Tools that were modified by the authors to fit the needs of Öresundskraft are 4) Checklist and 5) Carbon Intensity Ratio Scale. These tools and the idea generation and modification of 4) and 5) are further explained in section 5. Results
.

2.1.4 Synthesis through modelling

The literature study, idea generation, synthesis through modelling and critical evaluation were done side by side through an iterative process.

According to Pressman (2018), synthesis through modelling includes to "take the best ideas to a higher degree of resolution and detail, resulting in several alternative prototypes, models, or draft solutions". The best potential tools were selected by critical evaluation using results from the literature study and interviews, and then presented at the workshop, where employees at Öresundskraft got the opportunity to give feedback on the prototypes of tools.

2.1.5 **Critical evaluation**

The literature study, idea generation, synthesis through modelling and critical evaluation were done side by side through an iterative process.

Critical evaluation of the tools was done by introducing them to employees at Öresundskraft through interviews and the workshop, as well as through comparison with literature. This resulted in the discarding of tools at different stages of the process, identifying the strengths and limitations with the different tools and eventually the final recommendations presented in the thesis.

2.1.6 **Improvements of research approach**

To fully use the design-thinking approach a bigger focus should have been laid on the idea generation and synthesis through modeling steps. Design-thinking methodologies could have been used to generate and modify ideas. As will be described below, in section 2.4 Compilation of Carbon Management Tools, the need of modifying and developing tools came from the lack of existing tools in the literature. If this would have been foreseen the design-thinking approach could have been used to its fullest capacity, where additional time could have been spent on generating ideas.

It would also have been possible to take a different research approach, and earlier in the process choose to focus on one of two tools, and improve and adapt them more in detail for Öresundskraft's context and needs. This could have been enabled by excluding either the first or the second research question.

2.2 Literature study

To gain knowledge about different aspects of carbon accounting, carbon management tools and aspects of implementation of these tools a literature study was done. Information on carbon accounting included different carbon emission calculation methods and standards, the development of the research field. The literature study on carbon accounting also led to the identification of different carbon management tools. The literature review of implementation of these tools primarily focused on change management.

Within change management the primary focus was success and failure factors for changes within companies. Besides this a brief literature review on design thinking was done to describe the process of this thesis.

The search engines used for the literature study were LUB-search, Lund University internal search engine, and Google Scholar. Search words included carbon accounting, carbon management, carbon emission tool, carbon intensity ratio, normalized environmental impact data, internal carbon price, carbon emission index, carbon disclosure, internal carbon price, qualitative carbon accounting, and carbon management implementation for carbon accounting related research. For implementation, search words included change management, change fatigue, change management factors, change management process and design-thinking.

The selection of theory and models to include in the thesis was made based on different criteria. More recent published literature was preferred, especially related to carbon accounting as it is a research area that is in a developing stage. Research that was industry specific for industries considered very different from the energy industry, or markets very different from the Swedish, was often not included.

Besides using search engines dedicated to articles and research, the search engine Google was used. This primarily when looking for information on regulations, Öresundskraft, carbon accounting reporting standards or other specific subjects. Additional sources of information were handed to the authors by employees at Öresundskraft. These include internal sources about company structure and processes, and the consulting company Profu's guide for climate accounting.

2.3 Interviews

Both internal interviews, with employees at Öresundskraft, and external interviews was held throughout October to December of 2022. All interviews were held in a semi-structured way. Interview guides were developed before each interview, but where the conversation was allowed to take new turns if deemed relevant and time limits sometimes resulted in not all questions being asked. All interview guides can be found in the Appendix A and B. Besides the interviews the authors had check-ins with their supervisor, Anna

Sundberg, at the company and attended a monthly meeting for the Offering and Development department, which was held 19th of December 2022.

During the interviews both authors were taking notes. These notes have been used to compile the material and references found in this thesis. Some interviews resulted in a large amount of material to use in this thesis and other interviews served more as inspiration and indications of directions which contributed indirectly. All interviewees were given a chance to read through the material from their interview included in this thesis. However, most interviewees did not request to see their references and have therefore not done so. It should also be stated that this option was given only a few days before the finalization of the thesis, which is not optimal.

2.3.1 **Internal interviews**

Several internal interviews within Öresundskraft were held to gain a larger understanding about the company. For the internal interviews the authors supervisor at Öresundskraft, Anna Sundberg, assisted in finding a suitable interviewee for each area of interest.

Early on a need to further understand the company's current knowledge, resources, and actions towards sustainability was identified. The authors found it especially important to understand to what degree the company calculate carbon emissions as this is the foundation of many carbon management tools, which will be further explained in section 5.2 Results . The company only have one full-time employee, Cecilia Andersson, solely dedicated to working with sustainability and therefore she was interviewed.

Another need that was identified early was to understand Öresundskraft's investment decision-making process, as this is where one of the carbon management tools would be integrated. For this Niklas Kylvåg was recommended. This as he works closely with investments and have adjusted the decision-making process before. Through the interview with Kylvåg it was made clear that the company divides its investments into the three categories Grow, Transform and Run. Kylvåg only works with Grow and Transform investments, which motivated another interview with someone responsible for Run Investments.

It was difficult to find a person working with Run Investments that had time to participate in an interview and several people was contacted. The Run Investment interview was therefore delayed and held late in the process. This resulted in the thesis having a less developed view and discussion about how carbon management tools could be integrated for the process of Run investments. Gustav Enoksson who was interviewed about Run investments worked closely with these and was knowledgeable within the area.

Besides this, interviews about the company's strategy, business innovation and financial management were held. The interview about strategy is motivated as the strategy to a high degree focuses on sustainability, which we early on understood through conversations with employees. This interview was held with Patrik Hermansson who is a part of the management team and therefore works closely with the company's strategy. Hermansson is also the department head of Offering and Development at Öresundskraft, which is the department that this thesis is written for.

The interview about business innovation was motivated through an interest in how strategy could be put into motion through innovations, which could lead to investments. For this the head of Business and Innovation, Jessica Hård, was interviewed.

The financial management interview was motivated by carbon management tools being a type of steering. How Öresundskraft uses financial metrics to steer the company could therefore be used as inspiration for how they could steer using climate metrics. For this interview the financial manager, Charlotta Mühlow, was interviewed.

As mentioned above, it was difficult to find a person to interview regarding Run investments, but besides that there were no other difficulties in finding appropriate people to interview about the areas of interest. A summary of all interviews can be seen in Table 3 on the next page.

Table 3. Internal interviews

Interviewee	Role	Date	Topic
Charlotta Mühlow	Financial manager, Öresundskraft	17 Oct 2022	Organizational structure and financial management
Cecilia Andersson	Sustainability strategist, Öresundskraft	18 Oct 2022	EU-taxonomy and sustainability work
Niklas Kylvåg	PMO Portfolio manager, Öresundskraft	19 Oct 2022	Grow/ Transform investments
Patrik Hermansson	Director of Strategy and Innovation, Öresundskraft	26 Oct 2022	Strategy and financial management
Jessica Hård	Head of Business and Innovation	31 Oct 2022	Business Innovation
Gustav Enoksson	Department head of Network Planning	6 Dec 2022	Run investments

2.3.2 **External interviews**

In addition to the internal interviews, external interviews were held. These interviews covered different topics related to the research questions of this thesis to give an outside perspective.

During the interview with the financial manager, the owner perspective of Öresundskraft was raised as an important aspect. The owner, Helsingborg Stad, has both financial and sustainability targets for Öresundskraft and this motivated the interview with an environmental strategist, who has worked with Öresundskraft regarding sustainability before.

During the workshop, described in section 2.5, a need to further understand resources needed for carbon calculations was identified.
This motivated the interviews with the two carbon calculation consultants Jenny Westerberg, Profu, and Kristin Johansson, IVL. When mentioning the idea of a price on carbon, the company supervisor brought up that the company Wihlborgs had implemented an internal carbon price. After that, the company was contacted and the person initiating their implementation of an internal carbon price, Staffan Fredlund, was interviewed.

The authors academic supervisor Lars Bengtsson reached out to the authors about a seminar about Business management for sustainable development - from external legitimacy to internal relevance that he had come across. The authors found the seminar of interest since it is an adjacent subject to this thesis and therefore attended. Matti Skoog, the professor who held the seminar, was thereafter interviewed separately to provide more insights to this thesis.

Table 4: External interviews

Interviewee	Role and organization	Date	Topic
	Environmental strategist, Helsingborg Stad	2 Nov 2022	Helsingborg Stad's sustainability work
Jenny Westerberg	Consultant within energy systems and sustainability, Profu	16 Nov 2022	Climate accounting for energy companies
Kristin Johansson	Consultant within LCA, IVL	24 Nov 2022	Climate accounting
Staffan Fredlund	Sustainability strategist, Wihlborg	16 Nov 2022	Implementation of ICP
Matti Skoog (Seminary)	Professor in accounting and governance, Åbo Akademi	17 Nov 2022	Business management for sustainable development - from external legitimacy to internal relevance
Matti Skoog (Interview)		18 Nov 2022	Carbon management tools and corporate sustainability work

2.4 Compilation of Carbon Management Tools

2.4.1 **Carbon management tools found in literature**

Through the literature study different carbon management tools were found. These tools suitability for Öresundskraft was evaluated and some tools were ruled out in this early stage. Some tools were, based on the input from interviews, considered too complex for Öresundskraft, for example complex versions of internal carbon price, and therefore ruled out. Other tools were ruled out due to them being designed for external use, such as environmental assessment of companies for portfolio investments, which is not within this thesis purpose and research questions.

The tools described in this thesis are deemed the most relevant for Öresundskraft. These are described in section 5. Results
and are the following:

1) Internal Carbon Price – Shadow
2) Internal Carbon Price – Fee
3) Carbon Intensity Ratio

One challenge with the literature study was finding tools that could be used for internal investment decisions. The field of Carbon Accounting is a new field with limitations in regard to current research (He et al., 2021). This motivated a process of modifying and designing new tools.

2.4.2 **Carbon management tools modified by the authors**

The process of modifying tools to fit the needs of Öresundskraft was done alongside the literature study. It was an iterative process where research of tools was combined with needs expressed from Öresundskraft.
To understand this further background about carbon accounting and carbon management tools is needed. Therefore, the process of modifying these tools will be further explained in section 5. Results
. There it will be described how, for instance, literature and interviews, which are part of the information gathering step of the design-thinking process, led to idea generation and synthesis through modeling.

Two tools have been modified and designed through this thesis. These are described in section 5. Results
and are the following:

1) Checklist
2) Carbon Intensity Ratio Scale

2.5 Workshop

To gather input on the five selected tools, mentioned above in 2.4 Compilation of Carbon Management Tools and further explained in section 5. Results
, a workshop was held. Three employees at Öresundskraft participated in the workshop: Cecilia Andersson (Sustainability Strategist), Niklas Kylvåg (Portfolio Manager) and Charlotta Mühlow (Financial Manger).

The main purpose of the workshop was the fifth step in the design-thinking process, the critical evaluation. The employees were encouraged to discuss advantages and disadvantages of the different tools and evaluate their fit for Öresundskraft. However, the workshop also contributed to other steps in the design-thinking process, such as the information gathering .

The five tools presented will be further explained in section 5. Results
. The presentation material for the workshop can be found in Appendix C.

The workshop was held on the 7th of November 2022 and started with a 30-minute presentation where the authors of this thesis presented the five selected tools. The participants asked questions during the presentation, which provided some initial input on each tool. After the presentation, a structured discussion was held. First, the overarching goals and motivations of implementing a tool was discussed, followed by a discussion of pros and cons of respective tool to identify which ones that was perceived as most suitable for the company. Lastly, expected reactions from the organization of implementing a new tool were discussed. The literature on change management in this thesis was however not discussed during the workshop.

In general, the employees agreed with one another. When differing views were presented these were discussed. During the workshop the authors took turns in taking notes, and afterwards the input gathered was analyzed to find patterns and differences together with the material from interviews. The result from this is presented in section 5.2. Interviews and workshop at Öresundskraft.

As with the interviews, the people attending the workshop has been given the opportunity to read through the material presented in this thesis, but it was given late which resulted in the material not being looked through.

2.6 Validity and reliability

Validity in research is about the relevance of the data gathered for the objectives of the research and how well the gathered data is a correct representation of the phenomena studied. To ensure validity, measures must be taken both in the data gathering process and in the processing of the data. (Mälardalens universitet, 2022b)

For this thesis, measures for validity for interviews include carefully structured interview guides, with both open questions that are not leading the interviewee on, but also closed follow-up questions that to allow for exact information when needed. During the interview both authors took notes, and then these were then compared and complied. The validity could have been increased by asking the interviewees earlier if they wanted to review their contributions.

Regarding the relevance of theory, models, and other empirical material several sources were used to define important areas, and by iteratively evaluating the gathered data.

For quantitative studies, reliability is about choosing a method that will give similar results if the study was repeated. However, for qualitative studies, like this one, reliability cannot be ensured using numerical methods. (Mälardalens universitet, 2022a) Instead, this thesis addressed reliability by clearly explaining how data has been gathered and analysed.

3 Theory

The theory chapter of this thesis will cover the research field of carbon accounting, which this thesis is a part of. Two sub-areas of carbon accounting, being carbon disclosure and carbon management, are especially important to answer this thesis research questions. Therefore, these areas will be further explained. This chapter will also go into the area of carbon emission calculations, which many of the carbon management tools in this thesis rely upon.

Finally, this section will highlight different success and failure factors of change management that will contribute to the discussion of implementation of carbon management tools. Here, the choice using Kotter's eight step model for organizational change was made as it is considered a fundamental model for describing change.

Figure 2: Outline of Chapter 3

3.1 Carbon Accounting

This thesis is a part of the research field of Carbon Accounting, which the following section will cover. The field's four sub-areas will be explained, as well as the development of the research field.

The research field of carbon accounting emerged as an outcome of the Kyoto Protocol and the EU ETS. The field covers calculations of carbon emissions, deciding on relevant system boundaries for these, disclosure standards, how emission calculations can be used for management and steering of companies as well as other carbon emission related aspects. (He et al., 2021)

3.1.1 **Areas included in carbon accounting research**

Carbon Accounting can be divided into four sub-areas 1) Carbon Disclosure, 2) Carbon Assurance, 3) Carbon Management and 4) Carbon Performance, as illustrated in Figure 3.

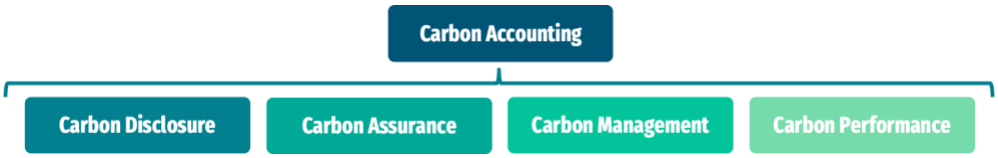


Figure 3: Areas within carbon accounting research (He et al., 2021).

Carbon Disclosure is the process where companies disclose information related to combating climate change, e.g., corporate sustainability efforts in annual or sustainability reports or through reporting GHG emissions to government agencies or CDP. (He et al., 2021)

Carbon Assurance is the process of auditing GHG statements. This is an emerging practice to assure that companies disclosed data is correct. (He et al., 2021)

Carbon Management involves practices companies undertake to mitigate its operational GHG emissions. Sometimes the term Carbon Management is also more widely used to refer to all carbon-related issues of companies. (He et al., 2021)

Carbon Performance refers to the performance of companies regarding managing and controlling carbon emissions. Research within this field includes information about the complexity of measuring carbon emissions and the factors that affect a firm's carbon performance. (He et al., 2021)

3.1.2 **Development of the research field**

The main driving-force of carbon accounting research is the increased awareness of climate change and the adoption of carbon accounting methods within companies. The field has previously been a part of other research areas, such as CSR or environmental studies, but have recently evolved into its own distinct research field. Publications on carbon accounting have

increased during the past two decades and have been evolving from conceptual to empirical. Empirical studies started gaining traction in 2012 and quantitative empirical studies have been increasing steadily since 2014. (He et al., 2021)

The field is still in the formative stage of development with limitations, which opens for future research. One limitation is the lack of research about companies' actions against climate change (He et al., 2021). A literature study by Clarke and Marlow (2022) also identified the integration of carbon calculations into systems of companies as a gap in the field. The authors identify that decision-making, budgeting, reporting and disclosure procedures are not integrated enough (Clarke and Marlowe, 2022). This thesis aims to contributing to reducing that gap.

3.2 Carbon Disclosure

This section is about Carbon Disclosure, a sub-area of Carbon Accounting, the practice of reporting carbon emissions. The section will address driving forces of why companies report emissions, the Greenhouse Gas Protocol which is the most used reporting standard, the Carbon Disclosure Project and legal reporting requirements of carbon emissions.

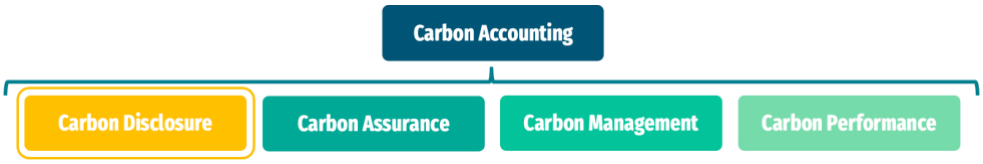


Figure 4: Areas within carbon accounting research, with Carbon Disclosure highlighted.

3.2.1 **Driving forces**

There are several reasons why companies measure and disclose their carbon emissions. These reasons can be categorized into social, market, economic, regulatory, and institutional pressure (He et al., 2021). An illustration of the relationship between these driving forces can be seen in Figure 5 below.

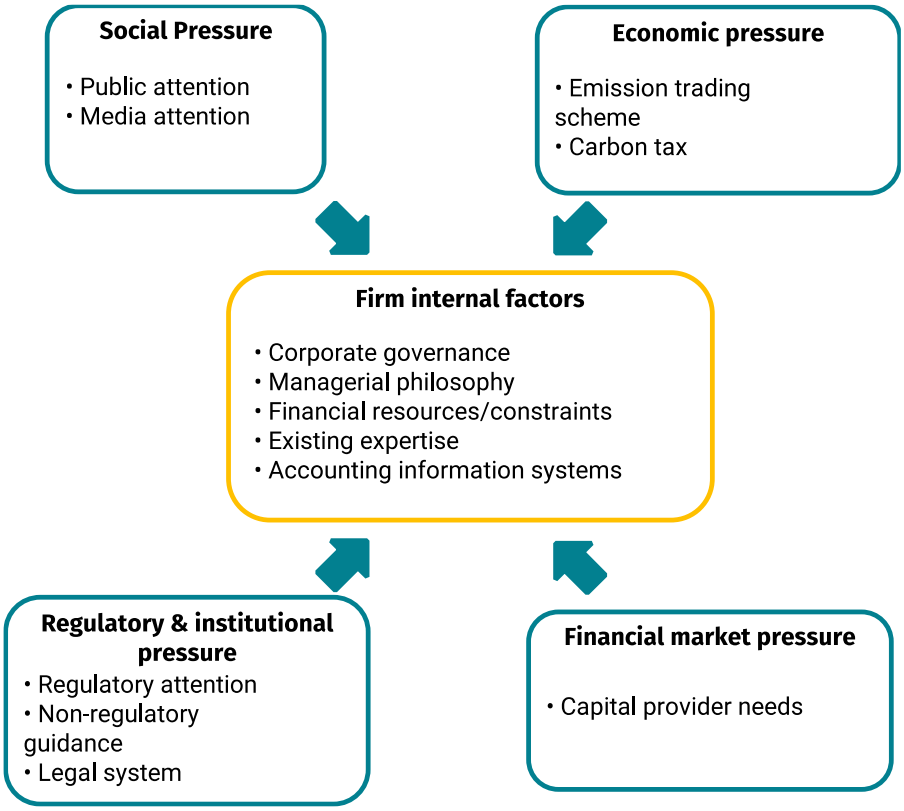


Figure 5: A framework of the determinants of corporate carbon disclosure. Modified figure from He et al., 2021.

3.2.1.1 Regulatory and institutional pressure

Laws and regulations drive companies to disclose their emissions. It has been shown that companies in carbon-intensive sectors, which are covered by higher regulatory pressure, also disclose their emissions to a higher degree than other companies. Studies from Australia, UK and USA also show that voluntary disclosure increases due to governmental or stock exchange regulations. Besides this, guidance from non-governmental organizations, such as CDP and GRI that will be covered later in this section, also increase the exhaustiveness of carbon disclosure. (He et al., 2021)

3.2.1.2 Economic pressure

One way that economic pressure can drive companies to measure and report their emissions is through internalized carbon-related costs from implemented climate policies. A firm's operating environment can also influence carbon disclosure. Firms in more concentrated markets, in markets

with more substitutability and in smaller markets are more likely to disclose their carbon emissions. (He et al., 2021)

3.2.1.3 Social pressure

Another factor is social pressure. Larger firms that attract more attention from the media and regulators are experiencing a higher degree of social pressure to disclose emissions. (He et al., 2021)

3.2.1.4 Financial market pressure

Investors play an important role in driving firms to disclose their emissions. This as they want to understand how their investments are exposed to climate risks and opportunities. (He et al., 2021)

3.2.1.5 Internal pressure

Internal factors also influence the extent of carbon disclosure of firms. Studies have found a link between overall quality of corporate governance and the extensiveness of carbon disclosure. Degree of profitability has also been identified to affect disclosure. Most research expects that firms with higher profitability also to a higher extent disclose emissions, this since they would have resources to do so. However, many studies also find no such correlation. Additionally, firms that already have an environmental management system is more likely to disclose carbon emissions. Besides these factors, managers' attitudes towards sustainability also affects the likelihood of disclosure. (He et al., 2021)

3.2.2 **Greenhouse Gas Protocol**

There are several guidelines and standards covering disclosure of emissions. This section will cover the most used standard, the Greenhouse Gas Protocol (GHG, 2022). Other examples of commonly used standards, that are not covered in this thesis, are ISO-standard 14064 and Global Reporting Initiative (GRI). (Naturvårdsverket, 2022c; GRI, 2016)

The Greenhouse Gas Protocol or GHG Protocol Initiative is a multi-stakeholder partnership of businesses, non-governmental organizations (NGOs) and governments gathered by WRI, the World Resources Institute which is a U.S. based environmental NGO, and WBCSD, the World Business for Sustainable Development which is a Geneva-based coalition of 170 international companies. (WBCSD and WRI, 2004)

The initiative has compiled two closely linked standards, both based on the Kyoto protocol (WBCSD and WRI, 2004; Naturvårdsverket, 2022c). One standard is focusing on companies disclosure of emissions and the other is focusing on quantifying carbon reductions from GHG mitigation project. (WBCSD and WRI, 2004). These standards are the most used for measuring and reporting greenhouse gas emissions. The high usage of the GHG Protocol is partly due to stakeholder outreach by WRI and WBCSD during each standard development project. (GHG, 2022)

3.2.2.1 Scopes

The GHG Protocol Corporate Standard, the standard focusing on company disclosure, divides emissions into four categories, seen below and illustrated in Figure 6: Scopes for classification of emissions.

