Decarb Compass

Navigate Smart Fuel Decisions

Empowering Sustainable Decision-making in the Maritime Industry.

Master Thesis

Gigi Bouman

Decarb Compass
Navigate Smart Fuel Decisions

MASTER THESIS

Gigi Bouman (4644999)
Integrated Product Design, TU Delft
March 2025

SUPERVISORY TEAM

Natalia Romera Herrera - *as Chair*
Vibhas Mishra - as *Mentor*

In collaboration with

Osprey Energy Marine

TU Delft

PROJECT TITLE

Designing a Socio-Digital Tool to Drive the Green Bunkering Transition

Helping Traders and Shipping Companies Turn Sustainability into Action.

As a reader, this marks the beginning of your experience. For me, this is the final piece of writing that marks the end of a meaningful journey: the end of my time as a student at the TU Delft. I hope this reading may spark or contribute to your perspectives and bring additional value to the way in which we approach sustainability and communication in complex contexts.

Preface

This thesis is about the development of a digital tool to promote the sustainable fuel transition in the maritime sector. The project has taught me a lot about sustainability, (behavioural) communication, strategic (digital)design, and scenario design.

The project was a unique opportunity for me to combine practical experience and available resources in a design process and solution that is relevant and necessary for a critical and emerging sustainable (maritime) transition. Hopefully, this project can contribute meaningfully.

I want to take this opportunity to thank a few people in particular who contributed and helped along the way. Their support meant a lot to me.

Foremost, my chair, Natalia Romero Herrera, for her interest in the project from the beginning, the guidance, and the always constructive and valuable feedback. I would also like to thank my mentor, Vibhas Mishra, who I could count on and who invested a great deal of effort and attention into coaching me throughout the project. The guidance of both was enjoyable, and they helped me bring clarity to my choices and stay focused on the process, even during times when I was struggling. I wouldn't have wanted to do this project without them.

In addition, I would like to thank the company and all my colleagues at Osprey Energy. Without them, I would have never started this project, nor would I have gained the knowledge and insights I have today. I am also grateful for the opportunity and input during the project, which helped me make important design choices.

I am excited about what lies ahead and feel curious and motivated to start the next chapter: my career journey.

Wishing you a pleasant and insightful read,

Gigi Bouman

Abstract

The maritime sector is under pressure from emission reduction regulations resulting from climate laws such as Fit for 55. With the introduction of the FuelEU Maritime regulations, which have been active since 2025, shipping companies and fuel traders are confronted with new requirements and complex decisions to reduce emissions. Solutions include retrofitting and switching to low-carbon fuels. These regulations will also indirectly impact fuel suppliers and traders, as demand for alternative fuels and strategies will increase.

Regarding the above, larger companies have the resources and capacity to respond and adapt adequately. For smaller and medium-sized companies, there are barriers that hinder or delay the transition. It is important that fuel companies also participate in the transition. Within fuel and bunker trading companies, there are traders who can play an important role as intermediaries in promoting low-carbon transition fuels. However, traders also face obstacles in communicating about sustainable fuels and regulations.

Therefore, this research focuses on the development of a digital tool that can support traders in communicating fuel options more effectively and stimulate informed decision-making towards the adoption of low-carbon transition fuels among shipping companies. A digital tool can positively influence and facilitate substantive communication and understanding between both stakeholders. The research project follows an iterative Double Diamond Design process divided into phases.

The project started with an in-depth exploration of the context, internal processes, regulations, (behavioral) barriers, and drivers among the main stakeholders. This highlighted bottlenecks such as uncertainty or the lack of knowledge and tools. But it also showed opportunities and strategies that could be implemented to stimulate communication and adoption, such as nudging strategies, intervention moments and the need for stakeholder collaboration.

Based on the insights gained, a design scope has been established, and a design vision has been defined that offers direction and constraints for the project. From that, concrete design goals and requirements have been formulated to encompass all needs and design choices.