1) **Scope 1**: Includes direct emissions from the organization itself, e.g. fuel combustion from vehicles, boilers and furnaces, emissions from chemical production. Includes emissions from owned or controlled equipment. (WBCSD and WRI, 2004)
2) **Scope 2**: Includes indirect emissions from bought electricity, steam, heat and cold. (Naturvårdsverket, 2022c)
3) **Scope 3**: Includes other indirect emissions, e.g. from bought materials, product usage and business trips. (Naturvårdsverket, 2022c)
4) **Avoided emissions**: Emissions can be avoided on a system level by using an alternative, more environmentally friendly, method, e.g. for energy production. (Profu, 2017)

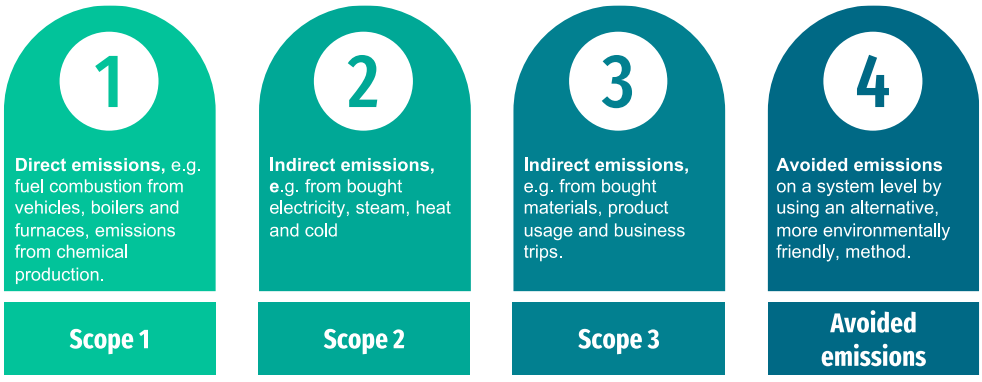


Figure 6: Scopes for classification of emissions

The usage of scopes helps separate between direct and indirect emissions, improve transparency, and provide usage for different types of organizations with different goals. Scope 1 and 2 are carefully defined to ensure that no more than one company account for the same emissions and to ensure that no double counting takes place (WBCSD and WRI, 2004). According to the GHG Protocol it is not mandatory to report avoided emissions, but when it is reported it should be done so separately (Profu, 2017).

Avoided emissions are of high importance for energy companies and will therefore be further explained in section 3.4.3.1 Avoided emissions. Research made in 2014 shows that 58% of the 377 companies asked are calculating avoided emissions, 35% are not, but would be interested if a methodology was available and 7% were not interested in calculating avoided emissions. (Profu, 2017)

3.2.3 **CDP – Carbon Disclosure Project**

CDP, Carbon Disclosure Project, is a non-profit organization that runs the world's largest global environmental disclosure system where companies, cities, states, and regions can report and track their environmental footprint. The organization has over 18,700 companies and 1,100 cities, states and regions reporting through their system (CDP, 2022). In 2016, 92% of Fortune 400 companies reporting their emissions to CDP used the GHG Protocol directly or indirectly (GHG, 2022).

3.2.4 **Legal Reporting Requirements**

3.2.4.1 Non-Financial Reporting Directive

The EU directive Non-Financial Reporting Directive (NFRD) requires companies which are of general interest to the public and that have more than 500 employees to compile sustainability reports. Additionally, there are other factors connected with the size of the company that can make it required to compile a report. The sustainability report should contain information about sustainability aspects needed to understand a company's results, development and consequences of its operations. (Finansinspektionen, 2022)

3.2.4.2 Corporate Sustainability Reporting Directive

The European Parliament and Council have decided on a preliminary political agreement regarding a new directive about companies'

sustainability reporting, the Corporate Sustainability Reporting Directive (CSRD). This directive is an expansion of the NFRD, with more demanding requirements. The directive will apply to all large and listed companies in the EU and begin to apply through national law by the 1st of January 2024. (Finansinspektionen, 2022)

In accordance with CSRD, companies' sustainability reports must be included within their annual report and follow more detailed reporting requirements in line with EU standards (Finansinspektionen, 2022). Which scopes companies like Öresundskraft will be required to report is not yet decided, but current proposal is Scope 1, 2 and 3 emissions from an accounting perspective. There is however no requirement to report avoided emissions (Andersson, 2022).

3.3 Carbon Management

*This section will briefly describe theory on Carbon Management, a sub-area of Carbon Accounting. However, all carbon management tools will be described in its own section, 5. Results
, in this thesis. Different firms use different carbon tools with the aim to reduce emissions, this section will cover a categorization of those tools.*

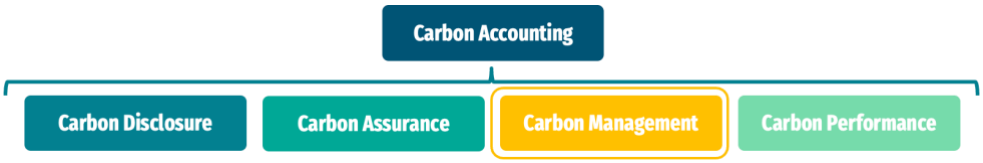


Figure 7: Areas within carbon accounting research, with Carbon Management highlighted.

Studies have shown that implementing carbon tools can have a positive impact on carbon performance and therefore limiting emissions. However, different firms use different carbon accounting techniques for managing their carbon footprint and with different underlying goals from management. As example companies might want to measure carbon emissions, evaluate performance, implement carbon strategies, perform green investments, manage risks, and control carbon costs. For these different goals different tools are needed. (He *et al.*, 2021)

3.3.1 **Dimensions of carbon management tools**

According to Csutora and Schaltegger (2012), different kinds of carbon management accounting be characterized using the dimensions:

- Monetary (costs or revenue from carbon related activities) or physical (carbon footprint calculations and carbon budgeting)
- Short term or long term oriented
- Past oriented or future oriented
- Based on routinely generated information or on ad hoc information.

Csutora and Schaltegger (2012) use these dimensions in a framework to distinguish between carbon management accounting practices, where some are used in decision making situations and some for different corporate contexts. The framework, which gives an overview of the of different carbon management activities, can be found in their report Carbon accounting for sustainability and management. Status quo and challenges.

3.4 Carbon Calculations

This section aims to give an introduction regarding methodologies and challenges of carbon emission calculations. Two different perspectives, the accounting and consequence perspective, will be explained. The choice of which perspective to use for carbon calculations will to a high extent change the results and is therefore of highest importance. Within the section about the consequence perspective the importance of avoided emissions and using a long-term system view will be described. Carbon calculations are important for all four areas of Carbon Accounting.

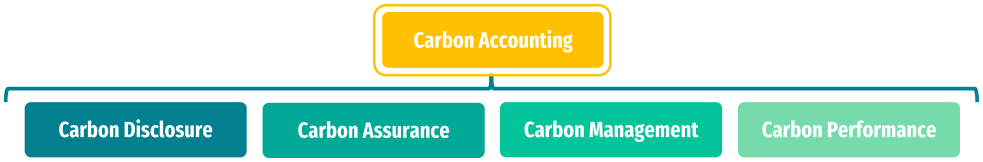


Figure 8: Carbon accounting calculations is an important aspect for all areas of carbon accounting.

The process of measuring GHG emissions is complex and to a high extent based on estimations. Therefore, the reliability and comparability of measurement is often questionable when different methods are being used. Besides this, there are issues regarding boundaries, scope and aggregate basis which affect the amount of emissions. (He *et al.*, 2021)

There are several methodologies for calculating carbon emissions. Two examples of methodologies are calculating combustion emissions and Life Cycle Analysis (LCA). Combustion emission calculations gives a focused view of GHG emissions that can be used within the EU emission trading system (ECO2) or within environmental reports. The method does not take the life cycle perspective into account, whereas LCA focuses on the entire life cycle and the cradle-to-grave perspective. (Naturvårdsverket, 2022b, 2022a) These two methodologies will not be covered more thoroughly in this thesis, however there are many connections between these and the focus point of this section, which is the accounting and consequence perspective.

3.4.1 **Different perspectives of carbon emission calculations**

The Swedish consultancy firm Profu created a report to guide energy companies with carbon emission calculations and creating climate accounting statements. Öresundskraft is one of 38 energy companies that were collaboration partners with Profu in creating the report. (Profu, n.d.) The climate accounting statement suggested by Profu is aligned with the GHG Protocol. (Profu, 2017)

Before creating a climate accounting statement, the reporting organization must decide what and how they should report their emissions. Assumptions regarding system boundaries and principles to use for calculations will influence the final output. Therefore, it is important for the reporting organization to consider what assumptions should be made. (Profu, 2017)

According to Profu (2017), climate accounting can be divided into three different principles for carbon emission calculations:

1) The accounting perspective
2) The consequence perspective – Reporting
3) The consequence perspective – Decision making

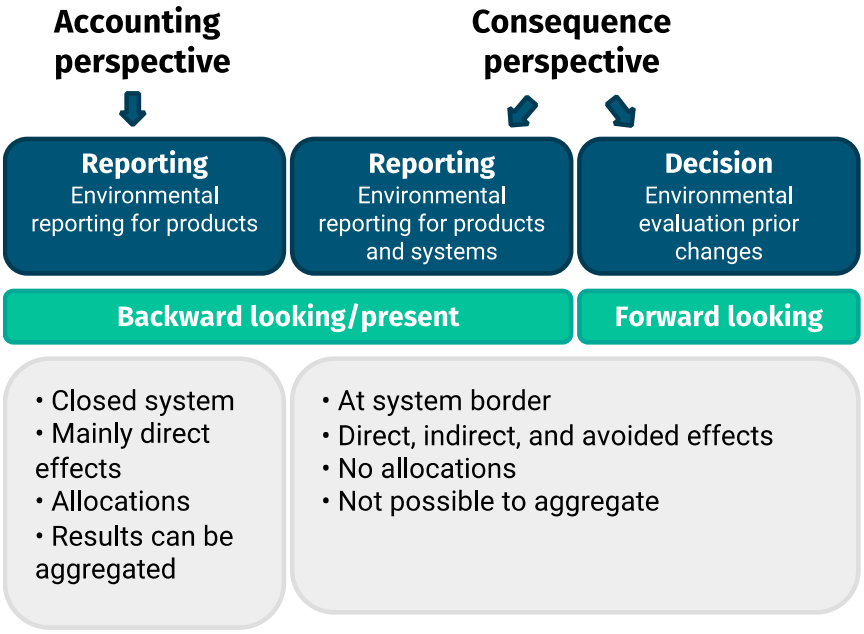


Figure 9: Overview of the different principles for carbon emission calculations. Modified version of figure from Profu (2017).

As seen in the figure on the last page the different principles target different time aspects, have different system boundaries, and the output can therefore be used for different purposes, disclosure or decision-making. A selection of purposes together with recommended principle can be seen in Figure 10 below.

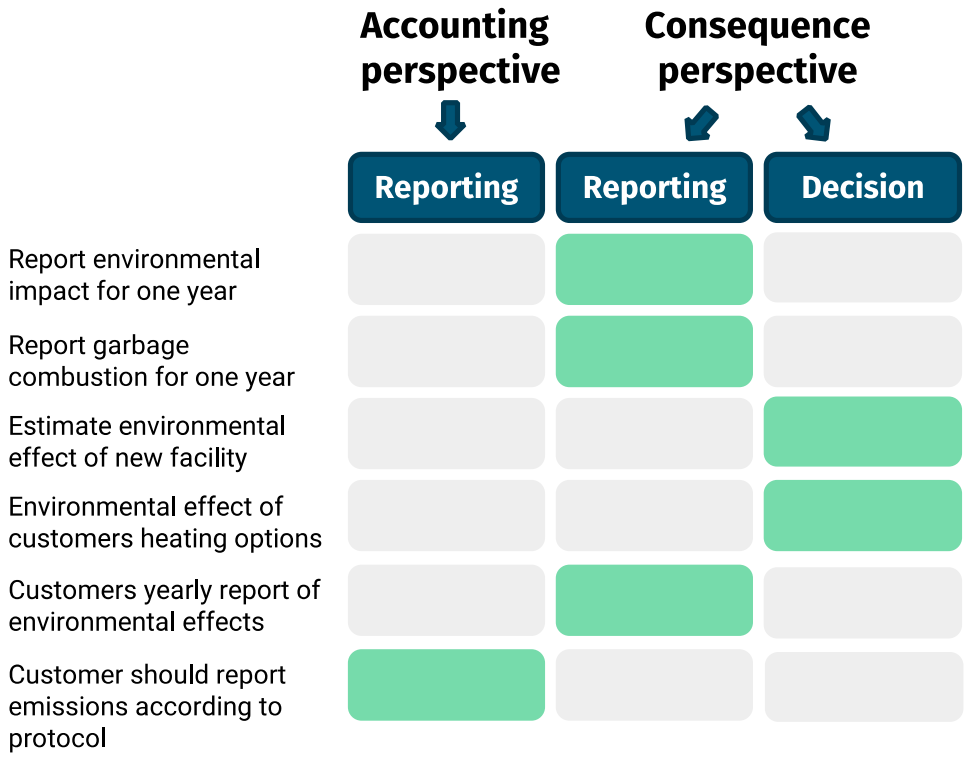


Figure 10: Recommended perspective to use for different areas. Modified version of figure from Profu (2017).

The most important differentiator between the principles is the assumptions made regarding system boundaries, where the consequence perspective has a wider view including emissions avoided from the company's products and services (Profu, 2017), which is illustrated in Figure 11.

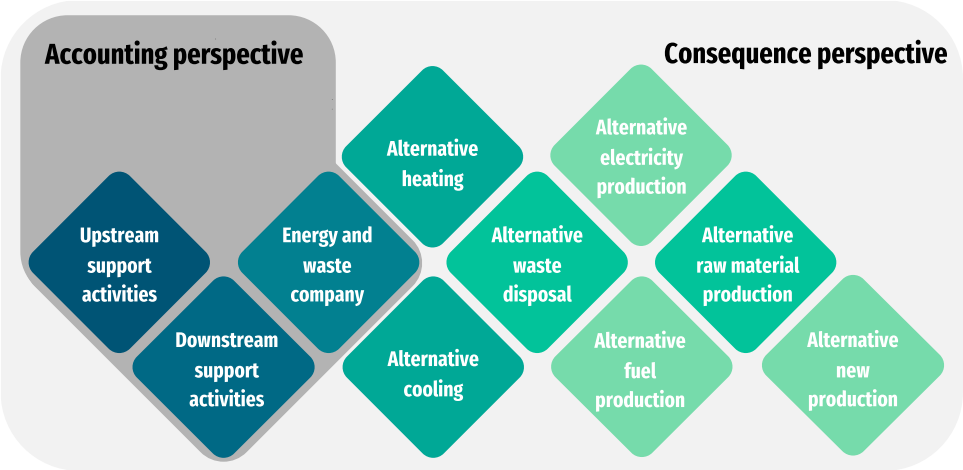


Figure 11: Activities included in accounting perspective and consequece perspective. All activites in the accounting perspective are also included in the consequnce perspective. Modified figure from Profu (2017).

A recommendation for the reader of this thesis is go back to Figure 10 and Figure 11 after having read more detailed explanations of the two perspectives.

3.4.2 **Accounting perspective**

The accounting perspective summarizes the company's direct (Scope 1) and indirect (Scope 2 and 3) added emissions, but exclude avoided emissions, i.e. how the company's products and services affect its environment. The perspective is, as an example, used by the association for Swedish energy companies Swedenergy (Energiföretagen Sverige) when they report environmental data for district heating each year. (Profu, 2017)

The accounting principle can be used when:

- The company's emissions are a part of a broader context and parts are to be summarized
- The emissions are to be compared to other companies using the same principle
- Distributing emissions between organizations

(Profu, 2017)

Using the accounting perspective for either assessing the energy companies' total climate effects or as a tool for decision making will often lead to misguiding conclusions. (Profu, 2017)

3.4.3 **Consequence principle**

The consequence principle can be used to describe a company's total climate effect on a societal level. The principle summarizes the company's direct (Scope 1) and indirect (Scope 2 and 3) added, and avoided emissions, i.e. how the company's products and services affect its environment. The method takes into consideration that the company produces goods that are in demand in society and thus also considers how these goods would have been produced if the company were to close its activities. Sometimes the principle is referred to as an "expanded climate accounting statement", as it is more extensive. (Profu, 2017)

With the consequence principle a company can:

- Study the company's total contribution to climate effects
- Evaluate different business areas' performance in terms of climate effect
- Analyze climate effects from changes
- Measure and track the effect of changes made

(Profu, 2017)

The consequence perspective is divided into two principles:

1) The consequence perspective – Reporting
2) The consequence perspective – Decision making

The first method is used for reporting that looks on historical data and the second method is used in situations of decision making of different alternatives that estimates the future emissions. (Profu, 2017)

As earlier mentioned the most important differentiator between the consequence perspective and the accounting perspective is the assumptions made regarding system boundaries, where the consequence perspective has a wider view including emissions avoided (Profu, 2017). Therefore, this aspect will be described through more deeply, with the elaboration of mean and marginal values, below. The section will also cover the aspect of taking

the long-term full system into account for decision-making calculations. (Profu, 2017).

3.4.3.1 Avoided emissions

Reporting avoided emissions does not always make a significant difference for companies, but for energy companies it is often these emissions that make up the largest contribution to climate impact. This as emissions can be avoided by using more environmentally friendly alternatives of production. An example is using district heating instead of individual heating. (Profu, 2017)

Therefore, it is important for energy companies to calculate avoided emissions when evaluating investments and changes from a net climate effect perspective. If there are doubts about what the alternative production is or how it should be calculated, the reporting organization could choose what gives a disadvantage to their own company to not be accused of green washing. (Profu, 2017)

3.4.3.2 Mean or marginal values

When calculating avoided emissions it is important to think through if mean or marginal values should be used, where the value that most accurately shows the alternative emissions should be used. (Profu, 2017)

Taking the electricity production as an example, the Swedish electricity market is integrated with the European market. Therefore, increased renewable production in Sweden can replace fossil fueled electricity production in Europe. At the same time, more variable production can lead to that Sweden import electricity produced with fossil fuels (Energiföretagen, 2021). Due to this, the marginal production of the European mix should be used for emission calculations (Profu, 2017).

However, another example is district heating, where introducing district heating replaces individual heating. This is not a marginal impact, since the whole system is switched out, and therefore mean values should be used for these calculations. (Profu, 2017)

3.4.3.3 Long-term system level

Additionally, when using the consequence principle for decision-making it is important to view the full system over its full lifetime, i.e. the time that the decision will affect the system. For example, when calculating the emissions

generated from building a new biofuel-fired heat and power plant one should consider the future development of the electricity system over its whole lifetime. With that aspect in mind, one can assume that climate ambitions in society will increase and the alternative electricity production alongside. Considering that, the climate benefit of the biofuel-fired heat and power plant will most likely decrease. This must be considered when deciding on the investment (Profu, 2017).

It is often difficult to foresee and estimate changes within the energy market, e.g. the increase in emissions caused by increased electricity demand or the reduction of emissions by increased renewables production (Öresundskraft AB, 2020). Profu has done model analyses over expected system changes that can be useful for taking these considerations into account when making calculations (Profu, 2017).

3.5 Change Management

This section will describe Change Management, which is the practice of controlling change within companies, which will be of importance for the implementation of carbon management tools. Kotter's eight step process of managing change will be reviewed alongside with success and failure aspects of change.

The term Change Management has become established for the special management techniques needed to control change processes. In contrast to strategic corporate management, that tries to find the optimal adaptation to the environment, change management is a primarily inward directed task. Where the optimal inward solution seeks to be found. (Lauer, 2021)

3.5.1 **Kotter's eight step model for organizational change**

For companies to survive, long-term changes and innovations must take place. Leading a company through changes is a challenging task, where resistance often arises from the people that the change will affect. Kotter's eight step model for organizational change was first published in 1995 and is still a guiding model for change management. (Harvard Business Review, 2007)

According to Kotter's eight step model, organizations go through a series of phases when implementing change. Failures in each step can have devastating impact in terms of slowing momentum and negating hard-won gains. Additionally, the process of going through these steps takes time and there are often no quick fixes. Skipping steps might seem efficient, but only creates the illusion of doing so as it never produces satisfying results. (Kotter, 1995)

Kotter's eight steps to transforming your organization is:

1) Establishing a sense of urgency
2) Forming a powerful guiding coalition
3) Creating a vision
4) Communicating the vision
5) Empowering others to act on the vision
6) Planning for and creating short-term wins
7) Consolidating improvements and producing still more change
8) Institutionalizing new approaches

(Kotter, 1995)

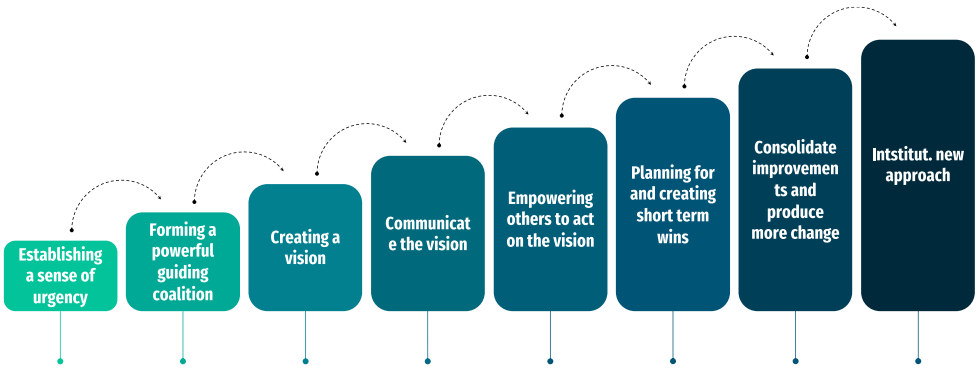


Figure 12: Kotter's eight step process for change management

3.5.1.1 Establishing a sense of urgency

Change is usually initiated by a company's competitive situation, market position, technological trends, or financial performance. Someone realizes that a change is needed to combat a challenge of some kind. When this happens, it is important to stress the need and urgency of change. It might seem easy, but 50% of companies watched by Kotter failed this first step. Without motivation employees won't help and the effort will fall short.

If a change affects the whole company, the support from the CEO is key. According to Kotter a change is established enough when 75% of management within the company honestly convinced that business-as-usual is totally unacceptable. (Kotter, 1995)

3.5.1.2 Forming a powerful guiding coalition

In order to go through with the change a large and powerful coalition to lead the change needs to be set into place. One or two persons cannot lead a major change. Kotter also states that it is impossible to get every senior manager on board, but that a powerful coalition is a must. Companies that fail this step usually underestimate the difficulties of producing change and therefore the importance of a powerful leading group. (Kotter, 1995)

3.5.1.3 Creating a vision

Another aspect of successful transformations is the creation of a vision of the future that is easily communicated. A vision always goes beyond the numbers found in a five-year plan and says something about the direction of the company. The vision is usually blurry at first, but develops and becomes clearer as the company works on it. (Kotter, 1995)

3.5.1.4 Communicating the vision

Besides creating a vision, that vision must be communicated well. There are several ways in which the communication of the new vision can be flawed. For instance, engaging employees by arranging one meeting or sending one information letter to employees is not enough. Even with more communication, there will be a lack of understanding if senior executives do not act according to the vision. (Kotter, 1995)

3.5.1.5 Empowering others to act on the vision

Successful transformation does not only include and engage the guiding coalition, but a larger number of employees. These should get the opportunity to develop new ideas and provide leadership. In order to provide these opportunities obstacles must be removed, e.g. too narrow job descriptions, old compensation systems that benefit employees better in the old structure or bosses that refuse change. (Kotter, 1995)

3.5.1.6 Planning for and creating short-term wins

Transformations often take time, which increases the need for short deadlines to celebrate. People usually will not go along with a change unless they can

see proof of the change within 12 to 24 months. Without short-term wins people tend to give up. (Kotter, 1995)

3.5.1.7 Consolidating improvements and producing still more change

A common mistake made by companies is declaring victory too soon. Changes take time to sink in and to be integrated into the culture of a company. Instead, continuous improvements should be made. (Kotter, 1995)

3.5.1.8 Institutionalizing new approaches

Kotter describes that "Change sticks when it becomes 'the way we do things around here', when it seeps into the bloodstream of the corporate body." In order to get there two things has to be done. 1) Showing that the new approaches, behaviors, and attitudes are improving performance. That the improved performance is a consequence of the transformation. 2) Taking sufficient time to ensure that the next generation of top management also personifies the approach. (Kotter, 1995)

3.5.2 **Reasons for change success and failure**

There are many factors that affect change processes, some of which are connected to success of the project and some that are connected with failure. A literature review from 2022 investigated all articles published on either Google Scholar or ScienceDirect on "Change Management" between 2006 and 2021 in order to provide an overview these factors. This resulted in 38 success factos and 23 failure factors. (Dempsey et al., 2022)

3.5.2.1 Change success factors

There are several factors connected with success of change management, the most prominent described in the field being 1) Communication, 2) Creating a vision, 3) Early active participation of groups affected and 4) Top management commitment. (Dempsey et al., 2022)

1) **Communication**: Is essential in order to create transparency, informing and involving employees. This is a key factor in order to overcome resistance of change.
2) **Creating a vision**: An important part for peeople to understand why change is necessary, which increases the probability of succcessful change. This also involves setting motivating goals and pointing the way.

3) **Early active participation of groups affected**: User involvement in the process is key. End-users of the change needs to be inolved and take ownership of the change, this in order to decrease resistance and enlargen motivation.
4) **Top management commitment**: The top management needs to both approve and commit to the change that is taking place. Otherwise it will be difficult to allocate the resources need to support the change. Besides this top management engagement also motivates employees.

(Dempsey et al., 2022)

3.5.2.2 Change failure factors

There are aslo factors connected with failure of change, where the most prominent are resistance to change, standardized concepts and view change initiatives as short-term program. (Dempsey et al., 2022)

1) **Resistance to change:** There are several areas of resistance: cognitive, affective and behavioural. Cognitive resistance addresses the thoughts on a change, wheras the affective addresses emotional and psychological reaction towards change. Behavioural resistance are the actions that are taking place due to resistance.
2) **Standardized concept**: Where an "one-size-fits-all" approach is taken, which does not in fact fit the organization or process which its applied to. There is no universal best way on how to manage change.
3) **View change initiatives as short-term program**: Changes comes in phases, from planning to implementation to consolidating the change. Changes take time and where a too short time frame is given it often leads to employees feeling unmotivated.

(Dempsey et al., 2022)

3.5.2.2.1 Change fatigue

One factor that might cause resistance is change fatigue, too many changes and uncertainty in a short amount of time. Already before the covid pandemic, employees within organizations were experiencing change fatigue, where they felt apathetic towards or even overwhelmed by many organizational changes is a row. During the pandemic, this fatigue increased even more. It is therefore important for leaders to understand that change exhaustion is a problem, not only on an individual level, but as a collective problem.

4 Öresundskraft and the Swedish Energy Industry

This chapter will describe Öresundskraft, the case study company of carbon management tools, and the Swedish energy industry which is the larger context Öresundskraft operates in. Öresundskraft's company structure, offering, sustainability work, strategy and steering and investment process will be described, together with the main trends and challenges within the energy industry.

Figure 13: Overview of Chapter 4

4.1 Company Structure and Offering

This section aims to give an overview of Öresundskraft as a company by describing the company's operations, legal and organizational structure, and the fixed assets they own.

Öresundskraft AB was founded in 1895 and is Sweden's tenth largest energy- and communication company. Öresundskraft sells, produces, and distributes electricity, district heating, district cooling and gas. They also offer a range of energy services, and infrastructure and services related to communication. (Öresundskraft AB, 2022d) (Öresundskraft AB, 2022)

Öresundskraft is fully owned by the municipality Helsingborg Stad. With 400 employees, Öresundskraft serves around 125 000 customers and has a turnover of 3 256 million SEK. (Öresundskraft AB, 2021a)

Öresundskraft AB is a group with four companies 100% owned:

- Öresundskraft Kraft&Värme AB, which produce district heating and cooling and electricity. Owns wind turbines.
- Öresundskraft Marknad, which trade electricity and gas, and sells energy services and district heating and cooling.
- Pingday AB, which offers city network and communications services through fiber, together with related services.
- Öresundskraft Företagsmarknad AB, which is resting.

(Öresundskraft AB, 2021a)

The different companies however work integrated, and the organizational structure can be seen in Figure 14. This organizational structure is new, introduced in 2022, and means to shift from a more silo-divided structure to a more holistic structure. The aim is to enable collaboration, which is further emphasized by the circle visualization of the new structure. (Mühlow, 2022)

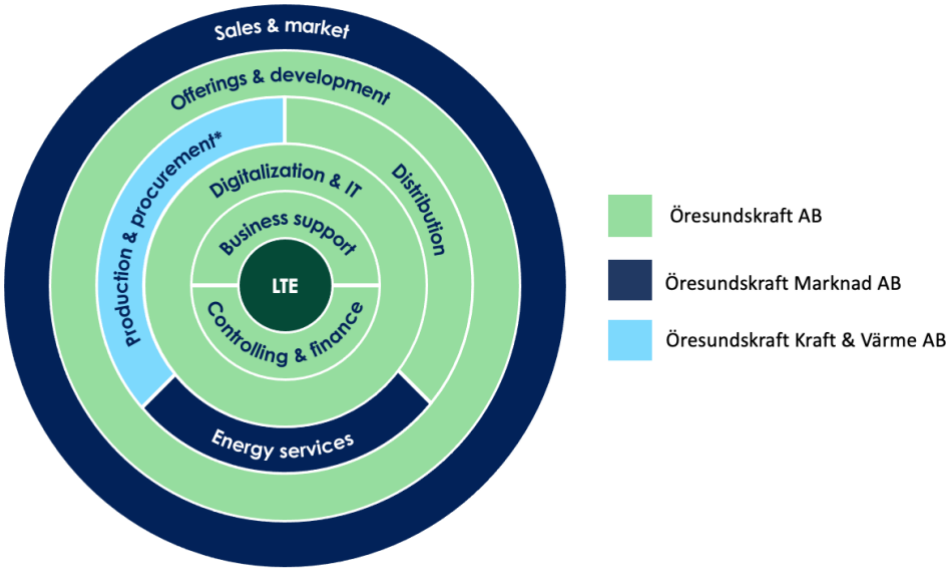


Figure 14: The different organizational units of Öresundskraft

Öresundskraft continuously invests in fixed assets. In 2021, around 430 MSEK were spent and for 2020, the number was around 404 MSEK. In 2021, it for example included replacement to new electricity meters for 63 MSEK. Recent investments also includes upgrading and expansion of the power grids and production facilities. (Öresundskraft AB, 2021a)

An overview of the infrastructure owned by Öresundskraft can be seen in Figure 15.

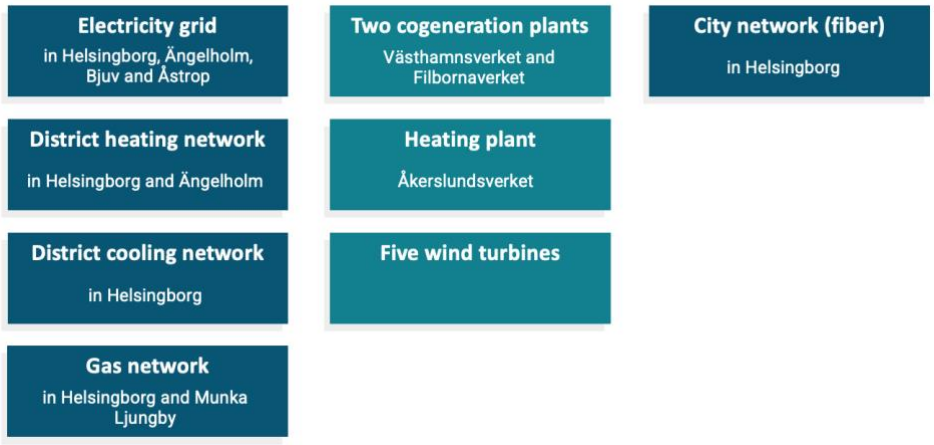


Figure 15: The fixed assets Öresundskraft owns. (Öresundskraft AB, 2022d)

4.2 Strategy and steering

Another important aspect of Öresundskraft for this thesis is how the company is steered. Introducing carbon management tools for the entire company will be easier if it is aligned with, or at least does not contradict, other goals. Therefore, this section will cover the strategy and steering of Öresundskraft.

4.2.1 **The Company Strategy "A Plan for one Planet"**

In 2021 the company launched a new group strategy called "A plan for one planet" (En plan för en planet), with a strong sustainability focus. The strategy puts climate on the agenda and covers four different strategic sustainability challenges for the company.
The four challenges highlight areas of prioritization, but additional sustainability initiatives are driven ad-hoc besides these primary challenges. (Hermansson, 2022)

The four strategic must-win-battles of Öresundskraft are:

1) **Lack of capacity:** Ensuring sufficient capacity as electricity usage is increasing dramatically
2) **Carbon neutral district heating:** Offering a climate neutral heating alternative
3) **Accessibility to electric vehicle charging:** Ensuring accessibility to charging stations as electrification of vehicles increases
4) **Green hydrogen gas:** Enable production, use and transportation of hydrogen from renewable energy

(Hermansson, 2022)

4.2.2 **Strategic map**

The company has a strategic map that shows the company's vision, business idea, strategic areas, must-win-battles, and values. The map, found in Figure 16, revolves around sustainability, from vision (working for a better world as a climate activist) to goals (e.g. zero carbon emissions 2030) to values (being a climate activist that acts right, for real). (Öresundskraft AB, 2022a)

Figure 16: Öresundskraft's strategic map. (Öresundskraft AB, 2022a)

4.2.3 **Helsingborg Stad**

4.2.3.1 Owner directive

As previously mentioned, Öresundskraft AB is owned by the municipality Helsingborg Stad. The municipality steers the company through an owner directive, in which the company's responsibilities and goals are stated. The directive establishes that Öresundskraft should provide and ensure the city's energy supply and electronic communication in a long-term sustainable way. (Helsingborg Stad, 2022). The responsibilities and goals as of 2022 is presented in Table 5.

Table 5: The responsibilities and goals as of 2022 for Öresundskraft set by the owner directive (Helsingborgs Stad, 2022).

Climate related goals (by 2022)	Financial goals	Price related regulations
Local production of solar energy making up 2 percentage of Helsingborg's electricity usage	Return on capital employed (ROI) must at least be the annual average for Stockholm Interbank Offered Rate 3 months + 6 percentage points in the long-term investment cycle (20 years)	Prices for network charges (electricity and gas) within the revenue framework and ceiling that energy market inspection determines
Zero percentage fossil fuels in district heating	Solvency of at least 40%	Prices for district heating to be lower than industry average, but with a maximum of 5 percentage difference
Customer agreements for at least 2 MW of adjustable power use in case of local capacity challenges	Group contribution from Öresundskraft is expected to be in the range of 40-60 percent of earnings before year-end allocations	Prices for electricity, natural gas and biogas determined by terms and conditions

4.2.3.2 Sustainability ambitions and initiatives

Helsingborgs Stad communicates that they are a leading municipality when it comes to environmental and climate work (Helsingborgs Stad, n.d.). Helsingborgs Stad has set ambitious climate targets, including reducing emissions by a half as well as becoming climate neutral by 2030.
This also applies to all its subsidiaries including Öresundskraft. (Environmental Strategist, Helsingborgs Stad, 2022)

When Helsingborgs Stad made a rough calculation of estimated investment expenses to become climate neutral by 2030 to include in an application for an EU-initiative, they reached out to the largest subsidiaries and discussed needed investments. Given these rough calculations, Öresundskraft will need 80% of the initial investment costs. This proportion does not include operational cost, connected with for instance the building of a CCS facility. (Environmental Strategist, Helsingborgs Stad, 2022)

That Helsingborgs Stad is dedicated to being sustainable can be supported by that they are part of several sustainability initiatives. One is an EU-initiative called 100 Climate-Neutral and Smart Cities by 2030, and another is Climate-Neutral Cities 2030 that is driven by the national strategic innovation program Viable Cities. (Environmental Strategist, Helsingborgs Stad, 2022)

4.3 Sustainability work

The following section will describe aspects of Öresundskraft's current sustainability work and ambitions. This to give an understanding of the context, including enablers and challenges, that carbon management tools would be introduced in.

4.3.1 **Sustainable development goals**

Öresundskraft stands behind UN's 17 goals for sustainable development and target three areas of sustainability and five of the FN goals for sustainable development where they can make an impact:

- Economic sustainability
    - Goal 9, Sustainable industry, innovations and infrastructure
    - Goal 12 Sustainable consumption and production
- Social sustainability
    - Goal 7 Sustainable energy for all
    - Goal 11 Sustainable cities and communities
- Environmental sustainability
    - Goal 13 Combat climate change

(Öresundskraft AB, 2022e)

4.3.2 **High ambitions**

Öresundskraft expresses an ambition to be a company that makes a real difference for the climate. On the company's website it says that Öresundskraft not only want to talk about sustainability, but also want to work in innovative ways and contribute to sustainable development (Öresundskraft AB, 2022c).

Also, in interviews with employees at Öresundskraft, high sustainability ambitions are expressed. Interviewees describe a strong ambition to create a real, positive impact as a part of the culture at Öresundskraft (Sundberg and Hermansson, 2022; Andersson, 2022; Mühlow, 2022; Kylvåg, 2022).

Some employees also express a concern of contributing to “green washing”, i.e., that the actions taken in the name of sustainability will not actually contribute to the desired effects, e.g. through making wrong assumptions about what actually creates climate benefits (Sundberg and Hermansson, 2022).

4.3.3 **Environmental sustainability**

Öresundskraft undertakes several activities that can be harmful to the environment, such as digging in the ground for the electricity grid or the district heating network, as well as from combustion in district heating power plants. For these activities environmental aspects are evaluated and mitigated to the degree possible. (Enoksson, 2022)

4.3.4 **Emission reduction initiatives**

The company has several initiatives to address climate change and reduce carbon emissions. As examples are providing renewable electricity, engaging with customers to help them reduce energy use and by enabling electrification of transportation (Öresundskraft AB, 2021b). Another carbon emission reduction initiative is the Carbon Capture & Storage (CCS) facility planned to be in place by 2027 (Öresundskraft AB, 2022b).

4.3.5 **Carbon emission calculations**

Öresundskraft does not currently track their total emissions caused on an organizational level, and very rarely calculates emissions when making investment decisions. Scope 1 emissions are calculated by the company and reported to Swedenergy. Internal knowledge on how to calculate Scope 2 exist within the company and the data are expected to be relatively easy to estimate. A project about calculating the entire company’s total carbon emissions, Scope 1-3, will start in 2023 due to new legislation from Corporate Sustainability Reporting Directive (CSRD). Scope 3 emissions are estimated to be more difficult than Scope 1 and 2 to calculate but will be carried out through the project. The project will use calculations from an accounting perspective. (Andersson, 2022)

The lack of emission data and the difficultness to estimate these are raised as a challenge within the company. There are several assumptions going into carbon emission calculations, not the least regarding time frame and system boundaries, which to a high degree determine the result of the calculations. This also raises a concern about green washing, which could be a result of setting the 'wrong' system boundaries. (Andersson, 2022)

4.3.6 **EU-Taxonomy**

Öresundskraft is currently in the process of investigating which of their activities are classified as sustainable according to the taxonomy. The taxonomy does not firsthand put focus on calculations of emissions. For a small share of the activities it is however required to make emission calculations. (Andersson, 2022)

The EU-taxonomy project at Öresundskraft has uncovered some areas of improvement that the company was unaware of earlier, where the company performed worse than expected. (Andersson, 2022)

4.3.7 **Sustainability in investment-decisions**

Even though the company's vision, strategy and goals in high degree prioritize sustainability and climate efforts, investment decisions that take climate aspects into consideration are made ad-hoc. Sometimes investment decisions premiere sustainability and sometimes profitability. This can for instance be dependent on specific project leadears and who is the final decision maker. . (Sundberg and Hermansson, 2022)

4.3.8 **Need to increase efforts**

Interviews with employees at Öresundskraft supports that there is a consensus within top and middle management that climate efforts should be prioritized. Even though employees express being proud and impressed by Öresundskraft's sustainability work and efforts, several interviewees express a desire to 'level up' even further, for which new ways of working are needed. (Sundberg and Hermansson, 2022; Mühlow, 2022; Andersson, 2022; Kylvåg, 2022; Hård, 2022)

4.4 Investments Processes

One of the research questions are aimed towards introducing a carbon management tool for decision-making. Therefore, the current decision-making process for investments will be described in this section.

Öresundskraft divide their investments into three categories:

1) **Run**: Investments made to uphold the current business and revenue streams, e.g., development of the electricity grid and district heating or a new elevator within an already existing facility.
2) **Grow**: Investments made to grow current business and revenue streams by using already existing capabilities, e.g., selling current products at a higher price or in a bigger volume.
3) **Transform**: Investments made to create new revenue streams, e.g. building a Carbon Capture and Storage factory. (Kylvåg, 2022)

The two types Grow and Transform are sometimes handled together under the name Develop. The investment decision process does not solely apply for current, growth and new revenue streams, but is also applicable for projects targeting other goals, i.e. sustainability. (Kylvåg, 2022)

4.4.1 **Run investments**

The major parts of Run are investments in electricity grids and district heating. For the electricity grid, Öresundskraft sets up a 10-year investment plan. Investments included in the plan is dependent on the demand of electricity, which for instance is affected by population growth and new buildings and facilities. Investments should not be based on speculations but need to be motivated by observed or carefully predicted needs. The 10-year investment plan is put into practice by being assigned as projects and carried through by collaboration with subcontractors. In this process, the procurement department is responsible. (Enoksson, 2022)

Investments within the electricity grid are to a large extent affected by external factors. As a grid owner, Öresundskraft is required by law to enable new customers to connect to the grid, which makes many investments non-negotiable. The prices that a grid owner is allowed to set is also heavily regulated. The planning and decision making is therefore to a large extent

steered by the regulations. In addition to analyses to comply with regulations, preparation for investment decisions within Run often includes risk and vulnerability analyses. (Enoksson, 2022)

4.4.2 **Develop: Grow and Transform Investments**

New developing investment ideas run through an established structure, with phases and gatekeeping decisions. This whole section is based on an interview with the PMO Niklas Kylvåg. Projects going through this process are doing that in an iterative and dynamic way, going back and forth within the structure. The timeframe for a developing project can spread between 3 months to 10 years. Before an idea goes through the investment process the idea itself must be generated, which can be done in multiple ways. Ideas can be sparked through dialogues, conferences, important challenges within the company or through being inspired by other companies. (Kylvåg, 2022)

The developing innovation process consists of 7 phases and 6 gatekeeping decisions. Gatekeeping decisions 1, 3 and 5 are the most impactful and important. The phases and gates are:

- Phase 1: Idea generation
- Decision gate 0: Assigned Project owner
- Phase 2: Business case development
- **Decision gate 1: Acceptance of business case – Project owner**
- Phase 3: Project initiation
- Decision gate 2: Acceptance of project – Project manager
- Phase 4: Project planning
- **Decision gate 3: Final acceptance of project**
- Phase 5: Project implementation
- Decision gate 4: Follow-up on goals
- Phase 6: Finalization
- **Decision gate 5: Presentation to project owner**
- Phase 7: Effect evaluation
- Decision gate 6: Effect check-ins
- Final project closing

The next two pages contains Figure 18 and 18 which gives an overview of what activites, decisions and actions that are included in the different phases and gates.

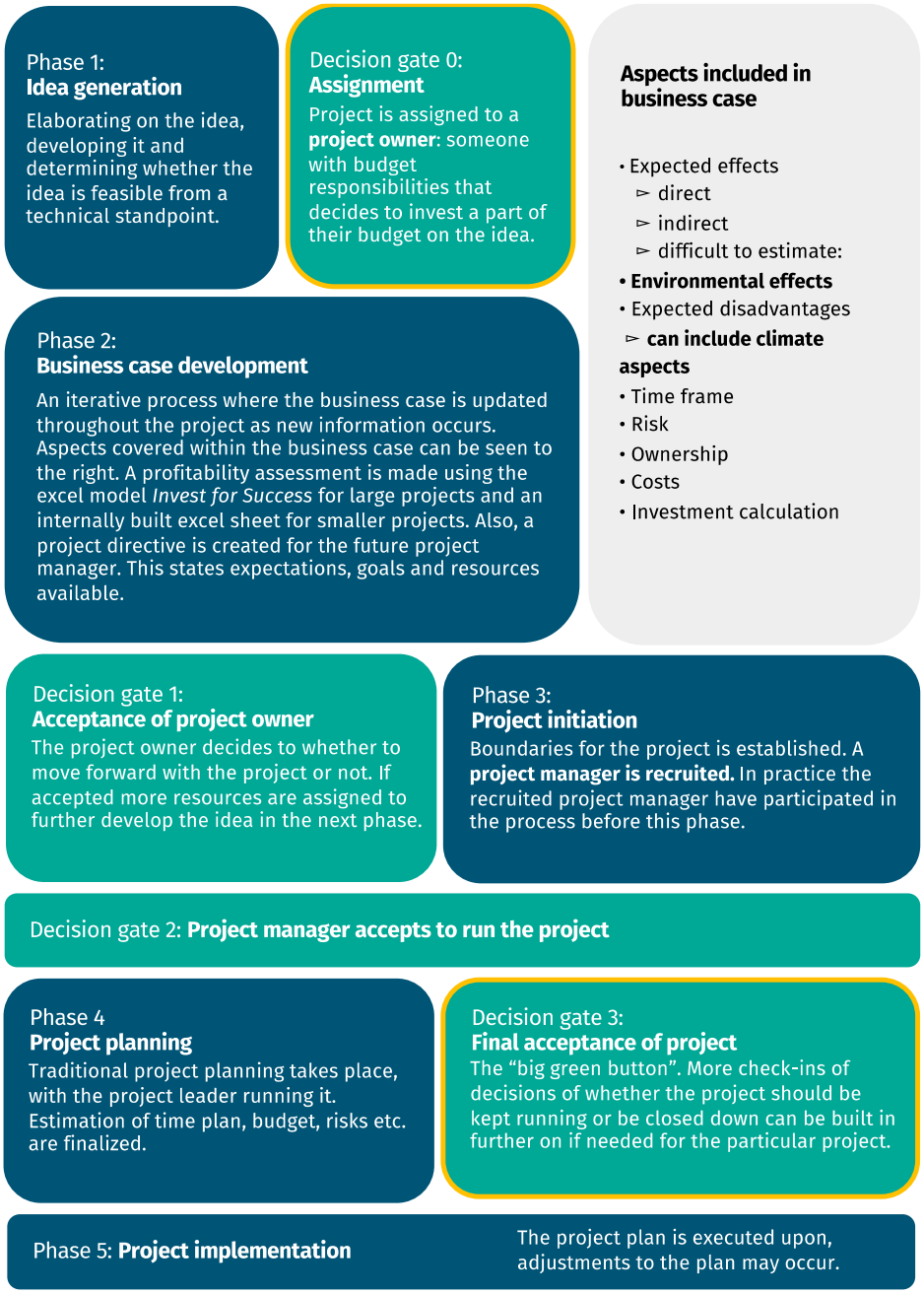


Figure 17: The decision-making process for Grow and Transformed investments. Basedon interview with Niklas Kylvåg (2022). Continues on next pages.

Figure 18: The decision-making process for Grow and Transformed investments. Basedon interview with Niklas Kylvåg (2022).

4.5 The Swedish Energy Industry

Driven by the digitalization, climate ambitions and current events, the energy industry is facing new circumstances and challenges. This section aims to give the reader understanding for the context Öresundskraft operates in.