These principles translated into 3 envisioned scenarios (standard relationship processes between stakeholders), from which associated concept ideas emerged for a calculation tool that provides strategic insight into fuel, compliance, and costs.

These concept ideas were tested with traders and found useful, effective, and strategically valuable. Traders expressed a need for a flexible and effective tool with clear insights that supported various customer interaction moments regarding sustainability, costs, and compliance.

After this validation and further insights, a final concept tool was developed with additional materials such as a toolkit, roadmap, leaflet, and mail report. All are designed to ensure the implementation and communication of the tool and its adoption, and to maximize impact. The tool is designed to meet the process and interaction needs of stakeholders. It enables fast and low-threshold scenario analyses and strategic decision considerations. In addition, it stimulates and improves stakeholder relations, makes benefits visible, minimizes barriers, and can be utilized in multiple usage scenarios.

The tool offers a scalable foundation for future digital solutions supporting informed communication and decision-making about sustainable fuel choices in the maritime sector.

Glossary

List of Abbreviations

AI – Artificial Intelligence– Carbon Intensity Indicator
CII – Carbon Intensity Indicator
CO_2 – Carbon Dioxide
COM-B – Capability, Opportunity, Motivation – Behaviour
EEXI – Energy Efficiency Existing Ship Index
EU ETS – European Union Emissions Trading System
FUELEU – FuelEU Maritime
GHG – Greenhouse Gas
HVO – Hydrotreated Vegetable Oil
IMO – International Maritime Organization
ISCC – International Sustainability and Carbon Certification
KPI – Key Performance Indicator
LCV – Lower Calorific Value
MRQ – Main Research Question
MRV – Monitoring, Reporting and Verification
MVP – Minimum Viable Product
OPS – Onshore Power Supply
PMI – Plus Minus Interesting
RED II – Renewable Energy Directive II
RQ – Research Question
SUBRQ1 – Sub Research Question 1
SUBRQ2 – Sub Research Question 2
SUBRQ3 – Sub Research Question 3
SUBRQS – Sub Research Questions
TTM – Transtheoretical Model
WtT – Well to Tank
TtW – Tank to Wake

AI
CII
CO_2
COM-B
EEXI
EU ETS
FUELEU
GHG
HVO
IMO
ISCC
KPI
LCV
MRQ
MRV
MVP
OPS
PMI
RED II
RQ
SUBRQ1
SUBRQ2
SUBRQ3
SUBRQS
TTM
WtT
TtW

Contents

Overview of chapter in this report

1. PROJECT INTRODUCTION

In this chapter, an introduction of the project and initial problem statement is presented.
Moreover, the party involved, design approach of the project and overview of the main design activities performed are illustrated.

1.1 The Brief

Short introduction on the initiation and forming of the project.

Halfway through my Master's, I joined Osprey Energy, where I took part in building the foundation of operations for the newly established subsidiary, Osprey Energy Marine.

Here, I learned about the process of Bunker deliveries, the procedure, the parties involved, and general industry know-how. Additionally, I noted the pressing need and regulatory pressure focusing on reducing emissions in the sector (European Council of the European Union, 2023).

Within the sector, large shipping companies are participating in decarbonization solutions, but they are more often focusing on the technical aspects. However, the fuel purchasing process (elaborated in Chapter 2.2.1) is still traditional and seems to fall behind or does not take sustainability into account (that often) yet. This research, therefore, examined where interventions can improve this process. The discovered touchpoints for sustainable interventions are highlighted in Chapter 3.3.1.

On the other hand, a few oil trading companies are taking the lead in educating and providing sustainable initiatives to their clients. They differentiate themselves by leveraging reducing emissions and the regulatory landscape, which strengthens their position in the market.

Within the shipping industry, this is also needed, as understanding the evolving regulations requires knowledge, and the information presented by the authorities is comprehensive. This creates a barrier for small and medium-sized companies. Fuel providers use this to their advantage to bring value and retain their clients.