4.5.1 **Overview**

The use of energy can be divided into electricity, heating, cooling, and transportation. Öresundskraft have traditionally been operating within electricity with production, distribution, and trade electricity, district heating and district cooling. With the introduction of electric vehicles, the company is now also involved in supplying energy to the transportation sector. (Öresundskraft AB, 2021a)

The electricity market can be divided into four components: production, distribution, trade, and consumption. Following that distribution system is a natural monopoly, it is heavily regulated which has implications on the operations and revenue streams. Distribution also needs to be legally separated from the other activities of energy companies (Energimarknadsinspektionen, 2020b, 2020a). But often, like in the case of Öresundskraft, distribution is under the same name and group leadership.

4.5.2 **Trends and challenges**

The Swedish power production has long been characterized by a large share of plannable sources of energy, i.e., nuclear power, hydro power, and combined power plants. In the past years, there has been an increase of weather dependent non-plannable renewable energy. This leads to larger variations in the supply of electricity produced at a given time, which leads to both large variations in price and challenges in maintaining the balance in the power distribution grid. (Energimyndigheten, 2018)

The demand for electricity in general follows certain consumption patterns. Naturally, the demand is lower during the night than during daytime. Also, there is generally a larger demand in the mornings and in the evenings. On a seasonal basis, demand is greater during the winter months as it is driven by

demand for heating. Times when the consumption is very high is referred to as peak loads. (Liljeblad, 2016)

There have been examples of when an excess of supply has led to Swedish electricity prices being negative (Energiföretagen, 2020). The recent year has however rather been characterized by exceptionally high prices. The high prices are due to an array of factors, including the war in Ukraine's effect on gas supply leading to high prices in Europe, maintenance of nuclear powerplants and lack of water in the dams for hydropower (Energimarknadsinspektionen, 2020b, 2020a). Öresundskraft's turnover is closely linked to the electricity prices both because they sell the electricity they produce, and doing trading for customers from other producers. (Öresundskraft AB, 2021a)

Öresundskraft has the responsibility to provide stable access to electricity for their customers. Shortages of electricity can be due to two factors: too little electricity production in relation to demand at a given time, and limitations in the grid capacity at a given time. Too little electricity production is referred to as power shortage. Limitations in the grid is set by the total amount that can be transferred through the wires, and when that does not match the amount demanded is referred to as capacity shortages. Capacity shortages is a challenge both between different parts of Sweden and locally. (Axelsson *et al.*, 2020) There are currently no problems with capacity shortages in the local grids Öresundskraft owns, but they are affected by capacity shortages in the regional and national grids (Sundberg, 2022).

According to the Swedish Energy Agency more variable power production requires new features of the electricity system. One such feature is more flexibility. That is, to be able to react to changes in demand and supply, so the stability in the distribution system is secured. Flexibility can also even out large variations in electricity prices and reduce the need for increased capacity in the distribution system, i.e. more transmission lines. (Energimyndigheten, 2018)

Flexibility markets are an example of when the role of customers is changing. This can be seen as a larger trend of the changed role of customers in the electricity market. Another example is that more customers are also becoming producers of electricity, in the form selling excess electricity from their small-scale solar panels. (Öresundskraft AB, 2021a)

Additionally, the demand for electricity is expected to rise in Sweden in the coming years, including in the geographical area where Öresundskraft is operating. One reason for this is the strategy to combat emissions from transportation and industrial processes through electrification. (Region Skåne, 2020)

To summarize, Öresundskraft is facing several changes in the environment they are operating in, and challenges to their traditional business model.

5 Results

This chapter starts with the presentation of five potential Carbon Management Tools. Then, the results from the interviews and the workshop with Öresundskraft's employees are presented. Together, this provides the foundation for Chapter 6 Discussion, where the tools are evaluated and recommendations to Öresundskraft are given. The evaluation of tools for decision making takes five aspects into consideration. These aspects are based on themes that were reoccurring and/or stressed by employees.

Figure 19: Overview of Chapter 5

5.1 Carbon Management Tools

This thesis has identified five Carbon Management Tools that potentially could fit the needs of Öresundskraft. Three of the tools have been found in literature and two tools have been modified from inspiration from literature. This section will describe these tools, their usage area and how decision-making tools could be integrated into the company's investment processes.

Figure 20: Overview of Chapter 5.1

This thesis has identified the five following carbon management tools:

1) Carbon Intensity Ratio
2) Internal Carbon Price – Shadow
3) Internal Carbon Price – Fee

4) Checklist
5) Carbon Intensity Ratio Scale

The tools have either been taken from literature or designed by the authors by modifying existing tools according to the identified needs. The tools, supporting literature and modifications are presented in Table 6 below.

Table 6: Supporting literature for the of carbon management tools

Tool	Supporting literature	Modifications (if applicable)
Carbon Intensity Ratio (CIR) A hypothetical price on carbon emissions with financial flows within the company.	Greenhouse gas intensity (OECD, 2022)(OECD, n.d.) The Greenhouse Gas Protocol (WBCSD and WRI, 2004) GRI 305 (GRI, 2016) (part of the set of GRI Sustainability Reporting Standards)	
Internal Carbon Price – Shadow price (ICP shadow) A hypothetical price on carbon emissions, included in profitability analyses.	Review of internal carbon pricing and the development of a decision process for the identification of promising Internal Pricing Methods for an Organisation (Gorbach et al. 2022) Putting a price on carbon. The state of internal carbon pricing by corporates globally (CDP Disclosure Insight Action, 2021)	
Internal Carbon Price – Internal Fee (ICP Fee) A hypothetical price on carbon emissions with financial flows within the company.	Same as for ICP Shadow	

Checklist A list of questions/statements to be analyzed and answered/graded before an investment decision.	Climate Governance Score and Tool (London Stock Exchange, 2021)	Adjust questions/statements for internal use and decision making, instead of for evaluation of whole organizations from an outside perspective.
Carbon Intensity Ratio Scale (CIR Scale) Carbon emissions divided by for example investment budget or profitability .	Carbon emissions intensity ratio: an indicator for an improved carbon labelling scheme (Zhao et al., 2012)	Choosing a denominator suitable for decision making. Deciding cut-off values for classification of good, acceptable, and non-acceptable values.

5.1.1 **Carbon Intensity Ratio**

This section will cover carbon intensity ratios, CIR, as a carbon management tool. Carbon intensity ratios is a way of putting carbon emissions in relation to another metric and therefore the process of choosing a denominator will also be described.

Carbon intensity ratios, or normalized environmental impact data, is a way of putting carbon emissions in relation to another metric, e.g. per company's size, turnover, produced unit (WBCSD and WRI, 2004). The metric is commonly described and used, and sometimes mandatory to report, in and by carbon accounting standardization protocols, e.g. in the GHG Protocol, in the GRI standard and by OECD (OECD, n.d.; WBCSD and WRI, 2004; GRI, 2016).

$$\frac{CO_2}{X}$$

5.1.1.1 Deciding denominator

The decision of which denominator to use is dependent on the purpose of the metric. When the GHG Protocol describes intensity ratios they are divided into physical activity and economic output intensity ratios. These are expressed as carbon emissions per unit of physical activity respectively economic output. Physical activity intensity ratios, e.g. emissions per KwH, are appropriate to use for comparing similar businesses. Economic output intensity ratios, e.g. sales, are suitable for comparing different types of businesses. A declining intensity ratio reflects a positive performance improvement. (WBCSD and WRI, 2004)

There are additional aspects going into the decision of which denominator to use. OECD describes the effects of using different denominators, where using the total value of facility's output, i.e., revenues, will make the metric sensitive to price fluctuations. If the price of the product increases the denominator may become larger and the carbon intensity ratio will decrease, implying a positive performance without decreasing emissions.

Additionally, if production increases and the price of the product remains the same the indicator will not show increases in total carbon emissions. Therefore, it is important to monitor both intensities and total emissions side by side. (OECD, n.d., 2022)

When using carbon intensity ratios divided with the product price the intensity of emissions is put in relation relative to its production. Ideally, targeting this value will decrease the company's total GHG emissions, even with increases in production.

5.1.1.2 Break down and separation of intensity ratios

The GRI standard emphasizes the need to break down the carbon intensity ratios where it aids transparency or comparability over time, e.g., by Business unit or facility, country, type of source or type of activity. For this different intensity ratios could be calculated (GRI, 2016).

Additionally, according to the GRI standard indirect (Scope 3) GHG emissions should be held separately from direct (Scope 1) and energy indirect (Scope 2) emissions when calculating intensity ratios. For example by calculating separate intensity ratios (GRI, 2016).

5.1.2 **Internal carbon price**

This section will describe internal carbon prices, ICP, i.e., when companies set a price on carbon emissions to guide decisions. There are several versions of internal carbon prices, and this thesis will cover two, Shadow price and Fee. The tool is, in comparison to other tools described in this thesis, the highly elaborated in literature and therefore specific implementation guidelines of the tool exist and is described below.

Internal carbon pricing is when companies set a price on carbon emissions to help and steer decision making. The concept has gained traction in recent years. Between the years 2017 and 2020 the number of the 500 biggest companies in the world that have or are planning to put a price on carbon doubled, to 226 (CDP Disclosure Insight Action, 2021). In Sweden, 12 of the 100 biggest companies report in a survey that they use ICP and eight that they are planning to implement it, and more companies are investigating to use it (Röhne, 2022).

The price can be set in different ways and serve different objectives, including changing internal behavior, drive low-carbon investments, increase energy efficiency, navigating GHG regulations, meet stakeholder expectations and create supplier engagement. (Almenberg et al., 2021)

However, an internal carbon price is often implemented for risk management, as many companies expect legislation to put a price on carbon emission in the future. Including a fictive price for carbon 8is a way to stress-test investments. (Almenberg et al., 2021)

5.1.2.1 Different types of Internal Carbon Prices

There are several types of internal carbon prices and two of these will be described below, ICP – Shadow price and ICP – internal fee. Besides these an implicit ICP will also be described as a reference.

For shadow price the carbon price is set using a hypothetical cost, for example $100 per ton carbon emissions. A shadow price can thereafter be included in financial analysis of investment and be a criterion in business decisions (CDP Disclosure Insight Action, 2021). Shadow price is the most

frequently used internal carbon price in companies. (Gorbach et al., 2022)

The use of a shadow price does not create any financial flows within the company, in contrast to using an internal fee. The internal fee is set, like a shadow price, hypothetically per amount per unit of emissions. The difference is that the internal price is imposed as an internal tax within the company. In addition to steering investments, the revenue from the fee can also be redistributed within the company and used for investments to reduce emissions. (CDP Disclosure Insight Action, 2021)

In addition, instead of using a hypothetical price, a company can choose to set the internal carbon price based on the actual costs related to reducing emissions and reaching climate targets and/or requirements, e.g. energy efficiency measures. This is called an implicit price. (CDP Disclosure Insight Action, 2021)

5.1.2.2 Implementing an internal carbon price

5.1.2.2.1 Barriers of implementation

There are several aspects going into implementing an internal carbon price. These include a lack of sufficient resources in smaller firms and lack of guidance in setting the price. ICP is also often perceived as an abstract tool. (Gorbach et al., 2021)

Another barrier is the resources going into implementation. Implementation of an internal carbon price that creates financial flows, such as an internal fee, is very time and resource consuming. In comparison a shadow price is relatively straightforward to implement. A shadow price does, however, not impact daily actions, since it is used for investment decisions, and the impact is hence more long term. (Gorbach et al., 2022)

This is an aspect that internal fee covers, where the effective direct price is a signal that additionally creates impact in the short run. This factor does however, as previously mentioned, come with a much higher administrative burden. The appropriate preparation time for an internal fee, based on 3 case companies, is suggested to be 1-3 years. In addition to the long preparation times, barriers for implementing an internal fee include difficulties in allocating emissions and that managers that lack power to take action and affect the emissions they are responsible for. (Gorbach et al., 2022)

Gorbach et al. (2021) mean that "the processes, resources, and skills which need to be in place before a company can adopt ICP can be far more complex than the instrument itself", and that this can require significant expenditures (Gorbach *et al.*, 2021).

5.1.2.2.2 Enablers of implementation

Enablers for a successful implementation of ICP include that the company's management are committed and that the business model(s) can handle pressure to lower carbon emissions. If that is the case, ICP can be useful tool that promotes finding ways to reduce emissions. (Gorbach *et al.*, 2021)

5.1.2.2.3 Gradual implementation

Many companies implementing ICP start with a pilot project, and then include more parts of the company (Gorbach et al., 2021). A gradual implementation is also suggested by CDP et al. in the report How-to Guide Corporate Internal Carbon Pricing (2017). In the report, it is recommended that an implementation of ICP should follow a 4-step process, summarized in Figure 20 below.

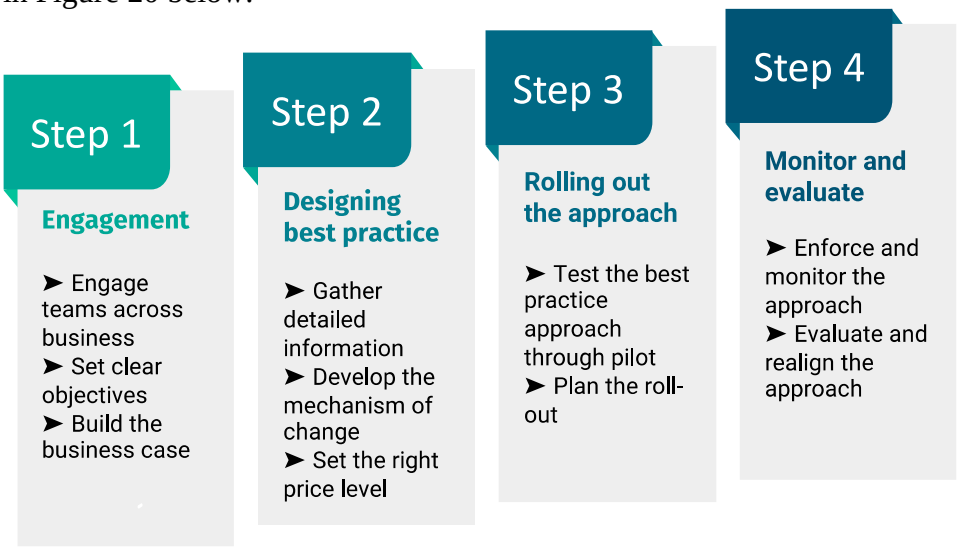


Figure 21: Recommended process to establish a best practice ICP approach (CDP et al., 2017).

CDP et al. also suggest that gradual change can be made along the dimensions of ICP: price level (height), GHG emission coverage (width), influence (depth) and time. The dimensions together with the recommended approach to implement ICP for each dimension is presented in Table 7 below.

Table 7: Dimensions of ICP and recommended practices to change the dimensions over time. This is a modified version of a table from How-to Guide to Corporate Internal Carbon – Four Dimensions to Best Practice Approaches (2017) by CDP, Ecofys and Generation Foundation.

Dimension	ICP Parameter	Best approach along the dimension
Height	Price level per unit emissions emitted.	Rise to a carbon price capable of changing decisions in line with the ICP objectives
Width	The emissions covered throughout the value chain by the approach, or the divisions within the company	Grow to cover all emissions in the entire value chain that can be influenced
Depth	The level of influence the ICP has on the business decisions of a company, and its value chain partners	Become increasingly influential to have a material impact on business decisions
Time	The development of the first three dimensions over time	Be evaluated regularly to bring the company's business strategy in line with a low-carbon economy

A similar suggestion is made by, Gorbach et al. (2021), that points out possible implementation over time such as increasing the price, including more divisions of the company, and including not only scope 1 and 2 but also scope 3.

5.1.3 **Checklist**

The following section will describe the process of designing a carbon management tool, which is referred to as a checklist, as well as the tool itself. The idea is based on inspiration from literature and thereafter modified to fit the needs of Öresundskraft.

5.1.3.1 Brief description

The checklist is a qualitative tool based on answering questions regarding a project's sustainability aspects, not only covering the climate aspect but other aspects as well. These questions could have answer alternatives in the form of yes/no or a numeric scale regarding how well an aspect is covered by the project and be supported by analysis. Questions could for instance be about carbon emission calculations, effect on peak loads, natural resource use and classification according to the EU-taxonomy.

5.1.3.2 Idea initiation

From interviews, an interest in a tool that is not centered around carbon emissions was identified. Several interviewees raised the benefits of including other environmental sustainability aspects, in addition to carbon emissions, in a tool for decision making. Examples of aspects include the alignment with the EU taxonomy, the use of limited natural resources and the effect on the balance and capacity of the electricity system. (Hård, 2022; Kylvåg, 2022)

The feasibility of including more aspects than carbon emissions was supported by a statement from a Portfolio Manager. After being briefed about the objectives of this thesis the Portfolio Manager said that, from his standpoint, there was no need limit to the tool to only take carbon emissions into account but could instead be further developed to integrate other aspects of sustainability. (Kylvåg, 2022)

In addition, the design of an additional tool that does not rely on calculations of carbon emissions was further motivated by the fact that Öresundskraft currently does not calculate carbon emissions for all business units and for almost no investments.
However, this is something that will be implemented throughout 2023 as ÖKAB will be obligated to report carbon emissions from an accounting perspective by CSRD starting in 2024 (Andersson, 2022). But as this is not

currently in place, it was considered relevant to propose a tool that does not require emission calculations.

5.1.3.3 Inspiration from literature

An example of an existing qualitative tool for sustainability assessment not relying on carbon emissions is the Management Quality Score (MQS) developed by Transition Pathway Initiative (TPI). TPI is a global initiative created by asset owners that aims to empower and support action on climate change and the low-carbon transition. The tool is for instance used by London Stock Exchange. (London Stock Exchange, 2021)

The MQS assessment criteria is based on 19 questions. It places companies at one of five levels:

- Level 0 (Unaware)
- Level 1 (Awareness)
- Level 2 (Building Capacity)
- Level 3 (Integrating into operational decision making)
- Level 4 (Strategic assessment).

By answering yes to a question presented, a company moves upward to the next question until they answer no. The number of questions answered yes will determine the company's awareness level. (TPI, 2022; London Stock Exchange, 2021) Since the tool is used of external assessment of companies and not for internal investment decision-making it had to be modified to fit that need of Öresundskraft.

5.1.3.4 Modification of the tool

Through the input from employees at Öresundskraft and this example of a qualitative sustainability assessment tool the idea of a checklist was generated. The idea of the checklist is a set of different criteria that determine a project's sustainability level. The list could be implemented in the current business case template for decision-making.
The list could either be designed as a yes/no criteria list or a grading system, like the MQS, where all criteria are assessed through a numeric scale generating a total score of a project.

The idea of a checklist was presented to Öresudnskraft during a workshop, where it received strong positive reactions. During the workshop, the participants suggested that it would be beneficial for the organization to

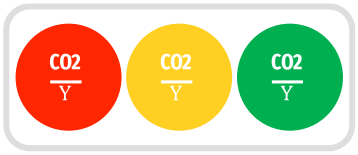
internally explore and decide what exact aspects to include in such a checklist. (Mühlow et al., 2022)

However, examples of aspects that could be covered by the checklist are:

- System benefits
  - Which kind of other energy production would increase/decrease if this investment is made?
- Peak loads
  - How would this investment affect peak loads?
- EU Taxonomy
  - How well is the investment aligned with the EU Taxonomy?
- Use of limited natural resources
  - To what degree does this investment use limited resources?

5.1.4 **Carbon Intensity Ratio Scale**

The following section will describe the process of designing a carbon management tool, which is referred to as a carbon intensity ratio scale, as well as the tool itself. The idea is based on inspiration from literature and thereafter modified to fit the needs of Öresundskraft.



5.1.4.1 Brief description

The idea of the CIR scale is to label projects into different categories based on a carbon intensity ratio, CO2 emissions divided with e.g investment cost. A scale of green, yellow and red light would thereafter indicate how good an investment is from a perspective where economic and climate factors are put in relation to each other. Red or yellow projects would thereafter be required to be assessed more thoroughly to proceed to the next step of the investment process.

5.1.4.2 Inspiration from literature

A similar tool to the CIR Scale can be found in Carbon emissions intensity ratio: an indicator for an improved carbon labelling scheme by Zhao et. al. (2012). In the article a carbon labelling schedule or scale ranging from low (green) to high (red) Carbon Intensity Ratio values is presented. The values are placed into the scale using a normal distribution curve. However, the tool

presented by Zhao et. al. is designed to label products' emissions to help consumer make good decisions when purchasing goods and not to be used for investment decision-making. (Zhao *et al.*, 2012)

5.1.4.3 Modification of the tool

Even though this labelling scheme was targeting consumers, it would be possible to use the same principle at Öresundskraft for internal decision-making. To be used as a tool for investment decisions, it is needed to determine what an acceptable value of the ratio is. To do this, cut-off values should be determined for Carbon Intensity Ratio, classifying projects and investments as either green (good), yellow (ok) or red (bad). How to decide what these values should be is not straight forward and could vary between investment categories.

One option is that the limits between investments could be established through a base year estimate, where the Carbon Intensity Ratio is calculated for all investments and the ranges of what a good or bad investment is established using a normal distribution curve. However, if the base year is not representable for investments made this would not be a good way to determine the cut-off values.

Another important design choice for this tool is the denominator. As Öresundskraft has expressed that they want to put climate benefits in relation to profit, a financial metric is suitable. Financial metrics are common for the carbon ratios, but often used on an organizational level and not project level. The denominators capital employed, and turnover are however possible to transfer to individual projects, as they are aggregated metrics. KwH could in some cases be used, but not in the general case.

Besides these previously mentioned denominators, the total cost of investment, or the expected profitability of the investment may be suitable. Investment size as the determinator will however allow expensive investments to create more emissions and set a limit for how much emissions each SEK is allowed to generate. Depending on the project type, this may be a misguiding metric as it can allow large amounts of emissions for very expensive projects. When putting emissions in relation to profitability, the implication is that profitable projects are allowed to have higher emissions. This may better serve the purpose of weighing profitability against carbon emissions.

5.1.5 **Usage areas for the tools**

This section will describe how the five carbon management tools could be used within an organization, if they could be used for decision-making, progress tracking or both. These findings will be summarized in a table in the end of this section.

Based on the research questions the authors have identified two usage areas for the tools:

- Guiding decision-making for investments
- Progress-tracking on an organizational level

As described above, ICP Shadow, ICP fee, the checklist and CIR Scale are designed to be used for decision-making on project level. CIR cannot be used for decision-making, which is why the CIR Scale was developed, however it is widely used for progress tracking on organizational level. Besides CIR, the other tools can be used for progress tracking on organizational level. This through different ways of aggregation that creates yearly summaries that can be compared as progress tracking. How that would be done for the respective tools will be described below.

For ICP progress tracking could easily be done using the total cost of carbon for one year. This could also be presented through the metric return on capital employed, where the carbon price would be included as a cost. Comparing this new metric to the normal return on capital employed would display how much of the return that is dependent on carbon emissions. The new metric can also be used for progress tracking on its own, by comparing it from year to year. This method would also require that the carbon expenses from investments are allocated as costs for each year, like a depreciation of an investment.

For the checklist, progress tracking can be carried through as a mean score for the total number of investments made during the year. When compiling a mean score it is important to take the size of investments into consideration through giving larger investments larger weights. It could also be reported question by question, for example 3/10 investments addressed the capacity challenge, or how many millions were spent on investments that are aligned with the EU Taxonomy.

For CIR Scale, progress tracking can be done through reporting how large share of investments made in a year are labeled green, yellow and red respectively.

The usage areas are summarized in Table 8, together with an indication if the tool requires carbon emission calculations.