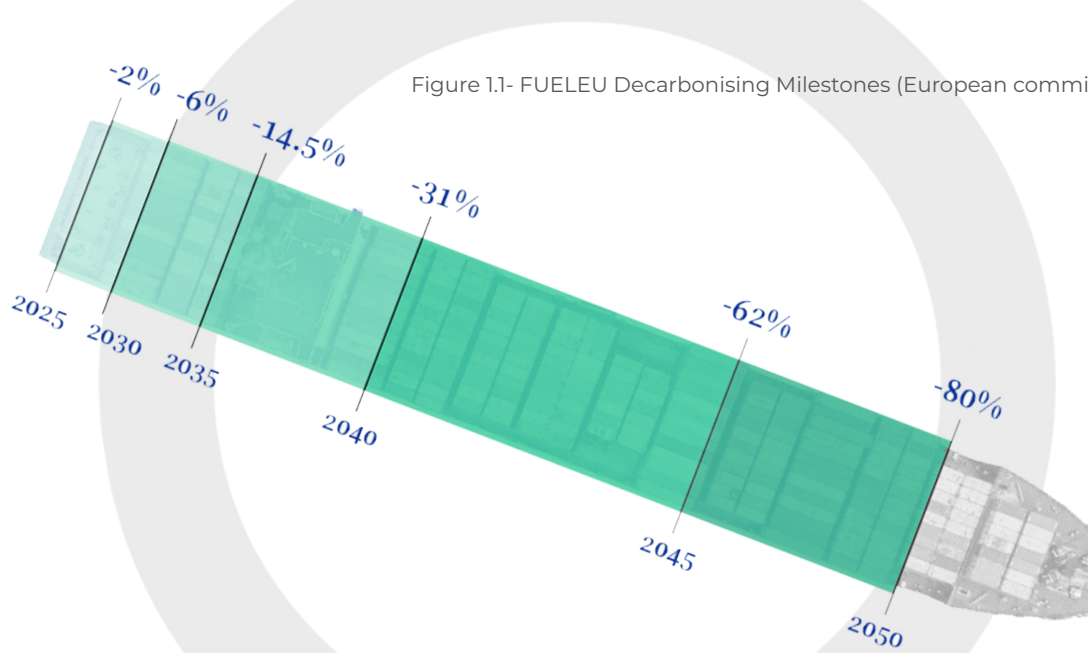


Figure 1.1- FUELEU Decarbonising Milestones (European commi

Therefore, I saw an opportunity within the company to put more emphasis on reducing emissions and generating impact for the shipping clients. With this in mind, I took the FuelEU maritime regulation as a starting point. This, is by using the requirements of the Regulation as a guideline to design a tool that aligns with and helps achieve the stated FUEL EU Maritime emission reduction targets.

FuelEU Maritime aims to reduce the maritime sector's carbon footprint by incentivizing the demand for renewable and low-carbon fuels (European Commission, n.d.-a). This is done by setting reduction targets that gradually increase over time, starting with 2% in 2025 and increasing to 80% by 2050 (Figure 1.1). With this initiative, there will be more investment, innovation, production, and uptake of sustainable fuels at more competitive costs.

sion, 2023).

The assessment of emission impact requires information, knowledge, and communication efforts. Information refers to reliable data on emissions, compliance standards, and fuel options. Knowledge means understanding and interpreting data to make informed choices. Communication efforts guarantee that this information and knowledge are successfully communicated to decision-makers in a clear and understandable manner.