Table 8: Usage areas for the different tools

	Requires carbon emission calculations	Can be used for decision-making on a project level	Can be used for progress tracking on an organizational level
ICP Shadow	Yes	Yes, in the investment calculation	Yes, by being included in financial metrics such as return on capital employed
ICP Fee	Yes	Yes, in the investment calculation	Yes, by being included in financial metrics such as return on capital employed
Checklist	No	Yes, to identify sustainability impact to guide decision-making	Yes, by reporting a mean score for all investments and/or reporting outcome per statement
CIR	Yes	No, as it has no reference value	Yes
CIR Scale	Yes	Yes, as an indicator if the carbon emissions are reasonable in comparison to financial metrics	Yes, by reporting how large share of investments done in a year are labeled green, yellow and red respectively.

5.1.6 **Integration into decision-making processes**

The tools that can be used for decision-making on a project level can be integrated into the decision-making processes in different ways. This section aims to explain the authors' ideas of how the different tools can be integrated into current structures within Öresundskraft. Only tools that can be used for decision-making on project level will be discussed.

5.1.6.1 Internal Carbon Price

For implementation of an internal carbon price within the Grow/Transform process, this would be included as an add-on to the existing excel workbooks for investment calculations of an investment. This could be done in a new sheet, with the same structure as the purely financial investment calculations, but where one of the rows for expenses covered carbon price expenses. The project owner would then insert the emissions on a yearly basis over the entire lifecycle of the investment, which excel would transfer to a corresponding carbon emission expense.

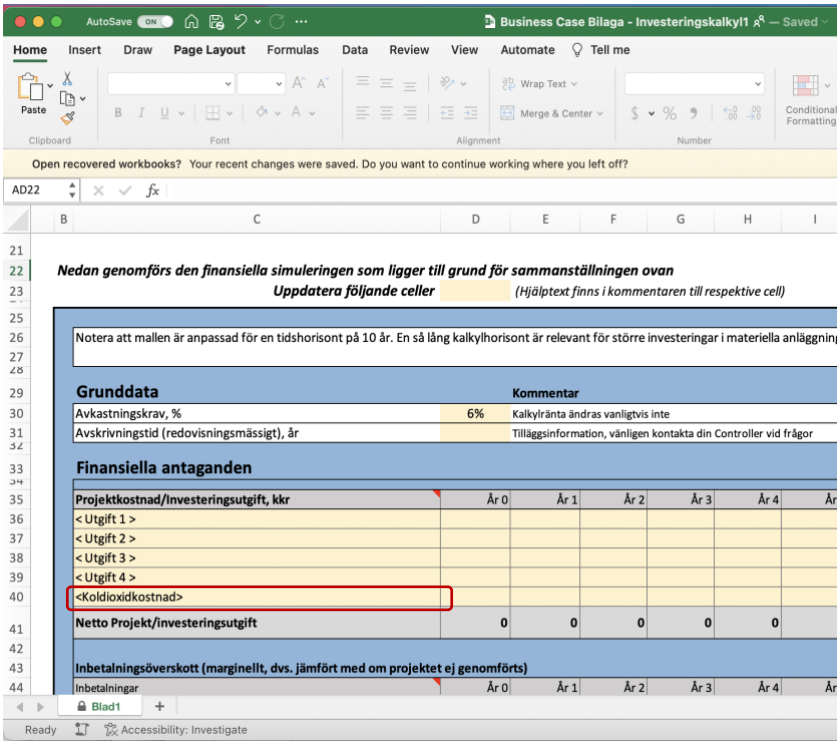


Figure 22: Illustration of how the checklist could be integrated in the current template for business cases for Grow and Transform. In Swedish, as it is inserted in the original template used at Öresundskraft.

In a similar way ICP could be used for procurement within Run investments. When evaluating the different alternatives carbon emissions for the different machinery or material could be requested from the subcontractors. An internal carbon price could thereafter be added on top of the economic expense when evaluating alternatives internally.

5.1.6.2 Checklist

For implementation of the checklist into Grow/Transform, this would be included as a section in the business case template, where the project owner would go through the list as a part of creating the business case.

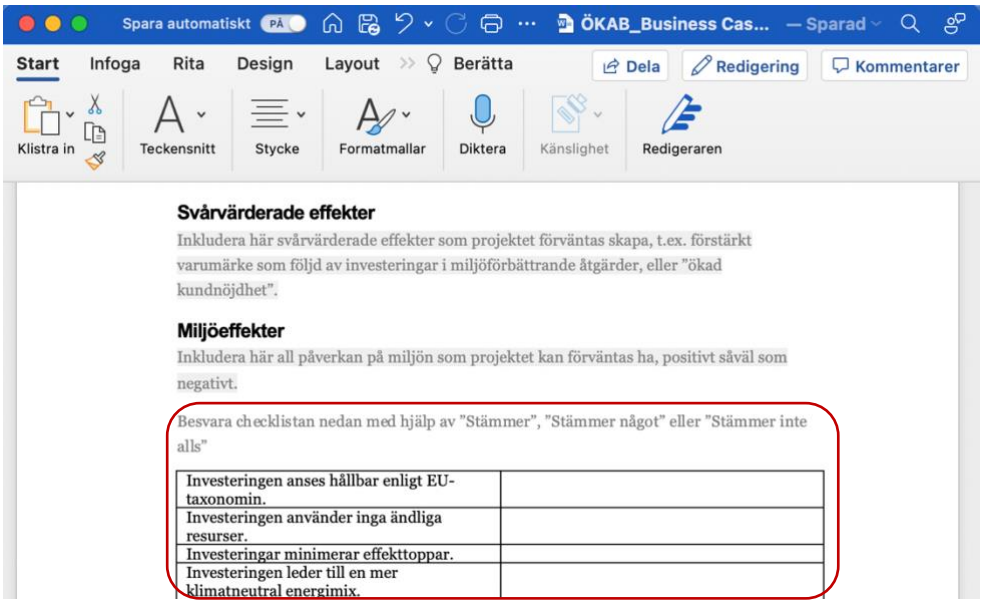


Figure 23: Illustration of how the checklist could be integrated in the current template for business cases for Grow and Transform. In Swedish, as it is inserted in the original template used at Öresundskraft.

When evaluating different Run investments environmental aspects are considered, where the checklist could serve as an additional tool. However, this thesis lacks information of a template or exact process in which the checklist could be integrated for Run investments

5.1.6.3 Carbon Intensity Ratio Scale

The carbon intensity ratio scale would also be integrated into the business case template for Grow/Transform, preferably through a new section within the template. Within that section the value generated from the CIR Scale would be displayed, the investment's color would be shown and actions to improve carbon emissions for the project would be discussed.

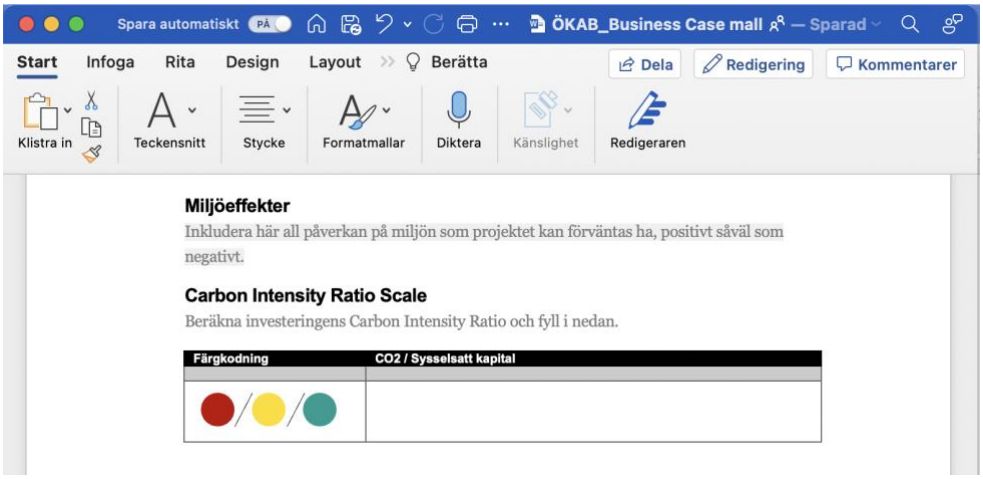


Figure 24: Illustration of how the CIR Scale could be integrated in the current template for business cases for Grow and Transform. In Swedish, as it is inserted in the original template used at Öresundskraft.

The Carbon Intensity Ratio Scale could be used in the same way for Run investments, where different subcontractors' offerings are categorized in accordance with the scale before deciding on which supplier to use. For this the subcontractors need to compile and share their estimated carbon emissions. This thesis lacks information of a template or exact process in which the scale would be integrated for Run investments.

5.2 Interviews and workshop at Öresundskraft

This chapter will describe additional results generated by both internal and external interviews as well as the workshop. Included in this chapter is general desired aspects of carbon management tools expressed by employees at Öresundskraft, specific input on the five tools as well as aspects of implementation generated from interviews and the workshop.

Figure 25: Overview of Chapter 5.2

5.2.1 **General input on tools**

This section will describe general desired aspects of carbon management tools expressed by employees at Öresundskraft through interviews and the workshop. Aspects that will be covered are climate benefit on a long-term system level, that what gets measured gets done, easiness to use and additional sustainability aspects besides taking climate into account. This will provide the foundation for the evaluation of tools that takes place in Chapter 6, presented in section 6.2.2. Aspects to consider.

5.2.1.1 Climate benefit on a long-term system level

An aspect that was raised and highly emphasized by employees working with sustainability was developing a decision-making tool that takes the long-term system benefit into account, not only looking at a short-term closed system. Considerations must be made about if large emissions in the short run may reduce emissions in the long run. In other words, the tool being developed for decision making should be based on carbon emission calculations from a consequence perspective, not an accounting perspective. (Andersson, 2022)

Mitigating carbon emission from an accounting perspective might look good to customers or within the sustainability report, but to ensure actual improved climate efforts one must look at the consequence perspective of investments. (Andersson, 2022)

The company's sustainability strategist also explain that this assessment will vary in difficultness based on which type of investment the company is

considering, where large investments such as a new cogeneration plant will be harder to assess than for instance services. (Andersson, 2022)

To implement these type of emission calculations the company's sustainability strategist means an increase in awareness is needed, as well as the bravery to turn away from the established truth that Öresundskraft as a company already is doing things right. (Andersson, 2022) When talking to other employees at the company it becomes clear that people in general do not have knowledge about different carbon emission calculation methods and how the decision of system boundaries impact the results to a high degree.

In an interview with Wihlborgs, a Swedish real estate company that has implemented an internal carbon price, another view was presented. The emission calculations that go into their investment calculation are calculated by subcontractors. To get comparable results Wihlborgs ask these contractors to use the accounting perspective. In cases where this results in large differences, e.g. for comparisons between biomaterials and non-bio materials, the additional positive aspects of biomaterials are reported qualitative instead. (Fredlund, 2022)

5.2.1.2 What gets measured gets done

There seems to be a strong consensus between the interviewed employees at Öresundskraft that an imperfect tool for integrating climate benefit in decision-making is better than no tool at all. "What gets measured gets done", meaning things that are tracked will also be taken into consideration. There are concerns and challenges with tracking and calculating carbon emissions, not the least in terms of system boundaries, but despite these challenges an imperfect tool should be able to point the company in the right direction. However, it is important that assumptions are clearly decided upon and communicated when calculating carbon emissions. (Sundberg, 2022; Andersson, 2022; Kylvåg, 2022)

5.2.1.3 Easiness to use

Another aspect being raised from the interviewed employees at Öresundskraft is the need for the tools to be easy to use. A reason for this is for instance that the person creating a business case for a project often are not the same person who evaluates the project. Even though it is the project leader's responsibility to evaluate and follow-up their own projects, this is many times not feasible on long-term projects as people switch jobs, retire, and change responsibility areas. For another person to step in and understand

what has been done in an earlier stage the business case has to be easy to follow and not be made overly complicated, which is something that also applies to the design of new climate benefit tools. (Hård, 2022)

5.2.1.4 Additional sustainability aspects

Employees interviewed have expressed that other sustainability aspects are important besides climate change. (Hård, 2022; Kylvåg, 2022) For instance, the handling of peak loads and the use of endless or toxic resources are important factors to consider when trying to integrate sustainability into investment-decisions and progress tracking. (Hård, 2022) This is also a view shared by one of Helsingborgs Stad's sustainability strategists, saying that it is important not to get a carbon vision tunnel and forget about other sustainability factors when chasing the goal of becoming climate neutral. (Environmental Strategist, Helsingborgs Stad, 2022)

5.2.2 **Tool specific input**

The tool specific input is a result from the workshop held with Öresundskraft where employees discussed the five tools and their relevance for the company. Material presented in the workshop can be found in the Appendix C. This input is then used to evaluate one aspect regarding the tools for decision making, in section 6.2.7. Appeal to employees.

5.2.2.1 Internal Carbon Price – Shadow price

The general input on the tool Internal Carbon Price – Shadow price was that it is efficient to put a price on carbon emissions. That makes the tool usable and clear. Long term, this option is a great idea. However, currently the carbon emission calculations at Öresundskraft are not sufficient to implement an internal carbon price. (Mühlow *et al.*, 2022)

5.2.2.2 Internal Carbon Price – Fee

The employees from Öresundskraft attending the workshop are skeptical towards implementing an actual fee connected to an internal carbon price. According to them it is too administrative complicated, and it also generates questions regarding what to do with the money coming from the fee. An existing example of this at Öresundskraft is "Distance Heating Gold", where customers pay an extra fee that goes directly to the building of a new CCS facility and to making district heating more sustainable. During the workshop Öresundskraft mentioned that allocating these funds correctly is administrative complex. (Mühlow *et al.*, 2022)

5.2.2.3 Checklist

The workshop attendees see many similarities with the current business case model and the checklist tool. Other qualitative aspects are currently being considered within the business case, and this would not be any different. Another thing that is highlighted in the discussion during the workshop is the connection that can be made to the EU taxonomy. Aspects from the EU taxonomy can be included within the checklist, which is seen as an advantage. In that way a business case might suggest an investment that as an example scores 7/10 points, but that through further expenses might become a 9/10. Through this it is easy to see what actions and expenses could lead to higher sustainability and decide on whether the company wants to go through with these additional expenses. (Mühlow et al., 2022)

Another advantage according to the workshop attendees is the flexibility of the checklist, that it easily can be expanded to include more aspects over time. Furthermore, the checklist is not as exhaustive as for instance the internal carbon price, which could be a positive aspect in terms of implementation. This also opens for the possibility of the tool to be implemented already in 2023. In the case of implementation of a checklist Öresundskraft believes it to be a good idea to design this tool themselves to ensure they include the most important aspects in a way that makes sense to them. (Mühlow et al., 2022)

The professor Matti Skoog, Åbo Akademi, does however raise another perspective of the checklist. According to him the idea of a checklist seems limiting as a carbon management tool, since the area of carbon management is larger than solely checking things of a list. (Skoog, 2022)

5.2.2.4 Carbon Intensity Ratio

When talking to the workshop attendees at Öresundskraft about implementing a carbon intensity ratio they suggest capital employed as the denominator as this is a stable metric for the different business units, e.g., for gas network, electricity grid etc. The reason for this is that capital employed puts focus on the fixed assets of the company. (Mühlow *et al.*, 2022)

5.2.2.5 Carbon Intensity Ratio Scale

An advantage with the carbon intensity ratio scale, according to the workshop attendees, is that follow-up using this metric will become clear, X amount of MSEK has been spent on green, yellow and red projects in comparison to Y the previous year. Additionally, they believe that investment cost will be a

useful denominator for the carbon intensity ratio used in the scale. In that way the metric will divide emission per SEK into different categories, which is easy to understand, correct enough and easy to implement. (Mühlow *et al.*, 2022)

5.2.3 **Input on implementation**

This section will cover the view on implementation, which is a result from internal and external interviews as well as the workshop. Challenges with implementation will be addressed as well as needed resources according to the carbon accounting consultants interviewed. Interview guides and the material presented in the workshop can be found in Appendix C. These results will be used to discuss

5.2.3.1 Challenges

Through both internal and external interviews several challenges regarding implementation of carbon management tools were addressed.

5.2.3.1.1 Changes take time

One challenge that was brought up by employees at Öresundskraft is that new ideas take time to implement. That Öresundskraft is not as agile as for instance Apple or Google and that the company lives more by the motto "hurry slowly". Therefore, the starting distance for a project like introducing carbon management tools would be rather long. However, if this is seen as important enough and if top management see a high degree of value in the project, then Öresundskraft will get it done according to the interviewee. (Kylvåg, 2022)

5.2.3.1.2 High workload

Another challenge with implementing a carbon management tool is the aspect of an already high workload for employees developing business cases and that this will add onto that workload. (Hård, 2022) Additionally, as earlier mentioned, there is currently only one fulltime employee solely dedicated to working with sustainability. However, the company is in the process of hiring a new sustainability manager. (Andersson, 2022)

The high workload of employees at Öresundskraft, at least within the department of Offering and Development, was further emphasized when the authors attended one of the department's monthly meetings. The high workload was a common topic raised when discussing which initiatives to

focus on going forward. The authors' impression was that there is a lot of things going on, employees have high ambitions and that the main bottleneck for the department is human capital to drive these changes.

5.2.3.1.3 Economic aspects

Another aspect being brought up regarding developing a new tool for investment decision-making is the economic pressure this might generate. People with budget responsibility are already pressured by the budgets and because of this there might be a slight resistance towards implementing a tool that premiers investments that are more expensive, but better for the environment, without any compensation for one's business unit. (Mühlow, 2022)

Furthermore, an employee at Öresundskraft addressed the aspect that integrating a new tool that takes climate impact into account for investment decisions might generate a conversation with top management, the board and ultimately the owner Helsingborgs Stad. A conversation about what level of profitability the company should aim for. If Helsingborgs Stad has the goal that Öresundskraft should be climate neutral in 2030 some sacrifices in terms of short-term profit might have to be done. (Mühlow, 2022)

Another aspect regarding economic pressure of introducing carbon management tools is how additional expenses, from balancing climate impact with economic wins, is how this will affect the company economically. Expenses related to an investment will not appear in the income statement as these are capital expenditures that is written of year by year. Therefore, the immediate effect on profitability might not be as large as first expected. In the long-term however, the profitability will be affected. The investment expense will however immediately be shown in the balance sheet and affect other key figures than profitability, for instance solvency. (Skoog, 2022)

5.2.3.2 Needed resources for climate accounting

The resources needed for climate accounting and calculations of total emissions for a company depend on how thorough the company wants to be when doing their calculations. It also depends on whether the calculations are done according to the consequence perspective or the accounting perspective. Using the accounting perspective can be as quick as a month if some preparations have been done, but if the company is starting from scratch this can take several months. (Johansson, 2022; Westerberg, 2022)

Doing calculations from the consequence perspective also usually require system models about the alternative avoided emissions. These models exist and can be bought in by consulting firms, e.g. Profu. However, even when using an external consulting firm to help calculate emissions from a consulting perspective inhouse knowledge is still needed. The consulting firm will need data about emission, material usage, size of buildings etc. to make their calculations. A knowledgeable client is as important as a knowledgeable consultant. (Johansson, 2022; Westerberg, 2022)

6 Discussion

This chapter aims to discuss and answer the three research questions. Since it is of highest importance to set the right system boundaries for carbon calculations, and tools presented rely on this, the chapter will start with a discussion about carbon calculations. Thereafter a discussion on decision-making tools will be held, followed by a discussion on progress tracking tools. Within these sections tools will be recommended for Öresundskraft, which also can serve as tools for other energy companies. The chapter will then discuss the implementation of these tools and present a roadmap for implementation.

Figure 26: Overview of Chapter 6

Öresundskraft has the ambition to reduce emissions and become carbon neutral in 2030. Today, Öresundskraft lacks structures for how climate benefits should be taken into consideration in decision making. However, the company wants an organization aligned on climate actions, so the consideration of climate benefits is not dependent on the project leader.

This motivates the implementation of a new tool that takes climate benefits into account for investment decisions within the existing business case structure. Besides this the large amounts invested in fixed assets, 430 MSEK in 2021 and 404 MSEK in 2020, also emphasizes the potential positive effects of introducing such a tool.

The fact that the company wants to make a positive impact, for real, when it comes to climate actions also emphasizes the need for a tool that secures thorough progress tracking of carbon emissions. Without progress tracking it is impossible to know if the company is moving in the right direction.

As a reminder, this thesis aims to answer the following research questions:

R1: What is a suitable tool for energy companies to use for integration of climate impact into decision making?
R2: What is a suitable tool for energy companies to use for progress tracking of total carbon emissions?
R3: What are important aspects to consider when implementing these tools?

As all but one of the proposed tools rely on calculating carbon emissions the challenges of these calculations will be discussed before proceeding to address the research questions.

6.1 Carbon calculations

This section will discuss different aspects of carbon calculations. Firstly, which perspective to use for the different tools will be discussed, thereafter different challenges with carbon calculations will be raised. This includes the availability of data, assumptions about the future, using mean or marginal values and how to disclose the carbon emission data.

6.1.1 **System boundaries**

Firstly, there is a challenge of deciding system boundaries, meaning which activities to include and not, for carbon emission calculations. What suitable boundaries are depends on the usage area, decision-making or progress tracking, of the calculations. Therefore two separate sections will describe the reasonable system boundaries.

6.1.1.1 Decision-making and follow-up on project level calls for the consequence perspective

According to Profu's guideline for climate accounting statements for energy companies' decision-making based on carbon emissions should always follow the consequence perspective, which takes the full lifetime of an investment and avoided emissions into account. Using the accounting perspective for decision-making can steer the company in the wrong direction as it looks at investments from a short-term perspective. In the long term, when using the consequence perspective, it might be beneficial for the

company to release a high amount of carbon emissions in the short term to release less emissions in the future. For instance, building a CCS-facility will release a lot of emissions in the short term, but can lead to a smaller carbon footprint in the long term.

Therefore, if Öresundskraft decides to move on with implementing a tool for decision-making that is based on carbon emission calculations, this tool should follow the consequence perspective, including Scope 1, 2 and 3 emissions, as well as avoided emissions. This also resonates with Öresundskraft's own expressed desire to contribute to climate benefit on a long-term system level.

Using the consequence perspective can also help mitigate the concern some employees have about green washing, where setting the right system boundaries was a concern. Avoided emissions are an important factor for energy companies and should therefore not be excluded.

6.1.1.2 Progress tracking on organizational level can be done through both perspectives

According to Profu's climate accounting statement guide for energy companies both the accounting and the consequence perspective can be used for progress tracking. Companies can therefore decide which perspective they want to use based on what resonates with their needs and goals of carbon reporting.

Through CSRD Öresundskraft, among other companies, will be obligated to report their emission through the accounting perspective in 2024. The accounting perspective is therefore a good place to start for progress tracking. However, if the company goes on with implementing a carbon tool for decision-making the competence of consequence perspective calculations could also be used for carbon emission's progress tracking.

Avoided emissions should however always be disclosed separately in accordance with the GHG Protocol, in that way both perspectives will be represented when disclosing emissions in accordance with the consequence perspective. To conclude, both perspectives can be used for progress tracking on organizational level, where the accounting perspective is a suitable starting point. Besides this, emissions for progress tracking should be calculated from a past-oriented view, showing actual emissions.

6.1.2 **Other considerations**

There are other things to consider besides setting the right system boundaries. For instance, the lack of available data and assumptions made about the future. The lack of data will result in usage of default values and the consequence perspective calls for several assumptions about the future in order to estimate avoided emissions. Due to these difficulties carbon emission calculations will never be exact.

Another thing that needs to be considered when using the consequence perspective is whether to use mean or marginal values as these will give different results. The choice requires analysis of which is most representative for the actual occurrence and use those values. As examples, when calculating emissions from a new energy source the marginal production of the European mix should be used and when calculating emissions from district heating the mean value should be used. Further guidance on this can be found in Profu's guideline for climate accounting statements for energy companies.

6.2 Tool for Decision-making

This section will address the first research question about finding a suitable tool for energy companies to integrate climate impact into decision making. The company Öresundskraft will be used as a case company to answer this question. Tools will be evaluated using aspects highlighted by employees at Öresundskraft: Climate benefit on a long-term system level, easiness to use, steering capabilities, wide or narrow focus as well as appeal to employees at Öresundskraft.

6.2.1 **Potential tools for decision-making on project level**

Four tools that can be used for decision-making on project level have been presented in this thesis:

1) ICP Shadow
2) ICP Fee
3) Checklist
4) CIR Scale

Using Csutora and Schaltegger categorization of carbon management tools the tools presented for decision-making can be described as: physical, long-term, future oriented and routinely generated carbon management tools.

6.2.2 **Aspects to consider**

When evaluating the tools several aspects could be considered. This thesis does not claim to have an exhaustive overview of all aspects that could be taken into consideration. The aspects chosen to be considered, presented in Table 9, are based on input provided by employees at Öresundskraft.

Table 9: Aspects for evaluation of the tools, together with questions to consider for the evaluation.

Aspect	Considerations	Earlier described in section:
Climate benefit on a long-term system level	Does the tool take climate benefit on a long-term system level into account?	5.2.1.1 Climate benefit on a long-term system level
Easiness to use	How easy is it for employees in decision-making processes to understand and use the tool? How easily is the result of the tool communicated to other employees in the organization?	5.2.1.3 Easiness to use
Steering capabilities	How well does the tool enable a trade-off between climate and economic factors? How easily can acceptance limits regarding climate effects be set up around the tool? How 'hard' is the steering provided by the tool?	5.2.1.2 What gets measured gets done 2.1.1 Problem analysis and definition
Wide or narrow focus	Does the tool focus on only climate or additional sustainability aspects?	5.2.1.4 Additional sustainability aspects
Appeal to employees at Öresundskraft	Which tool is the most appealing to the company of which it is being implemented at?	5.2.2 Tool specific input

6.2.3 **Climate benefit on a long-term system level**

The aspect of providing climate benefit on a long-term system level has been emphasized by employees at Öresundskraft. This has also been touched upon in the discussion on which system boundaries to use for carbon emission calculations, where the consequence perspective ensures climate benefits on a long-term system level for decision-making.

ICP Shadow, ICP Fee and CIR Scale rely on carbon emission calculations. If these use the consequence perspective and are executed right, they will take climate benefit on a long-term system level into account. The checklist does not necessarily provide climate benefit on a long-term system level. A checklist does not require carbon emission calculations. Instead, aspects regarding climate benefits on a long-term system would need to be included by carefully constructed questions. It is possible that this in some cases would be an effective way to do so. However, it is difficult to compare the checklist to other tools in terms for this aspect.

Table 10: Evaluation of the tools regarding the aspect Climate benefit on a long-term system level.

Climate benefit on a long-term system level – considerations: • Does the tool take climate benefit on a long-term system level into account?			
ICP Fee	**ICP Shadow**	**Checklist**	**CIR Scale**
Yes, if the emission calculations are executed right	Yes, if the emission calculations are executed right	Uncertain. Depends on questions included and how these are analysed.	Yes, if the emission calculations are executed right

6.2.4 **Easiness to use**

An important aspect to consider of a new tool that integrates climate benefit into decision-making for investments is how easily understood the tool is for its users and how easily communicated the results are within the company.

This was raised as an important aspect during the workshop as the employees creating business cases for projects are not the same that later on uses the business case for evaluation. An easier understood tool will also be easier to implement. However, a too simple tool might overlook important aspects. Therefore, there is a possible trade-off between easiness to use and correctness of measuring climate impact.

The tools ICP Shadow, ICP Fee and CIR Scale all rely on carbon emission calculations, which can be rather extensive and complex as described throughout this thesis. These tools call for an understanding of how these calculations are done, as well as assumptions going into the calculations, e.g., system boundaries, using mean or marginal values and the availability of data. Similarly, the procedure of carbon calculations could therefore be difficult to communicate to employees that do not work with these themselves.

The only proposed tool for decision-making that does not necessarily rely on carbon calculations is the checklist. However, the checklist could be demanding in other ways since questions of more qualitative nature may also be difficult to answer. For instance, the checklist could include how well the project aligns with the EU taxonomy, how it affects peak loads and if it relies on usage of endless resources. These aspects could also be complex for project leaders to describe and consider when evaluating a business case.

Table 11: Evaluation of the tools regarding the aspect Easiness to use.

Easiness to use – considerations: **• How easy is it for employees in decision-making processes to understand and use the tool?** **• How easily is the result of the tool communicated to other employees in the organization**			
ICP Fee	**ICP Shadow**	**Checklist**	**CIR Scale**
• Complex • Knowledge about carbon calculations is needed • Difficult to implement	• Complex • Knowledge about carbon calculations is needed	• Uncertain • Potentially complex due to questions not being straight forward to answer	• Complex • Knowledge about carbon calculations is needed

6.2.5 **Steering capabilities**

Another aspect to consider is the tools' steering capabilities, i.e. if the tool enables a trade-off between climate and economy, how easily acceptance limits can be set up around the tool and how direct steering is provided by the tool. Being able to balance climate benefit with economic profit was the initial request from Öresundskraft and therefore important to evaluate.

A tool highly integrated with economic figures could more easily be used for steering as the company mainly is steered upon economic measures. However, that does not mean that tools with lower integration with economic figures cannot be used for steering. But for these tools clear targets or acceptance limits needs to be set up.

ICP could be considered having the highest degree of integration with economic figures, as it translates carbon emissions into monetary terms which allows for direct comparison between profit and climate benefits. ICP Fee that creates internal financial flows does this to an even higher degree than ICP Shadow.

CIR Scale also connects carbon emissions to economic figures, but instead of translating these into monetary terms, it displays a relationship between the two. For the CIR Scale limits must be set up to understand if a value is good or bad, once this is set up the scale will be more guiding in decisions.

The checklist does not have a direct connection to economic figures in the decision-making process either. For strong steering with the checklist, some sort of limit must be set up to guide decision-makers more than solely giving them an overview of sustainability aspects of a project.

In comparison to the CIR Scale and the checklist, limits come naturally when using ICP. An investment that without an internal carbon price was estimated to be profitable can with an internal carbon price become unprofitable. When choosing between two investments, the economically more expensive project might be premiered when using an internal carbon price as the cheaper alternative might have higher emissions. Due to these aspects, the ICP can be considered to have strong steering capabilities. However, there is a challenge regarding setting the right price on carbon, which is need for the tool to have effective steering.

What degree of steering that is desirable needs to be considered when introducing a carbon management accounting tool. As mentioned in the theory section, there are several reasons for companies make efforts to reduce their emissions and be more sustainable, including laws, social pressure from customers or media or internal ambitions to limit climate change. Depending on the reason for implementing a carbon accounting tool different degrees of steering might be desirable. Given Öresundskraft high sustainability ambitions and expressed ambition to balancing profit with climate effort, high steering capabilities is considered suitable.

Table 12: Evaluation of the tools regarding the aspect Steering capabilities.

Steering capabilities – considerations: • How well does the tool enable a trade-off between climate and economy? • How easily can acceptance limits in regard to climate effects be set up around the tool? • How 'hard' is the steering provided by the tool?			
ICP Fee	**ICP Shadow**	**Checklist**	**CIR Scale**
• Enables trade-off • Limits are set by price • Very strong steering	• Enables trade-off • Limits are set by price • Can enable strong steering	• No direct connection to economic figures • Limits could be set up • Softer steering	• Climate benefit in relation to economic figures • Limits could be set up • Can enable strong, but probably softer steering

6.2.6 **Wide or narrow focus**

Another aspect to consider when deciding on a carbon accounting tool is whether the tool solely should focus on climate effects or if the tool should cover a wider sustainability focus. For the tools presented in this thesis, ICP Fee, ICP Shadow and CIR Scale have a narrow climate focus, whereas the checklist has a wider focus.

A wider sustainability focus has been requested by some interviewed employees at Öresundskraft, which is why the checklist was developed in the first place. However, there is a risk connected with choosing a wider sustainability focus. This risk is losing focus on reducing carbon emissions and combating climate change. Taking more things into account could potentially lead to each aspect losing its individual power in the decision-making process.

The authors deem it impossible to create an all-around tool that takes all possible sustainability aspects into consideration and therefore it instead comes down to a question of prioritization: What is the main purpose of this

tool? The authors suggest that a narrower climate focus will benefit Öresundskraft more. The original request made by Öresundskraft when requesting this thesis was finding a tool that takes climate benefits into account to become climate neutral in 2030. Therefore, the authors suggest that the tool for decision-making solely should focus on that aspect. Once a tool that reduces carbon emissions is implemented additional tools, such as the checklist, could be considered for implementation.

Table 13: Evaluation of the tools regarding the aspect Wide or narrow focus.

Wide or narrow focus – consideration: • Does the tool focus on only climate or additional sustainability aspects?			
ICP Fee	**ICP Shadow**	**Checklist**	**CIR Scale**
Climate focus	Climate focus	Wider sustainability focus	Climate focus

6.2.7 **Appeal to employees**

Another aspect of which tool to implement is the appeal it has to employees and management at Öresundskraft, which is something that was addressed during the workshop. The opinions that were raised during the workshop are fully described in chapter 5.2 Interviews and workshop at Öresundskraft, but as a summary the employees particularly found the checklist and ICP Shadow interesting for decision-making. ICP Shadow was found appealing since it is easy to communicate emissions in terms of a price and enables trade-off between climate benefits and economy.

However, the employees also highlighted that carbon emission calculations at Öresundskraft currently are not sufficient to implement an internal carbon price These calculations need to be sorted out before implementing an internal carbon price. The checklist was found appealing due to its simplicity, its connection with the EU-taxonomy and that it could be adopted already in 2023.

CIR Scale was also considered as a useful tool, where the employees appreciated the function of the scale, that it is easily communicated that X number of projects have been green this year, Y has been yellow and Z has been red.

ICP Fee was considered too administrative complex to implement and not seen as an alternative for Öresundskraft. The administrative burden of ICP Fee is also supported by literature where the tool is considered very time and resource consuming.

Table 14: Evaluation of the tools regarding the aspect Appeal to employees

Appeal to employees – consideration: • Is the tool appealing according to employees?			
ICP Fee	**ICP Shadow**	**Checklist**	**CIR Scale**
Not appealing due to its administrative burden	Appealing due to effective communication and trade-offs	Appealing due to its wider sustainability focus and early implementation	Relatively appealing due to possible effective communication

6.2.8 **Summarization of aspects**

A summarization of the aspects highlighted in the discussion can be seen in Table 15 below.

Table 15: Summarization of all aspects evaluated regarding the tools.

ICP Fee	ICP Shadow	Checklist	CIR Scale
Climate benefit on a long-term system level			
Yes, if the emission calculations are executed right	Yes, if the emission calculations are executed right	Uncertain. Depends on questions included and how these are analysed.	Yes, if the emission calculations are executed right
Easiness to use			
• Complex • Knowledge about carbon calculations is needed • Difficult to implement	• Complex • Knowledge about carbon calculations is needed	• Uncertain • Potentially complex due to questions not being straight forward to answer	• Complex • Knowledge about carbon calculations is needed
Steering capabilities			
• Enables trade-off • Limits are set by price • Very strong steering	• Enables trade-off • Limits are set by price • Can enable strong steering	• No direct connection to economic figures • Limits could be set up • Softer steering	• Climate benefit in relation to economic figures • Limits could be set up • Can enable strong, but probably softer steering
Wide or narrow focus			
Climate focus	Climate focus	Wider focus	Climate focus
Appeal to employees			
Not appealing due to its administrative burden	Appealing due to effective communication and trade-offs.	Appealing due to its wider sustainability focus and early implementation	Relatively appealing due to possible effective communication

6.2.9 **Recommendation**

The recommendation to Öresundskraft, and other energy companies, is to implement ICP Shadow. The tool is deemed a suitable tool for decision-making due to its strong steering capabilities, its ability to take long-term climate benefit into account on a system level and its lower administrative burden in comparison to ICP Fee.

Additionally, the tool's solely focus on climate is seen as a positive aspect in order not to lose focus on the main target of reducing emissions. Besides that, a climate focus in line with the company's ambitious climate targets of becoming climate neutral in 2030, its strategy and its values portraited in the strategic map. The tool is rather complex due to all aspects going into carbon emission calculations, but the authors believe that this is needed to steer the company towards lower emissions. Once ICP Shadow is implemented successfully the company could take a wider sustainability focus and implement another tool with a wider sustainability focus, such as the checklist.

However, the risk of change fatigue needs to be highlighted when discussing implementing two tools. There is a risk that employees will become exhausted by changes and instead resist these if too many occur at the same time. This supports implementing one tool successfully before moving on to the next. The checklist's indefinite design and the company's ambitious target to become climate neutral in 2030 makes the authors prioritize ICP Shadow as a suitable tool for decision-making.

6.3 Tool for Progress tracking

This section addresses the second research question about finding a suitable tool for energy companies to use for progress tracking on an organizational level. Öresundskraft will be used as a case company to answer the question.

6.3.1 **Potential tools for progress tracking on organizational level**

For progress tracking on an organizational level the aim is to be able to compare the company with itself on a yearly basis regarding carbon emissions. The company's goal about climate neutrality in 2030 makes this

aspect of high importance. It must be ensured that the company is moving in the right direction which requires progress tracking.

Using Csutora and Schaltegger categorization of carbon management tools the tools presented for progress tracking can be described as physical, long-term, past-oriented, and routinely generated tools.

The tools identified in this thesis that can be used for progress tracking on an organizational level are the same as for decision-making, with one additional tool being Carbon Intensity Ratio. These can be seen in the list below:

3) ICP Shadow
4) ICP Fee
5) Checklist
6) CIR
7) CIR Scale

6.3.2 **Evaluation of tools for progress tracking**

As earlier described, several tools would have to be aggregated and categorized to use for progress tracking. Using these tools for progress tracking on an organizational level makes the most sense if the tool already is being used for decision-making on project level. Spending additional resources to, for instance, review investments from the checklist's point of view after the project already has been decided upon is a both time and cost consuming if the checklist evaluation was not already a step in the decision-making process.

A compliment to the tool used in decision-making, or to stand on its own regardless of if a tool is implemented and used for decision-making, is Carbon Intensity Ratio.

As earlier described, CIR is the most common way to disclose carbon emissions. The tool puts emissions into relation to another metric and works as any other key figure. There are however different factors that can be used as denominators within the metric. The additional calculation of creating another CIR once the carbon emissions are followed through is not difficult or heavy work, therefore several CIR can be calculated. Because of this, the authors suggest that several CIR should be implemented if CIR is chosen as a progress tracking tool on organizational level.

The most relevant CIR for Öresundskraft is however carbon emissions divided with capital employed. This as return on capital employed is the profitability metric used for Öresundskraft. Besides this, it is a stable metric for the different business units, e.g. for gas network, electricity grid etc. The reason for this is that capital employed puts focus on the fixed assets that stays rather stable from year to year within the business units. Additionally, the metric received positive responses in the workshop.

6.3.3 **Recommendation**

Even though it is possible to use ICP Fee, ICP Shadow, the checklist and CIR Scale for progress tracking the authors deem CIR as a more straight-forward approach. This since the CIR is the most common way to disclose carbon emissions and widely used within other companies. Therefore, the recommendation to Öresundskraft, and other energy companies, is to calculate and disclose carbon intensity ratios, carbon emissions divided with capital employed being the most important one due to its denominator's stability.

6.4 Implementation

This section will address the third research question about different aspects to consider when implementing carbon management tools. Öresundskraft will be used as a case company to identify different aspects to consider. The need of top management commitment and having a dialogue with the owner, Helsingborgs Stad in Öresundskraft's case, about target prioritization will be discussed and then a 7-step roadmap will be presented.

Öresundskraft as a company has a strong climate focus. The company has ambitious sustainability targets, i.e., becoming climate neutral in 2030, and the company's strategy, including goals and values, revolve around climate aspects. This is also the case for the company's owner Helsingborgs Stad which is shown through its own climate neutrality target and other climate initiatives. Reducing emissions and taking climate aspects into account is clearly important for both top management and Helsingborgs Stad, which will enable the implementation of carbon accounting tools. This since less efforts will be needed to motivate the introduction of such tools.

However, top management commitment of introducing a carbon management tool is needed for successful implementation. Furthermore, introduction of tools might generate a dialogue with Helsingborgs Stad about how to prioritize economic and climate targets. The aspects of top-management commitment and a dialogue with Helsingborgs Stad is therefore further explored below.

6.4.1 **Top management commitment**

As stated above, top management has a high commitment to reducing emissions and combating climate change. For successful implementation, top management commitment is also needed specifically for the introduction of carbon management tools. Having top management's engagement is an important enabler within change management according to literature.

In practice, this includes the high workload at the company, which is expected to increase even more with implementation of carbon management tools and emissions calculations related to the tools. The current high workload of employees at Öresundskraft includes the sustainability strategist's high workload and the entire Offering and Development

department. To resolve this challenge action from top management is needed. If top management is serious about their target to become carbon neutral in 2030 and considers carbon tools as an effective way to reach this goal the initiative of implementing the tools must be prioritized. This includes giving the project sufficient resources.

As one of the employees at Öresundskraft put it, the company lives by the motto "hurry slowly", where the starting distance of projects can be rather long. But if top management see a high degree of value in a project the company will get it done. This emphasized the need of getting top managements approval and commitment to implement the tools.

6.4.2 **Dialogue with the owner Helsingborgs Stad**

Introducing a carbon accounting tool, especially an internal carbon price, might put additional economic pressure on the company. For instance, when comparing two investments using ICP, the more expensive alternative may be chosen if it results in less emissions.

If the investment cost is considered operational this would therefore affect the company's profitability. However, if the investment is a capital expenditure this will not immediately be shown in the income statement. Instead, the effect will be shown in the balance sheet of the company and then slowly be shown in the income statement as depreciation of investments. For those cases economic pressure will be shown in other metrics, i.e., solvency due to new loans.

How introducing an internal carbon price might affect Öresundskraft's income statement and balance sheet will not be further investigated in this thesis, however the fact that it will have effects is clear. Therefore, introducing carbon tools might prompt conversations with Helsingborgs Stad about Öresundskraft's targets and owner directive. If Helsingborgs Stad wants Öresundskraft to be climate neutral in 2030, some sacrifices of short-term profit may be needed. Dialogue with Helsingborgs Stad may threfore enable introduction of carbon management tools that limits the company's carbon emissions to a higher degree.

6.4.3 **Roadmap**

Top management commitment and having a dialogue with Helsingborg Stad is seen as prerequisites for successful implementation. Bearing these enablers in mind, a 7-step roadmap have been developed and will be described in the following section. The roadmap can be seen in, Figure 27 below.

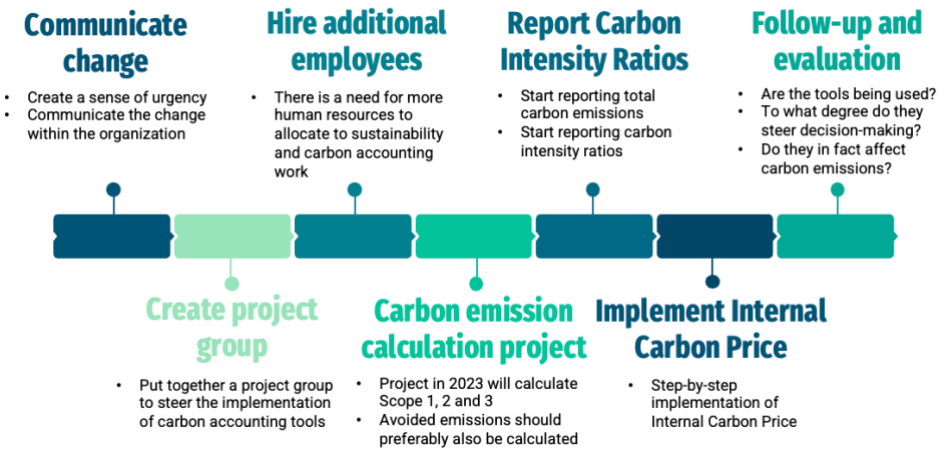


Figure 27: Roadmap for implementation of carbon management tools at Öresundskraft.

6.4.3.1 Communicate change

Even though the implementation of carbon accounting tools is not as big of a change as an organizational transformation, there are learnings to be gained from Kotter's eight step model and literature on change management.

According to Kotter, before forming a powerful guiding coalition, or a project group, a sense of urgency needs to be established. To some extent a sense of urgency is already established. This through the climate crisis and need for companies and people to act now. New legal requirements regarding carbon disclosure for large companies, e.g., Öresundskraft, also increase the urgency and need for internal carbon accounting tools.

However, since there often is a lack of established urgency internally for companies going through larger changes, the reason for change should be further emphasized to employees at Öresundskraft that will be affected by the implementation of tools. Additionally, communicating the change and

motivating employees is in line with the first step of CDPs four step process for implementation of ICP: Engaging the business on ICP.

Communication is the most critical change success factor, and it can therefore not be stressed enough that changes and the reason behind the change needs to be communicated well. Clear communication should not stop after having created a sense of urgency, instead it should be ongoing throughout the project. This to ensure motivated employees and decrease change resistance.

Even though there is a consensus at Öresundskraft regarding increased climate actions, change resistance can still be identified. There are for instance different views on how large economic 'sacrifices' can be made to reduce emissions and how easy it will be to implement changes, e.g. due conflicts with tight budgets. The challenge of resistance can partially be mitigated by repeated communication. Creating a concrete vision of change, as well as engaging employees in the development of the tools are additional ways to mitigate change resistance and motivate employees, which is also emphasized in the literature regarding change management.

6.4.3.2 Create project group

It should be the guiding coalition's task to communicate with the organization about the upcoming and ongoing change. In Öresundskraft's case this would be a project group for the implementation of tools, preferably consisting of a mix of individuals. Individuals that have been a part of the early investigating stage through this thesis, e.g. employees that have been participating in interviews and the workshop, can preferably be a part of the group. Someone that will be affected by the change, e.g. business area managers that often act as project owners/leaders for investments, can also preferable be a part of the group. According to Kotter, it is important to show that senior executives agree and act accordingly with a major change, which also is one of the most important success factors for a change. Therefore, it is preferred if at least one senior executive is a part of the coalition.

The guiding coalition should, besides communicating to the organization, set up a concrete plan for development and implementation of the carbon management tools suggested in this thesis. The roadmap presented in this thesis could work as a highly overarching plan, but the project needs to be further broken down and concretized. While generating this plan it is

important to have change management success and failure factors in mind, as well as Kotter's eight step model.

6.4.3.3 Hire additional employees

It has been clear that the current sustainability strategist has a high workload and will not be able to take on additional work. Therefore, additional human resources will be needed when introducing an exhaustive carbon management tool such as ICP.

Öresundskraft is already in the process of hiring a new sustainability manager, which to some extent potentially could cover this need. However, the needed resources might be larger than what the sustainability manager can cover. Öresundskraft should therefore consider hiring another employee to help with sustainability work and not the least, carbon emission calculations.

The hiring process can start earlier than stated in the roadmap, but an employee should preferably be hired before implementing an internal carbon price as this will increase the workload of carbon calculations.

6.4.3.4 Carbon emission calculation project

During 2023, Öresundskraft will calculate the company's total emission in Scope 1, 2 and 3 from an accounting perspective. This due to the new CSRD regulation. This project comes timely in the process of implementing a climate benefit tool as it is needed for implementation of the two recommended tools.

For decision-making however, avoided emissions through the consequence perspective must also be calculated. Therefore, it would be beneficial for Öresundskraft to include these calculations as a part of the project. This to build up the knowledge and resources needed to start calculating emissions from a consequence perspective.