A fuel-providing company can and is in the position to communicate these efforts more seamlessly and facilitate a more straightforward decision-making process whereby greater reduction can be achieved. This insight served as the foundation for this research, leading to the following research question:

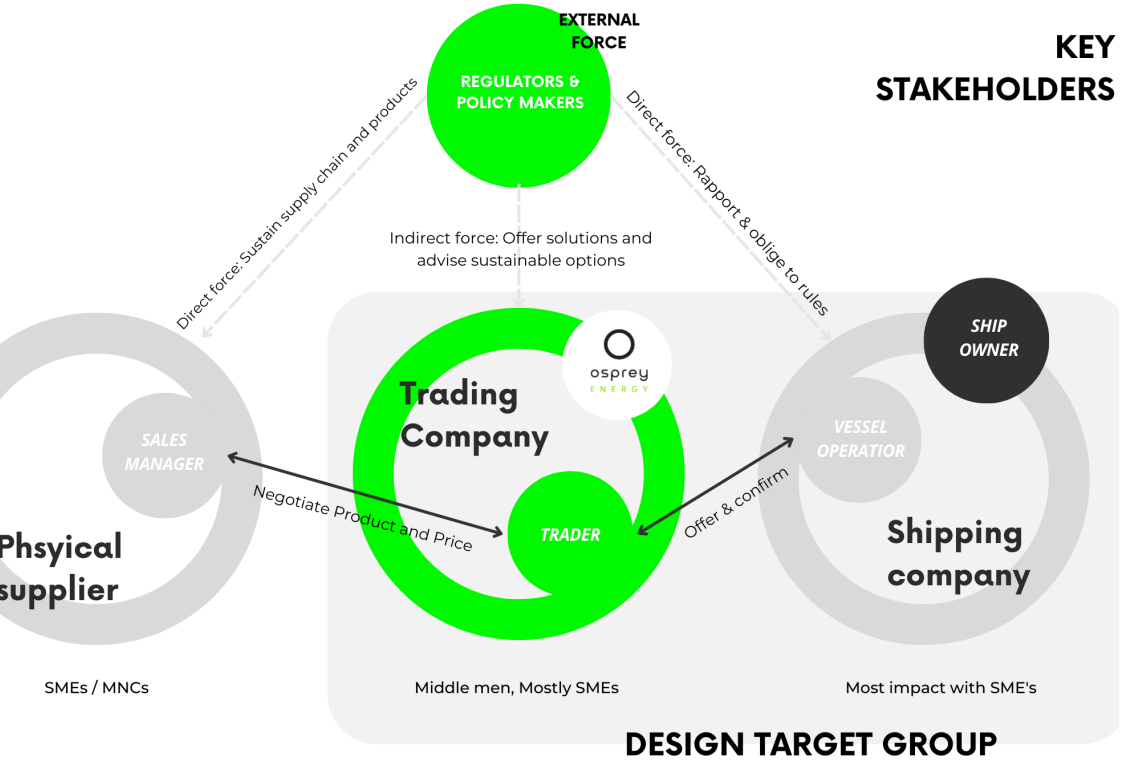


Figure 1.2- Key Stakeholders..

► How can a fuel-trading company use a simulation dashboard to communicate sustainability efforts more seamlessly to shipping companies, with the goal of achieving greater emission reductions?

Figure 1.2 shows the main stakeholders, in which trading and shipping companies are highlighted as the design target group within this project. Other actors are relevant but outside the design scope. All three stakeholders experience a direct or indirect force to decarbonize. Trading companies make an active effort to establish and maintain a relationship with shipping companies, whereby trading companies act as intermediaries and, to a certain extent, also enter into a relationship with the supplier. The employees of the trading companies are traders who connect and communicate with vessel owners, operators, or managers.

Within the stakeholder context, Osprey Energy Marine is a trading company for its customers. Occasionally, depending on the location and the product, Osprey Energy may also act as a supplier for deliveries.

To ensure that the acceptance and uptake of more biofuels is properly implemented among key stakeholders, the following design brief has been formulated as a starting point for this project:

► Design a simulation dashboard for a fuel trading company that supports traders in empowering shipping companies to strategically assess sustainable fuel options, for compliance with upcoming mandatory EU decarbonization targets

1.2 Research Questions

In this chapter, the Main Research Questions (MRQ) and the Sub Research Questions (SUBRQ) have been outlined.