Avoided emission calculations rely on a high degree of assumptions about the future, for which consulting companies have developed models for. A simple way for Öresundskraft to calculate these emissions is therefore to use these existing models from consulting companies. However, the knowledge around how the calculations are done are still needed internally at Öresundskraft. This in order to give the consulting company the right input

data and for project leaders to understand how to adjust investments in order to reduce emissions.

Based on other companies it takes around 1-3 years to prepare an internal carbon price fee before implementation, where one difficulty will be allocating emissions. The recommended tool for Öresundskraft is a shadow price, and not an actual internal fee, but the timeframe for ICP fee gives a time perspective of the change. Additionally, as earlier mentioned "the processes, resources, and skills which need to be in place before a company can adopt ICP can be far more complex than the instrument itself", as Gorbach et al. (2021) describes it. Therefore, it should be stressed that preparing the carbon emission calculations is a complex step that should not be rushed. This in accordance with the second step in CDP's four step process for implementation of ICP: Designing a best practice ICP approach.

6.4.3.5 Report Carbon Intensity Ratios

Preparing the carbon emission calculations for usage as an internal carbon price is more exhaustive than what the CSRD regulation requires, as the former is based on the consequence perspective and the latter on the accounting perspective. The development of calculations for an internal carbon price might therefore not be finalized when the CSRD legislation is actualized in 2024. However, once total emissions from an accounting perspective are calculated the company can start reporting carbon intensity ratios alongside with total emissions, which would be in the start of 2024. The most relevant metric is as earlier mentioned emissions divided with capital employed, however other metrics can also be calculated and disclosed.

6.4.3.6 Implement internal carbon price

Once there are existing structures for how carbon calculations should be done, both from an accounting and a consequence perspective, the internal carbon price can be further developed and implemented.

Designing the best practice ICP approach is, besides setting up the calculations, also about developing the mechanism of change to drive the approach. This involves setting the right price, which is an important part before rolling out the approach. Once this is decided it is time to implement and roll out the internal carbon price, which is the third step of CDP et al.'s four step process for implementation of ICP. (CDP et al., 2017)

One important challenge covered by literature regarding implementation of an internal carbon price, is managers' lack of power to take action and affect the emissions they are responsible for. It is therefore important when implementing ICP to make sure that project leaders get sufficient mandate, budget, and time to adjust project plans to decrease total emissions. As an example, the purchase department might need a larger budget when also adding requirements on taking climate benefits into account for Run investments. The same applies to project leaders for Grow/Transform investments.

In accordance with CDP's recommendations the internal carbon price should be implemented gradually. CDP's four dimensions of an internal carbon price can be used as inspiration for this gradual implementation, showing that there are different ways to expand the implementation over time. The four areas are as earlier mentioned, price level (height), GHG emissions coverage (width), influence (depth), and time.

When implementing the carbon price Öresundskraft could set a lower price (height) and raise this gradually. Another way to gradually implement the price is division by division, increasing ICPs influence (depth) within the organization. Öresundskraft can find further inspiration regarding this in CDP's How-to Guide Corporate Internal Carbon Pricing and in the Greenhouse Gas Protocol.

6.4.3.7 Follow-up and evaluation

When the tools are set into motion and used by the organization they should be further revised and evaluated. When adjustments are needed, these should be applied. For example, the internal carbon price will most likely need adjustments as it is difficult to find the right price level – that does not hinder operation, but still steer towards reduced emissions.

6.4.4 **Insights for energy companies**

This section will describe how insights regarding implementation of tools at Öresundskraft can be used by other energy companies. The discussion of top management commitment will be an important factor for any company wanting to implement a carbon management tool. The aspect of having a dialogue with the owner of the company will be the most relevant for other companies being municipality owned, e.g. many other Swedish energy companies.

The 7-step roadmap also contributes with many relevant aspects for other energy companies. However, there are two steps in the roadmap that can be considered more company specific and focused on Öresundskraft specifically. Those steps are 3) Hire additional employees and 4) Carbon emission calculation project. All companies wanting to implement carbon management tools will need to evaluate their resources, but some might find that they have sufficient resources. All companies will also need to set up structures for carbon emission calculations, but some firms might already have these established.

6.5 Reflections

In this section, the thesis will be reflected upon regarding design and execution. Identified limitations will be discussed, and potential other methods will be presented.

Firstly, the scope of the thesis is relatively broad. It covers finding tools for decision-making and progress tracking, the implementation of such tools, as well as methods and challenges related to calculating carbon emissions. In addition to this, Öresundskraft has a range of different activities and investment types with different characteristics that all are being covered by the scope of this thesis. This broad scope resulted in limited depth in the analysis. However, this was done in favor of a more complete coverage of relevant elements for more climate focus in decision making and progress tracking.

With more time at hand, it would also have been possible to differentiate between different kinds of investments, e.g. Grow/Transform and Run. The thesis puts a larger focus on decision making in Grow/Transform. These are important areas which include Öresundskraft forward-looking investments, where it is possible to make great contributions especially regarding avoiding emissions. Run should however not be overlooked, as large investments are done within Run, often involving buying both material and transportation causing emissions. That the thesis does not focus as much on Run is mainly due to trouble with getting in contact with the right interviewees, and limitation of time. The interview that solely focused on Run was held late in the process and after the workshop was held.

Carbon emission calculations were not included in the research questions but were still covered in the thesis as it was considered necessary for tracking climate benefits. A more thorough examined analysis of different ways to measure carbon emission calculations can however be beneficial for Öresundskraft and other energy companies to make well-informed decisions and create 'real' positive climate impact.

Another limitation in the thesis the lack of detailed real-life examples of the practical use of carbon management tools, especially regarding ICP and CIR, and their effects on organizations. This lack is emphasized in the literature as a general lack in the research field.

The conclusions drawn regarding the tools' appeal to employees and Öresundskraft's culture could have been more reliable if more interviews with employees had been held or if a survey had been sent out. This especially includes employees with less strategic responsibilities, and business area managers that often are responsible for business cases. A second workshop only evaluating ICP Shadow would have been valuable but was not done due to time constraints.

7 Conclusions

In this chapter, the answers to the research questions are presented. Thereafter, key-take aways for other companies will be presented. The chapter ends with contributions to the research area and suggestions for further research.

7.1 Answering research questions

R1: What is a suitable tool for energy companies to use for integration of climate impact into decision making?

ICP Shadow is deemed a suitable tool to use within decision-making. This is due to its strong steering capabilities, its ability to take long-term climate benefits into account on a system level and its relatively low administrative burden. The tool has a narrow focus on the climate aspect, which is considered positive. To use the tool, carbon emissions need to be calculated from a consequence perspective, which is considered a rather complex process. However, this is according to the authors needed to steer the company towards lower emissions.

R2: What is a suitable tool for energy companies to use for progress tracking of total carbon emissions?

Based on the analysis for Öresundskraft, energy companies should focus on calculating carbon intensity ratios. This since CIR is the most common way to disclose carbon emissions and it is widely used within other companies. Both the accounting and the consequence perspective can be used for progress tracking of emissions.

Capital employed is deemed a suitable denominator for Öresundskraft as it stays stable from year to year for the company. Other energy companies can also use this metric if it stays stable for their specific company as well.

R3: What are important aspects to consider when implementing these tools?

Important aspects to consider have been presented in the 7-step roadmap, which can be seen below in Figure 28. Even though the roadmap is created to cover the needs of Öresundskraft, it is relevant for other energy companies as well. The roadmap emphasizes the need of communicating the change and its importance, creating a steering project group, hiring additional employees to have the resources needed, figuring out the exact structures for carbon emission calculations, implementing the tools, as well as evaluating the process and adjusting thereafter. The two aspects that are specific for Öresundskraft are step 3) Hire additional employees and 4) Carbon emission calculations project. For other energy companies these aspects can be translated into making sure that the company has sufficient resources and setting up structures for carbon calculations if these do not already exist.

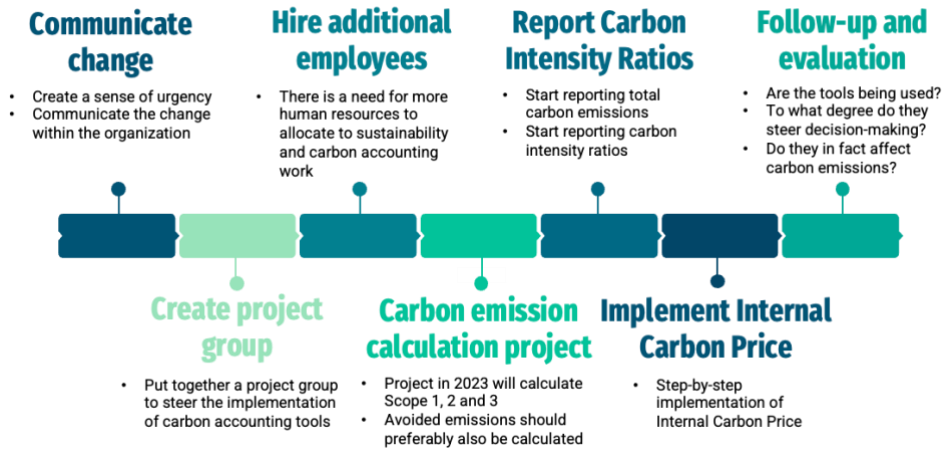


Figure 28: Roadmap for implementation of carbon management tools at Öresundskraft

Besides these steps, two important enablers have been identified for implementation of the tools, these being top management commitment and conversations with the company's owner, which is the municipality Helsingborgs Stad in the case of Öresundskraft.

7.2 Key-take aways for other companies

There are several key-take aways for companies, not only in the energy industry, from this thesis. For instance, the difficulty of carbon emission calculation cannot be stressed enough. There are many uncertainties and assumptions going into the calculations, which create barriers for companies wanting to calculate emissions in order to decrease them.

Besides this, there is the challenge of motivating employees to do carbon calculations and the additional workload that this would result in. Employees are torn between different demands, e.g. climate efforts and keeping budgets, which can disable them from making climate beneficial decisions. This challenge can even be seen in Öresundskraft, where climate is on top of the agenda. Due to this, tools and guidelines for investment decision-making need to be designed to take more than one demand into account and give decision makers authority to choose a better alternative for the climate.

7.3 Contribution to research field and further research

The research field of carbon accounting is still in its formative stage with many limitations. There are currently few articles about companies' actions against climate change, i.e., Carbon Management, giving real life examples on how companies use carbon management tools. An example of this is how carbon calculations and climate benefits can be integrated into decision-making, which is a current gap in the field identified by Clarke and Marlow (2022) that this thesis contributes to fill.

This thesis has covered two different tools, one for decision-making and one for progress tracking within Öresundskraft. As earlier mentioned, Csutora and Schaltegger (2012), divide carbon management tools into different categories which can be used to describe the tools in this thesis. The decision-making tools in this thesis can be described as physical, long-term, future oriented and routinely generated carbon management tools. This while the progress-tracking tools within this thesis could be described as physical, long-term, past-oriented, and routinely generated tools. This

thesis contributes to this research through putting Csutora and Schaltegger's categorization into a real-life context.

As stated in the thesis there are several reasons why companies work with carbon accounting. These driving forces include social, regulatory, economic, and financial pressure as well as firm specific internal factors. This thesis provides an example of what can be done when there are high ambitions and driving-forces internally. It is also shown how these internal factors are not isolated from the other aspects, where additional driving forces, such as regulations, enable these internal ambitions. The driving-forces work alongside each other to drive carbon management.

This thesis found that there are few examples of carbon management tools for decision-making where climate impact and economic factors are balanced against each other. Development of new tools would therefore be a contribution to the field. It is also possible that companies are acting in ways that are not described in research. Further research could therefore investigate implementation of tools in practice, and study success-factors and challenges in relation to that. This includes both how carbon management tools are affecting decision making, and what effects it has on emissions on a system level.

References

Almenberg, J., Bäckström, H., Zeitoun Eckerhall, S. (2021) *FI-analys 30: Internpris på koldioxid – vad och varför?* Finansinspektionen. Available at: https://www.fi.se/contentassets/a252e77c5bea47adbdb95156890c3374/fi-analys-30-internpris-pa-koldioxid.pdf [Accessed: 19 October 2022].

Andersson, C. (2022) *ÖKAB: Sustainability efforts and EU-taxonomy*. Intervieweed by authors. 18 October.

Brennan, M., Dempsey, M., Geitner, L., McAvoy, J. (2022) *A Review of the Success and Failure Factors for Change Management.* IEEE Engineering Management Review, vol. 50, no. 1, pp. 85-93. Doi: 10.1109/EMR.2021.3130989.

CDP, Ecofys, Generation Foundation. (2017) *How-to Guide to Corporate Internal Carbon – Four Dimensions to Best Practice Approaches*. Available at: https://cdn.cdp.net/cdp-production/cms/reports/documents/000/002/740/original/cpu-2017-how-to-guide-to-internal-carbon-pricing.pdf?1521554897 [Accessed: 28 November 2022].

CDP (2022) CDP: *About us - What we do*. Available at: https://www.cdp.net/en/info/about-us/what-we-do [Accessed: 25 October 2022].

CDP Disclosure Insight Action (2021) *PUTTING A PRICE ON CARBON The state of internal carbon pricing by corporates globally*. Available at: https://cdn.cdp.net/cdp-production/cms/reports/documents/000/005/651/original/CDP_Global_Carbon_Price_report_2021.pdf?1618938446 [Accessed: 19 October 2022].

Clarke, A. & Marlowe, J. (2022) *Carbon Accounting: A Systematic Literature Review and Directions for Future Research.* Green Finance (Vol. 4, Issue 1) AIMS Press. Available at: http://dx.doi.org/10.3934/GF.2022004

Csutora, M., Schaltegger, S. (2012) *Carbon accounting for sustainability and management. Status quo and challenges*. Journal of Cleaner Production, Volume 36, 2012, p. 1-16. Available at: https://doi.org/10.1016/j.jclepro.2012.06.024

Duetz, P, Zhao, R., McGuire, M., Neighbour, (2012) *Carbon emissions intensity ratio: an indicator for an improved carbon labelling scheme*. Doi: 0.1088/1748-9326/7/1/014014. Available at: https://iopscience.iop.org/article/10.1088/1748-9326/7/1/014014/pdf. [Accessed: 2 November 2022].

Energiföretagen (2020) *Negativa elpriser – Energiföretagen förklarar*. Available at: https://www.energiforetagen.se/pressrum/nyheter/2020/februari/negativa-elpriser--energiforetagen-forklarar/ [Accessed: 28 October 2022].

Energiföretagen (2021) *Energiföretagen förklarar: Exportöverskott och ont om el – samtidigt.* Available at: https://www.energiforetagen.se/pressrum/pressmeddelanden/2021/energiforetagen-forklarar-exportoverskott-och-ont-om-el--samtidigt/ [Accessed: 15 November 2022].

Energimarknadsinspektionen (2020a) *Flexibilitet i elsystemet*. Available at: https://ei.se/bransch/flexibilitet-i-elsystemet [Accessed: 28 October 2022].

Energimarknadsinspektionen (2020b) *Ny som koncessionsinnehavare.* Available at: https://ei.se/bransch/koncessioner/natkoncession-for-linje/ny-som-koncessionsinnehavare#:~:text=N%C3%A4tf%C3%B6retag%20som%20ing%C3%A5r%20i%20en,redovisas%20skild%20fr%C3%A5n%20annan%20verksamhet. [Accessed: 28 October 2022].

Energimyndigheten (2018) *Vägen till ett 100 procent förnybart elsystem*. *Delrapport 1: Framtidens elsystem och Sveriges förutsättningar*. ER 2018:16.

Enoksson, G. (2022) *Run Investments*. Interview by authors. 6 December. [Online]

Environmental Strategist, Helsingborgs Stad (2022*) Sustainability efforts at Helsingborg Stad*. Interview by authors. 2 November. [Online]

E.ON (2022) *Vad är elbrist, effektbrist och kapacitetsbrist? Så skiljer du mellan begreppen.* Available at: https://www.eon.se/om-e-on/kapacitetsbristen/elbrist-effektbrist-naetkapacitetsbrist [Accessed: 15 November 2022].

Finansinspektionen (2022) *Hållbarhetsredovisning.* Available at: https://fi.se/sv/hallbarhet/regler/redovisning/ [Accessed: 10 November 2022].

Fredlund, S. (2022) *Wihlborgs Internal Carbon Price*. Interview by authors. 16 november. [Online]

GHG, G.G.P. (2022) *Greenhouse Gas Protocol: Standards*. Available at: https://ghgprotocol.org/standards [Accessed: 17 October 2022].

Gorbach, G., Kost, C., Riedel, F. (2021) *Barriers to Internal Carbon Pricing in German Companies.* Energy Policy, Volume 159. Available at: doi:10.1016/j.enpol.2021.112654 [Accessed: 29 November 2022].

Gorbach, G., Kost, C., Pickett, C. (2022) *Review of internal carbon pricing and the development of a decision process for the identification of promising Internal Pricing Methods for an Organisation.* Renewable and Sustainable Energy Reviews. Volume 154. Available at: https://doi.org/10.1016/j.rser.2021.111745

GRI, G.R.I. (2016) *GRI 305: Emissions*. Available at: https://www.globalreporting.org/standards/media/1012/gri-305-emissions-2016.pdf [Accessed: 29 November 2022].

Hård, J. (2022) *Innovation at Öresundskraft*. Interviewed by authors. 31 October. [Online]

He, R., Luo, L., Shamsuddin, A.,Tang, Q. (2021) *Corporate carbon accounting: a litterature review of carbon accounting research from the Kyoto Protocol to the Paris Agreement.* Accounting and Finance 62(1), pp. 261-298–298. Doi: 10.1111/acfi.12789.

Helsingborgs Stad (2022) *Ägardirektiv för Öresundskraft AB*. [Internal Document]

Helsingborgs Stad (n.d.) Tillsammans för en hållbar framtid. Available at: https://helsingborg.se/bo-bygga-och-miljo/klimat-och-miljo/helsingborgs-klimat-och-energiplan/ [Accessed: 11 November 2022].

Hermansson, P. (2022) *Strategy at Öresundskraft*. Interview by authors. 28 October.

Johansson, K. (2022) IVL. *Climate accounting*. Interviewed by authors.

Kotter, J.P. (1995) *Leading change: why transformation efforts fail*. Harvard Business Review, 73(2), p. 59. Available at: https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,uid&db=edsggo&AN=edsgcl.16716270&site=eds-live&scope=site [Accessed: 30 November 2022].

Kotter, J.P. (2007) *Leading Change: Why Transformation Efforts Fail*, Harvard Business Review, 85(1), pp. 96–103. Available at: https://search-ebscohost-com.ludwig.lub.lu.se/login.aspx?direct=true&AuthType=ip,uid&db=bth&AN=23363656&site=ehost-live [Accessed 30 November 2022]

Kylvåg, N. (2022) ÖKAB: *Developing Investment Decisions*. Interviewed by authors. 19 October. [Online]

Lauer, T. (2021) *Change Management - Fundamentals and Success Factors*. Springer.

Liljeblad, A. (2016) *Framtidens elanvändning*. Kungl. Ingenjörsvetenskapsakademien (IVA). Available at: https://www.iva.se/globalassets/info-trycksaker/vagval-el/vagvalel-framtidens-elanvandning-delrapport.pdf [Accessed: 28 October 2022].

London Stock Exchange (2021) *Climate Governance Score and Tool*. Available at: https://docs.londonstockexchange.com/sites/default/files/documents/LSEG_Climate%20Governance%20Score%20and%20Tool_Oct2021_final.pdf [Accessed: 4 November 2022].

Mälardalens universitet (2022a) *Reliabilitet*. Available at: https://libguides.mdu.se/c.php?g=678062&p=4832301 [Accessed: 28 December 2022].

Mälardalens universitet (2022b) *Validitet.* Available at: https://libguides.mdu.se/c.php?g=678062&p=4832296 [Accessed: 28 December 2022].

Mühlow, C. (2022) *Öresundskraft: Financial management*. Interviewed by authors. 17 October.

Mühlow, C. et al. (2022). *Evaluation of tools.* Workshop held by the authors. 7 November.

Naturvårdsverket (2022a) *Naturvårdsverket: Beräkna klimatpåverkan*. Available at: https://www.naturvardsverket.se/vagledning-och-stod/luft-och-klimat/berakna-klimatpaverkan/#E-1962274830 [Accessed: 12 October 2022].

Naturvårdsverket (2022b) *Beräkna klimatpåverkan - Beräkna direkta utsläpp från förbränning*. Available at: https://www.naturvardsverket.se/vagledning-och-stod/luft-och-klimat/berakna-klimatpaverkan/berakna-direkta-utslapp-fran-forbranning/ [Accessed: 18 October 2022].

Naturvårdsverket (2022c) *Beräkna Klimatpåverkan - Beräkning enligt GHG Protocol eller ISO Standard.* Available at: https://www.naturvardsverket.se/vagledning-och-stod/luft-och-klimat/berakna-klimatpaverkan/berakning-enligt-ghg-protocol-eller-iso-standard/ [Accessed: 13 October 2022].

OECD (2022) *Greenhouse Gas Intensity*. Available at: https://www.oecd.org/innovation/green/toolkit/o4greenhousegasintensity.htm [Accessed: 18 October 2022].

OECD (n.d.) *GHG Intensity*. Available at: https://www.oecd.org/innovation/green/toolkit/o4greenhousegasintensity.htm [Accessed: 19 October 2022].

Öresundskraft AB (2020) *Öresundskraft AB Sustainability Report 2020*. Available at: https://www.oresundskraft.se/globalassets/pdf/hallbarhetsredovisning/hallbarhetsredovisning-2020-webb.pdf [Accessed: 28 October 2022].

Öresundskraft AB (2021a) *Årsredovisning 2021*. Available at: https://www.oresundskraft.se/globalassets/pdf/arsredovisning/arsredovisning_2021_ok.pdf [Accessed: 15 October 2022].

Öresundskraft AB (2021b) *Hållbarhetsredovisning 2021*. Available at: https://www.oresundskraft.se/globalassets/pdf/hallbarhetsredovisning/hallbarhetsredovisning-2021-web.pdf [Accessed: 15 October 2022].

Öresundskraft AB (2022a) *Strategic map draft*. [Internal document]

Öresundskraft AB (2022b) *Klimatkompensera verksamheten genom negativa utsläppsverifikat*. Available at: https://www.oresundskraft.se/foretag/ccs-negativa-utslappsverifikat/ [Accessed: 10 November 2022].

Öresundskraft AB (2022c) *Om oss - Hållbarhetsarbete*. Available at: https://www.oresundskraft.se/om-oss/hallbarhetsarbete/ [Accessed: 24 October 2022].

Öresundskraft AB (2022d) *Öresundskraft AB: Om oss - Snabba Fakta*. Available at: https://www.oresundskraft.se/om-oss/snabba-fakta/ [Accessed: 24 October 2022].

Öresundskraft AB (2022e) *Öresundskraft AB: Om oss - Tillsammans för 17.* Available at: https://www.oresundskraft.se/om-oss/Tillsammansfor17/ [Accessed: 24 October 2022].

Öresundskraft AB (2022) *Öresundskraft AB: Om oss - Historik.* Available at: https://www.oresundskraft.se/om-oss/historik/ [Accessed: 24 October 2022].

Pressman, A. (2018) *Design Thinking*. 1st ed. [Online]. London: Routledge. Available at: https://doi.org/10.4324/9781315561936 [Accessed: 2 December 2022].

Profu (2017) *Klimatbokslut för energiföretag - Fördjupning*. [Internal document]

Profu (n.d.) *38 st företag med klimatbokslut*. Available at: https://www.profu.se/pdf/F%C3%B6retag%20med%20klimatbokslut.pdf [Accessed: 7 December 2022].

Röhne, J. (2022) *Börsjättarna som tar utsläppskostnaden*. Dagens Industri. Available at: https://www.di.se/hallbart-naringsliv/borsjattarna-som-tar-utslappskostnaden/ [Accessed: 19 October 2022].

Skoog, M. (2022) *Carbon management tools and corporate sustainability work*. Interview by authors. 18 November.

Sundberg, A. (2022) Input on workshop material.

Sundberg, A. & Hermansson, P. (2022) Introduction interview about the thesis.

TPI (2022) *TPI's methodology report: Management Quality and Carbon Performance*. Available at: https://www.transitionpathwayinitiative.org/publications/90.pdf?type=Publication [Accessed: 4 November 2022].

UN (2016) *List of Parties that signed the Paris Agreement on 22 April*. Available at: https://www.un.org/sustainabledevelopment/blog/2016/04/parisagreementsingatures/ [Accessed: 23 December 2022].

UN (n.d.) *SDGS - History*. Available at: https://sdgs.un.org/goals#history [Accessed: 23 December 2022].

UNEP, U.N.E.P. (n.d.) *Facts about the climate emergency.* Available at: https://www.unep.org/facts-about-climate-emergency [Accessed: 4 November 2022].

WBCSD, W.B.C. for S.D. & WRI, W.R.I. (2004) *The Greenhouse Gas Protocol*. Available at: https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf

West Duffy, M. & Fosslien, L. (2022) *Managers, What Are You Doing About Change Exhaustion?* Harvard Business Review. Available at: https://hbr.org/2022/05/managers-what-are-you-doing-about-change-exhaustion [Accessed: 1 December 2022].

Westerberg, J. (2022) *Profu - Climate accounting*. Interview by authors. 16 November.

WWF & W.W.L. (2022) *Effects of Climate Change - Overview*. Available at: https://www.worldwildlife.org/threats/effects-of-climate-change [Accessed: 23 December 2022].

Appendix A Interview guides for employees at Öresundskraft

Separate interview guides were made for each employee and adjusted for their specific role. The interviews were held in Swedish, as well as the interview guides, and have been translated.

A.1 Reoccurring questions to employees at Öresundskraft

All interviews started with a short introduction the project, and was ended with the following context and general questions:

The goal of our work is to develop a measure that provides guidance in investment decisions by comparing different investment options from both a climate and profitability aspect. This is to be able to help you reach climate neutrality by 2030. The idea is also that the measure can be used in the follow-up of decisions.

- What comes to mind when we say tool/measurement for climate benefits?
- What do you think such a measure can bring?
- What do you think might be problematic about implementing such a metric?
- What aspects are important to review when designing such a measure?
- What do you think is a good way to integrate a measure of climate with an economic measure?
    - What climate measure?
    - What economic measure?
- Are there any resources/documents that can be helpful to us in our work?
    - How can your work help us?
    - How can our work help you?
- How do you think such a metric should be implemented.

A.2 Charlotta Mühlow, Financial Manager

Initial questions

- Tell us about your role at Öresundskraft.
- Tell us about the Business Case/Investment Forum department

Main topics

Business Case/Investment Forum

- What does the Business Case/Investment Forum department do?
- What types of investments do you handle?
- What criteria do you use to make decisions?
    - E.g., profitability, present value analysis, pay-back, environmental aspects, connection to company strategy.
    - How do you take climate benefits into account in decisions today?
- What does the process for making decisions look like?
- Are there other important actors/stakeholders that influence your decisions?
- How does the follow-up of the decisions you make work?
    - Project level or organization level?
    - Climate?
- Is there an annual cycle for the work?
- What works well with the current work?
- What works less well with the current work?

Financial control

- How does Öresundskraft work with financial control?
    - What metrics do you use for governance and follow-up?
- Do you have an annual cycle that you follow for this?
- As a municipally owned company, how tightly controlled are you by return requirements?
    - Your annual report describes that you have a return requirement on capital employed of 6% per year. In 2021, this was 11.1%, how come you are so high above the set goal?

Summary

- Is there anything you would like to add?

A.3 Cecilia Andersson, Sustainability Strategist

Initial questions

- Tell us about your role at Öresundskraft.

- Tell us about the EU taxonomy project.

Main topics
The EU taxonomy at ÖKAB
- What is the purpose of your project?
- Who is working on the project?
- What resources are put into the project?
- What have you come up with so far?
- What time horizon is there on the project and how far have you come?
- Which of the 6 taxonomy goals is relevant to Öresundskraft?
- What works well with the project?
- What problems have you encountered so far in the project?

Sustainability and climate calculations at Öresundskraft
- What do you think needs to be worked on in the sustainability work at ÖKAB?
    - To reduce climate emissions/reach climate neutrality by 2030?
- What do you calculate climate emissions for currently?
    - How are the calculations made?
    - Who does it?
- What is your ambition regarding climate calculations?
    - How much do you want to measure?
    - What system boundaries do you want?
- What does it take to get started with these climate calculations?

Summary
- Is there anything you would like to add?

A.4 Niklas Kylvåg, PMO

Initial questions
- Tell us about your role at Öresundskraft

Main topics
Business Case/Investment Forum
- What types of investments do you handle?
- Tell us about the process of investing in Grow?
    - What steps does an investment go through?
- What criteria do you use to make decisions?
    - E.g. profitability, present value analysis, pay-back, environmental aspects, collaboration with a general strategy
    - How do you take climate benefits into account in decisions today?

- Are there other important actors/stakeholders that influence your decisions?
- How does the follow-up of the decisions you make work?
    - Project level or organization level?
    - Climate?
        - System level?
- Is there an annual cycle for the work?
- What works well with the current work?
- What works less well with the current work?

Summary

- Is there anything you would like to add?

A.5 Gustav Enoksson, Department Head of Network Planning

Initial questions

- Tell us about your role at Öresundskraft.

Main topics

- What types of investments do you handle?
- Tell us about the process of investments and projects in Run?
- Does the process look different from Grow/Transform?
- What steps does an investment go through?
- What criteria do you use to make decisions?
    - E.g. profitability, present value analysis, pay-back, environmental aspects, collaboration with a general strategy
    - How do you take climate benefits into account in decisions today?
- Are there other important actors/stakeholders that influence your decisions?
- How does the follow-up of the decisions you make work?
    - Project level or organization level?
    - Climate?
        - System level?
- Is there an annual cycle for the work?.
- What works well with the current work?
- What works less well with the current work?
- Are you working on the strategy of a Plan for a Planet?
- How can you bring more climate thinking into your business?

Summary

- Is there anything you would like to add?

A.6 Patrik Hermansson, Director of Strategy and Innovation

Introduction

What we've done so far:

- Investigated different measures of climate benefit
- Supervision from Anna. Interviews with Charlotta (The reorganization), Cecilia (EU taxonomy and sustainability work) and Niklas (The investment process in Grow/Transform)

What we want to get out of today's meeting)

- Talk about Öresundskraft's strategy work and financial management
- Present what we have produced so far and get your initial input.

Strategy & goals

- Would you like to tell us more about your group strategy "A plan for a planet"?
    - What is included in the strategy? What are your strategic goals?
    - What is the timeframe for the strategy?
- Are there concrete sub-goals for how the strategy will be achieved? What are these?
- What are the primary challenges when it comes to goals linked to your sustainability work?

Financial control)

- What metrics do you use for governance and follow-up?
- Do you have an annual cycle for follow-up of key figures?
    - E.g. that in May the key figures are presented to the board, then new goals are set for the coming years
- As a municipally owned company, how tightly controlled are you by return requirements?
    - Your annual report describes that you have a return requirement on capital employed of 6% per year. In 2021, this was 11.1%, how come you are so high above the set goal?
- Why do you use return on capital employed?

Updating the process

- Climate benefit is difficult to define, we will look at carbon dioxide emissions
    - Thoughts on that?
- Review the different metrics briefly
    - We have previously talked about Climate benefit on capital employed is difficult to use as a metric for investment assessments.
        - Thoughts on that?

Climate benefit as investment requirements

- What do you think the challenges of implementing a metric might be?
- What aspects are important to review when designing such a measure?
    - If you can dream, what does our measure help with?
- Are there any resources/documents that can be helpful to us in our work?
- How do you think such a metric should be implemented?
- Is there a business area where there are greater challenges in following the strategy?

Summary

- Is there anything you would like to add?

A.7 Jessica Hård, Head of Business and Innovation

Initial questions

- Tell us about your role at ÖKAB
- Examples of projects you do?
- How do you work in those projects?
    - Team members
    - Which stages of the projects are you involved in?

Main topics

We have talked to Niklas about Grow/Transform: How do you think the process for these investments, the creation of the Business Case, works today?

- What works well?
- What is problematic?

A.8 Gustav Enoksson, Department Head Network Planning

Initial questions

- Tell us about your role at Öresundskraft.

Main topics

- What types of investments do you handle?
- Tell us about the process of investments and projects in Run?
- Does the process look different from Grow/Transform?
- What steps does an investment go through?
- What criteria do you use to make decisions?
    - E.g. profitability, present value analysis, pay-back, environmental aspects, collaboration with a general strategy
    - How do you take climate benefits into account in decisions today?
- Are there other important actors/stakeholders that influence your decisions?
- How does the follow-up of the decisions you make work?
    - Project level or organization level?
    - Climate?
        - System level?
- Is there an annual cycle for the work?.
- What works well with the current work?
- What works less well with the current work?
- Are you working on the strategy of a Plan for a Planet?
- How can you bring more climate thinking into your business?

Summary

- Is there anything you would like to add?

Appendix B Interview guides for external interviews

B.1 Environmental Stategist, Helsingborgs Stad

Initial questions

- Tell us about your role and work at the City of Helsingborg

Main topics

Helsingborg Stad

- Helsingborgs Stad wants to be climate neutral by 2030, how does the municipality work for this?
    - How do you take decisions?
    - How do you follow up?
    - Do you have a specific budget line for climate work?
    - Do you have concrete tools/measures for this work?
        - E.g. calculation of CO2 emissions?
    - How does the City of Helsingborg think about the balance between economic factors and climate benefits?
- According to you, what role does Öresundskraft have in the work towards climate neutrality by 2030?
    - What is the City of Helsingborg's position on the balance between economic returns from Öresundskraft and minimizing CO2 emissions?
- Öresundskraft believes that they have done a lot right in terms of sustainability already, but that they want to take further steps in the future.
    - What do you think of their current work?
    - What works well and where are the development opportunities?

Climate benefits as investment requirements

In our thesis, we investigate how a measure that takes climate into account when making investment decisions can be designed, and how it can be supplemented with an additional measure that can be used for overall follow-up of Öresundskraft's climate emissions. We want to bring in different perspectives on

this, and therefore want to ask:

- What aspects do you think are important to review when designing such a measure?
    - If you were allowed to dream, what does our measure help with?
- Are there any resources/documents that you think can be helpful to us in our work?

Summary

- Is there anything you would like to add?

B.2 Jenny Westerberg, Profu and Kristin Johansson, IVL

Initial questions

- Tell us about your role.

Main topics

The consequence perspective - Investment assessment

- Do you work with companies that use climate calculations as a basis for investment decisions?
    - How does it work?
    - Who has implemented this?
    - Is this weighed against profitability in any way?
    - What are the challenges in this work?
    - What resources are required for a company the size of Öresundskraft?
        - Number of employees
        - Hours of work
        - Do you think they need to hire more people than are currently working on the issue (1 person)?

The accounting perspective - Follow-up

- How long does it take to make a climate report according to the accounting perspective?
    - What resources are required for a company the size of Öresundskraft?
        - Number of employees
        - Hours of work
        - Do you think they need to hire more people than are currently working on the issue (1 person)?
- What are the challenges in creating a climate report?

- What synergies are there between the accounting perspective and the impact perspective?
- Others who have similar ambitions to make trade-offs between climate and profitability?

Summary
- Is there anything you would like to add?

B.3 Staffan Fredlund, Sustainability Strategist, Wihlborg

Initial questions
- Tell us about your role.

Main topics
- Describe how ICP is used in your company.
    - Is it a shadow price or actual price used?
    - How are your climate calculations made?
        - What system limits are used (Scope 1, 2, 3 & avoided emissions)?
        - Why these?
- How far have you come with the implementation of ICP?
- What has the implementation been like?
    - Have you had training sessions?
    - Have you hired new people to work on this?
    - Are there other resources you have needed?
- How has the measure been received in the organization, high and low?
- What challenges have you seen so far with the implementation?
- If you could redo something during implementation, what would it be?
- Are there scenarios where you cannot let the new price that will result from ICP rule?
- Did you consider any other options besides the ICP when investigating whether to introduce the measure?
- Is ICP also used for follow-up of projects and at the organizational level or only in investment decisions?

Summary
Is there anything you would like to add?

B.4 Matti Skoog, Professor in accounting and governance at Åbo Akademi

- Our hypothesis – initial thoughts?
- Recommendations of sources/experts on this topic?
- Do you know of any concrete tools for internal governance? Other companies working on this?
- Concrete incentives for sustainability reporting and governance?
- Can you give examples of support processes?
- Models presented during the seminar - have you created these yourself or found in literature?
    - Key figures, measurement data, activity, control effects
- We are thinking about building our measure on climate calculations as a basis for investment decisions and are thinking about what extra resources will be required to start performing climate calculations.
    - Do you know any companies that have implemented this?
    - What are the challenges in this work?
    - What resources are required for a company the size of Öresundskraft?
        - Number of employees
        - Hours of work
        - Do you think they need to hire more people than are currently working on the issue?
- You said yesterday "It's good to approach sustainability from a financial perspective" - do you want to develop on that?
- What is common mistake companies make when trying to establish internal governance of sustainability?

Appendix C Workshop material

Current state

Literature study
- Energy Industry
- Measuring/reporting carbon emissions and system boundaries
- Climate accounting tools

External interviews
- Milou Mandolin - Helsingborg Stad
- Lars Bengtsson - Guidance

Suggest preferred tool
- Evaluate tools based on external and internal sources
- Suggest a preferred tool

Final presentation
- Recommendation of tool and implementation plan

Internal interviews
- Anna Sundberg - Guidance
- Cecilia Andersson - EU Taxonomy
- Charlotta Mühlow - Financial mgmt.
- Niklas Kylvåg - Investment Process
- Patrik Hermansson - Strategy
- Jessica Hård - Innovation

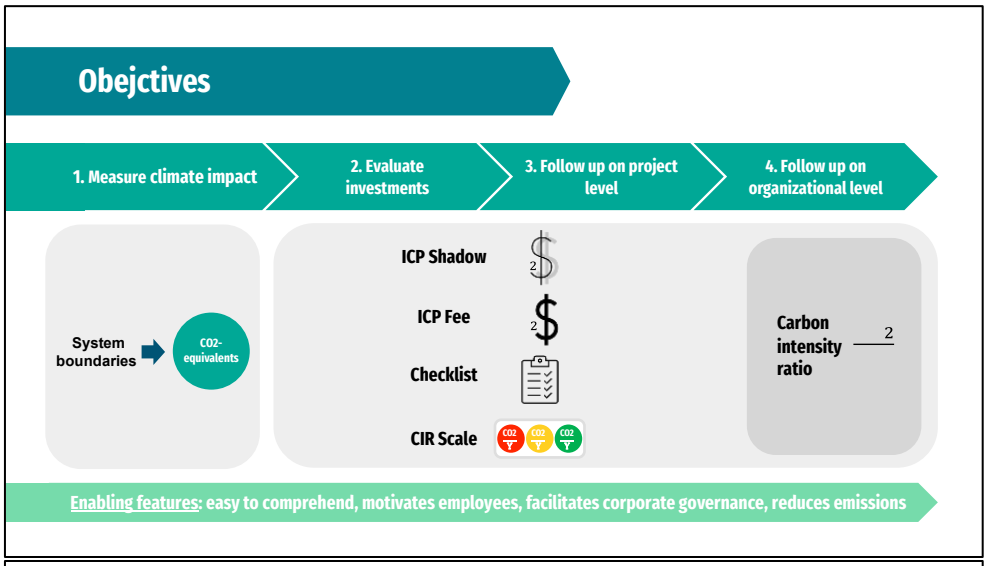
Workshop: Tools
- Present alternatives
- Gather input

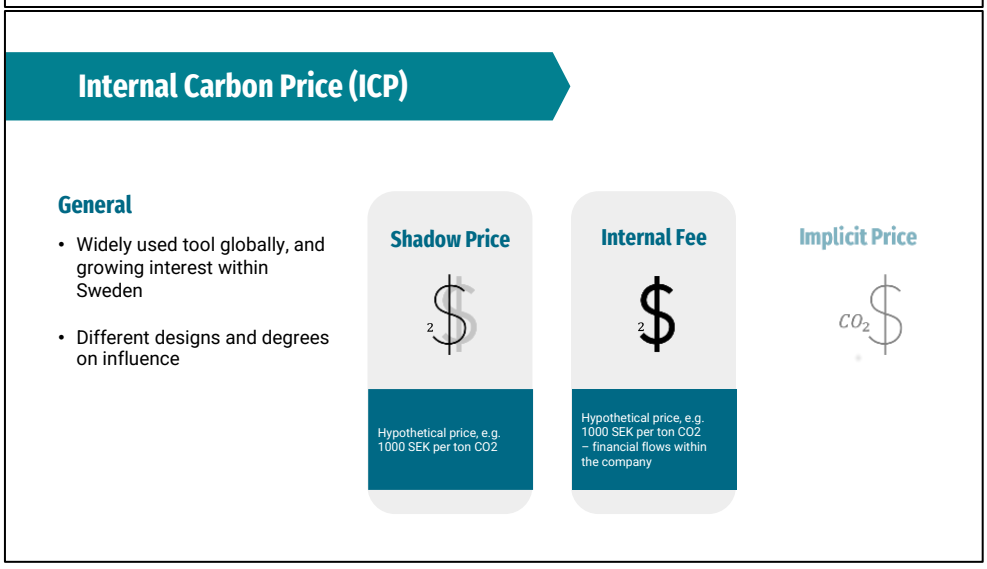
Today's meeting

Implementation plan
- Evaluate how the tool should be implemented
- Discuss resources, responsibilities and process integration

Overview of tools

Internal Carbon Price: Shadow Price	Internal Carbon Price: Internal Fee	Checklist	Carbon intensity ratio	Carbon intensity ratio scale
Hypothetical price, e.g. 1000 SEK per ton CO2	Hypothetical price, e.g. 1000 SEK per ton CO2 – financial flows within the company	Evaluating projects based on a checklist of aspects	Putting carbon emission in relation to another metric	Putting carbon emission in relation to another metric. Classifying output according to a scale.


Obejctives
1. Measure climate impact
2. Evaluate investments
3. Follow up on project level
4. Follow up on organizational level
System boundaries
CO2-equivalents
ICP Shadow
ICP Fee
Checklist
CIR Scale
Carbon intensity ratio
Enabling features: easy to comprehend, motivates employees, facilitates corporate governance, reduces emissions


Internal Carbon Price (ICP)
General
• Widely used tool globally, and growing interest within Sweden
• Different designs and degrees on influence
Shadow Price
Hypothetical price, e.g. 1000 SEK per ton CO2
Internal Fee
Hypothetical price, e.g. 1000 SEK per ton CO2 – financial flows within the company
Implicit Price

Tool 1: ICP – Shadow Price

Description

Hypothetical price on carbon e.g. 1000 SEK per ton CO2

Most common ICP metric

Used for sensibility analysis for the risk of actual carbon prices

Usage area

Primary usage: Incorporation into financial calculations for **investments decision**

Primary usage within industry: **Sensibility analysis of investments** for the risk of actual carbon prices

Advantages

- **Easily communicated**
- **Easily implemented**
- **Commonly used**

Challenges

- **Does not necessary have an impact** on decision making
- **Difficult** to determine a reasonable price

Tool 2: ICP – Internal Fee

Description

Hypothetical price on carbon e.g. 1000 SEK per ton CO2, sent to a internal fund

Fund could be **earmarked money for sustainability projects**

Usage area

Primary usage: Incorporation into financial calculations for **investments decisions**

Advantages

- **Easily communicated**
- **Commonly used**
- **Fund for specific projects**
- **High impact**

Challenges

- **Difficult to determine a reasonable price**
- More **difficult to implement,** system needs to be set-up, behavioural
- **Risk of misallocation of resources**

Tool 3: Checklist

Description

Metric **based on questions**. Could be either yes/no or a scale. Can also **include other environmental aspects.** May result in a score

Questions about e.g.:
- Carbon emissions
- Effect on peak loads
- Natural resource use
- Classification by taxonomy

Similar methods are used for assessment of companies from an outside perspective

Usage area

Primary usage: **Decision making**

Could also be used for **follow up** on a business unit or company level if it results in a score

Advantages

- **Encourage analysis effects on system level** – not only relying on scope 3 emissions
- **Avoids carbon tunnel vision, covers more aspects**
- **Easily implemented**

Challenges

- Relying on qualitative analysis, **risk of subjectivity**, may reduce comparability between projects
- **Weak connection to financial figures**
- **Does not necessarily have an impact** on decision making

Tool 4: Carbon Intensity Ratios

2

Description

Intensity ratios express **GHG emission impact per unit** of physical activity or economic output

Examples of denominators:
- Capital Employed
- Turnover
- KwH (ÖKAB uses)

Widely used metrics in sustainability reports *(Exception: GHG over Capital Employed)*

GHG Protocol: **Optional to report**

Usage area

Primary usage: **Follow-up** on a business unit or company level

Carbon reduction goal as a percentage point decrease

Advantages

- **Easily communicated**
- **Easily implemented**
- **Widely used** for follow-up

Challenges

- **Based on historical data**, difficult to implement as a forward-looking metric

Denominator specific:
- GHG over Capital Employed: **Limited literature**, not widely used. **Decreased amount investments** will affect the metric
- GHG over Turnover: **Sensitive to price fluctuations**

Tool 5: Carbon Intensity Ratio Scale

Description

Scales can be used to **label projects** into different categories **based on a carbon intensity ratio metric,** CO2 emissions divided with e.g. investment cost

Scale of green, yellow and red light could be developed

Red or yellow projects required to be **assessed more thoroughly**

Usage area

Primary usage: **Highlight the carbon impact** of a project prior decision making.

Secondary usage: Ensure that **carbon intensive projects are thoroughly assessed** and motivated. **Increase of requirements on other criteria**

Advantages

- **Easily understood**
- **Easily implemented**

Challenges

- **Difficult to determine levels**
- **Does not necessarily have an impact** on decision making

Input on tools

General

What should be **accomplished** with a **new tool for measuring climate benefits**?

Tool specific

Tools for decision making:
1) ICP – Shadow price
2) ICP – Internal fee
3) Checklist
4) CIR Scale

What are the **pros and cons** of respective tool?

Next step: Implementation

What do you think will be the **reaction from the organization** when implementing a tool?

What could be **potential obstacles**? How can these be **mitigated**?

How can these tools be **implemented** in existing structures?

Instructions for use (free users)

In order to use this template, you must **slidesgo** by keeping the Thanks slide.

You are allowed to:

- Modify this template.
- Use it for both personal and commercial purposes.

You are not allowed to:

- Sublicense, sell or rent any of Slidesgo Content (or a modified version of Slidesgo Content).
- Distribute this Slidesgo Template (or a modified version of this Slidesgo Template) or include it in a database or in any other product or service that offers downloadable images, icons or presentations that may be subject to distribution or resale.
- Use any of the elements that are part of this Slidesgo Template in an isolated and separated way from this Template.
- Delete the “Thanks” or “Credits” slide.
- Register any of the elements that are part of this template as a trademark or logo, or register it as a work in an intellectual property registry or similar.

For more information about editing slides, please read our FAQs or visit Slidesgo School:
https://slidesgo.com/faqs and https://slidesgo.com/slidesgo-school