The formulation of the MRQ came from the growing and unconscious need for more effective communication between the target stakeholders regarding alternative fuel options. As regulatory pressure increases and the maritime sector faces decarbonization challenges, traders must bridge the gap between compliance requirements and operational decision-making. However, sustainability efforts are often complex, difficult to quantify, and challenging to integrate into business conversations. The MRQ is defined as follows:

RESEARCH QUESTION

How can a fuel-trading company use a simulation dashboard to communicate sustainability efforts more seamlessly to shipping companies, with the goal of achieving greater emission reductions?

Chapters that contribute greatly to the Main Research Question (MRQ):

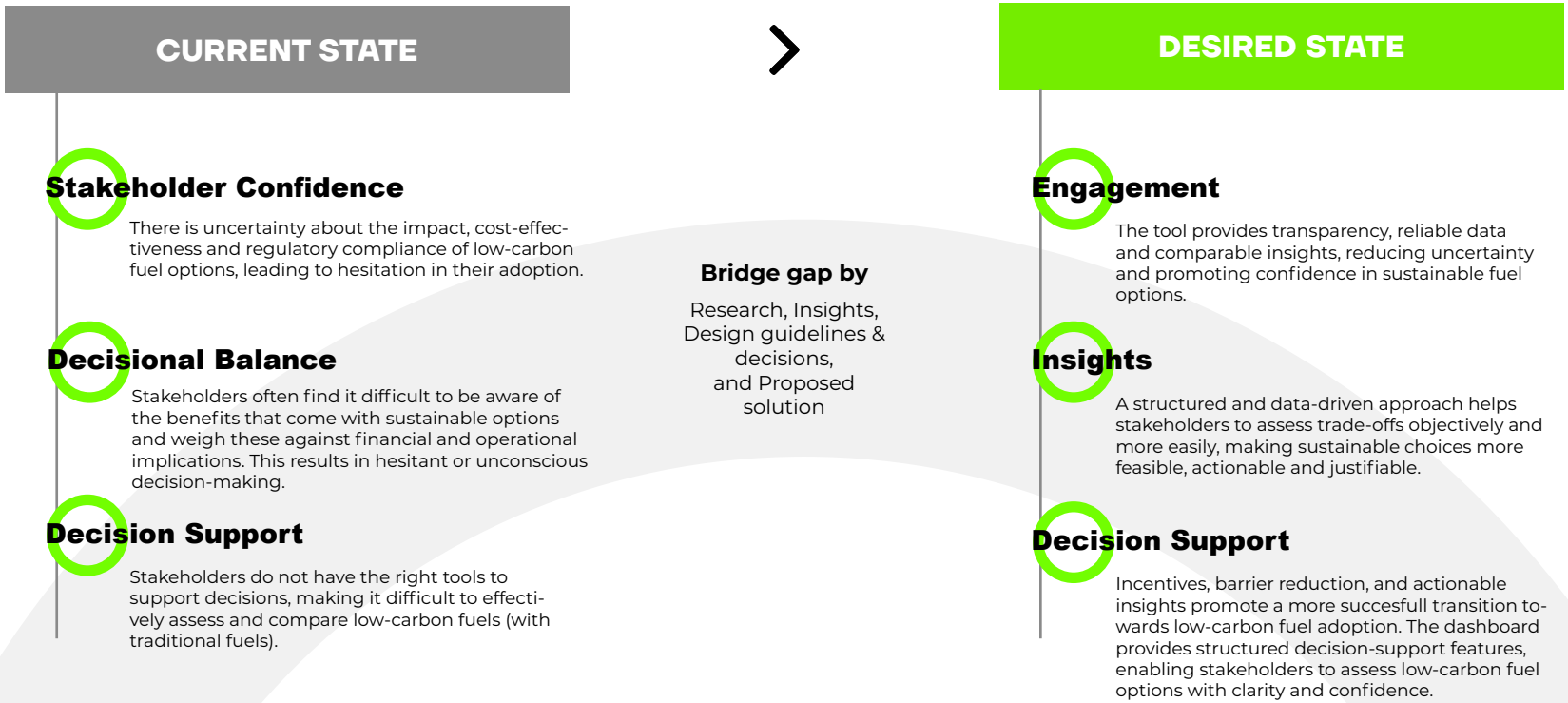
1.1 The Brief: Establishes and introduces the need for the MRQ.
2.1 Stakeholders: Defines stakeholders and covers their emission reduction drivers.
2.2 Industry Research: Highlights regulations that force and drive emission reduction, covers the opportunity trading companies and traders have to help shipping companies minimize risks and decarbonize through communication.
2.3 Behavioural models: Covers Behaviour models that provide a theoretical foundation for the dashboard that allows design for behaviour change.
3.3 Design Vision: A Design Vision was formed to guide the development of the design phase in line with the MRQ.

Increasing trust and improving the decision balance between stakeholders are essential to support and transition to low-carbon fuel adoption and solutions. Traders, shipping companies, and decision-makers in the companies need to trust in the feasibility and understand the benefits and implications that come with sustainable fuel options. The tool can help with this if it increases stakeholder confidence through transparency, (scenario-based) analysis, and clear value demonstration. Therefore, the following sub-research question was formulated:

SUB RQ1

How can stakeholders' confidence and decisional balance be stimulated to support the adoption of low-carbon fuels?

By answering, addressing and implementing the research question correctly, the following positive changes can be achieved:



Effective communication in the deal-making and relationship-building process is crucial for adopting sustainable fuels. Traders and shipping companies rely on trust, negotiation, and strategic relationships that provide information, benefits, and resources, and employee dynamics are at play. It is essential to understand these dynamics when designing a dashboard that supports seamless collaboration and decision-making and can position itself within current workflows. Therefore, the following sub-research question has been formulated:

SUB RQ2

How can the dashboard align with stakeholders' deal-making and relationship-building processes to enhance communication?

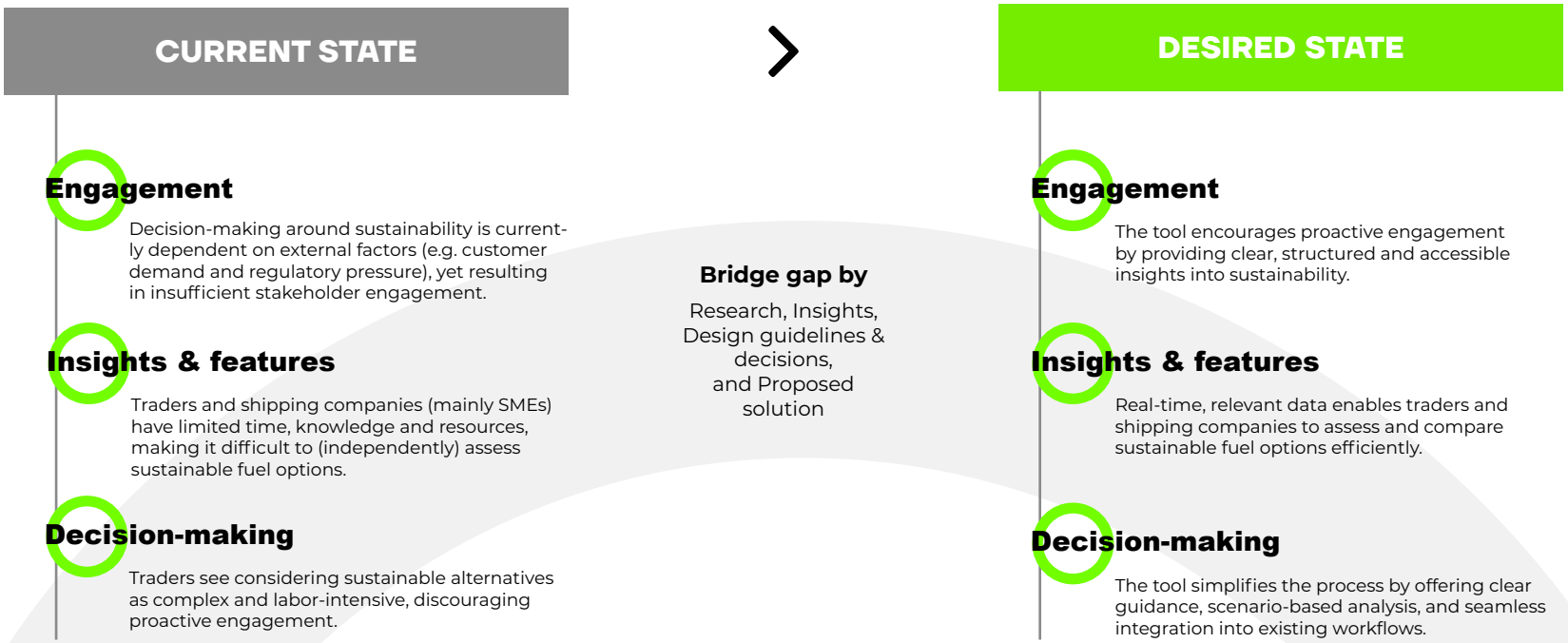
By answering, addressing and implementing the research question correctly, the following positive changes can be achieved:

CURRENT STATE		DESIRED STATE
Sustainability Sustainability is often a reactive topic of conversation for traders, depending on external pressure (customers/regulations).	Bridge gap by Research, Insights, Design guidelines & decisions, and Proposed solution	**Sustainability** Sustainability is proactively communicated as a strategic advantage in relationships, negotiations and inquiries.
Information Traders have limited knowledge about the benefits of biofuels and regulations, which prevents them from discussing this with clients.		**Information** Efficient, clear and relevant (real-time) insights support traders to present better substantiated sustainable choice options and customers to consider sustainable offerings.
Decision-making Shipping companies and traders are not conscious about making sustainable choices.		**Decision-making** The dashboard provides decision support to make sustainable choices easier and feasible

To facilitate sustainable decision-making (in compliance with regulations), traders and shipping companies need access to relevant and clear insights. A tool can provide and support stakeholders in making well-considered sustainable choices. The tool should integrate the right contextual features and insights to enable users to act proactively. Therefore, the following sub-research question was formulated:

SUB RQ3 What dashboard features and insights are required to foster engagement and simplify sustainable decision-making?

By answering, addressing and implementing the research question correctly, the following positive changes can be achieved:



1.3 The Company

About Osprey Energy and its subsidiaries

The project explores the world of Marine Bunker trading, supply, and sustainability industry-specific initiatives, which is feasible due to the experience and involvement of **Osprey Energy Marine.**

Osprey Energy is a younger fuel industry player which its main interest to deliver innovative and sustainable energy solutions. Since 2018 they are operating in Denmark, The Netherlands and France and over the past two years they have expanded their operations and become a global partner.

Osprey Energy operates through multiple divisions of which most importantly: Road, Marine and Carbon. Their operations cater the road and vehicle supply, trade marine bunkers and provide carbon managements helping businesses reduce their offset. Next to that, they have an exclusive trading and supply network, and they have storage and blend facilities in the Netherlands and Denmark.

Within this project, the main involvement will be of Osprey Energy Marine. Their focus is on trading marine bunkers as well as provide fuel solutions for the maritime industry, such as (un)conventional fuels, pricing strategies, biofuels and sustainability initiatives. They have a global network of suppliers and industry experts, allowing them to offer the right fuel options in many locations. As the industry is receiving pressure to lower emissions, they are transitioning into providing solutions to their clients that reduce emissions.

In-line with offering greener solutions, Osprey Energy had successfully obtained the ISCC certification which ensures the traceability, sustainability and quality of the renewable fuels in their supply chain (Osprey Energy, 2024). Enabling the distribution of auditable measurements and reductions of biofuels from certified feedstocks (ISCC, n.d.).

1.4 Design Approach

Explanation about the project design approach used and steps taken within the phases

The double Diamond design framework has been chosen as the leading design approach within this project. The framework is a design process that consists out of four stages: Discover, Define, Develop and Deliver and is a method taught at the Bachelor of Industrial Design at the TU Delft and also widely used in the subsequent master's courses. Figure 1.3 illustrates the visual representation of the framework (design council, n.d.).

The first diamond focuses on understanding the problem space while first exploring the topic and relevant angels by gathering insights. After this collection of insights, focus lies on identifying the key challenges and defining the core for the project. The outcome of this phase is a redefined project definition based on previous insights.

Following, the develop phase is mainly an iterative ideation process where concepts are brainstormed, validated tested and developed to provide a fitting and effective solution to the redefined project definition. Lastly, the most effective concept will be further developed and improved on smaller scale while taking into account recommendations and limitations.

One of the key design principles valid during the whole design approach is iterating, which also is considered vital during this project. Meaning, there is a continuous cycle of redefining along and within the different phases. This to improve understanding and make corrections and include new findings.

Within this project, the focus will be on designing a dashboard that will support the stakeholder's readiness for change by moving them from the pre-contemplation stage, where there is no awareness and understanding, to the contemplation stage, where they can consider decarbonization efforts in their operations (Friman et al., 2017)

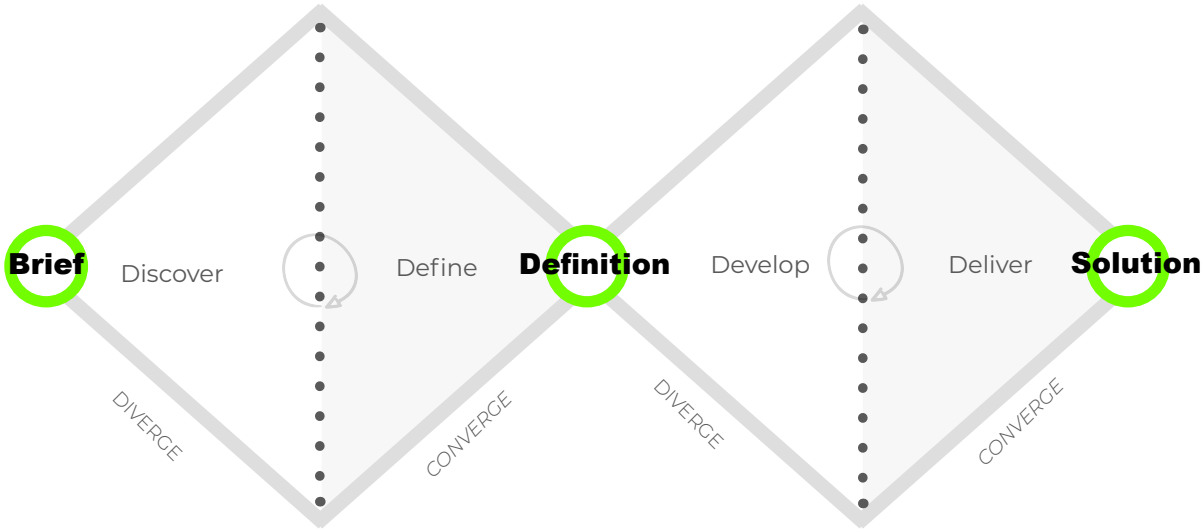


Figure 1.3 Visual illustration on the Double Diamond process

1.5 Design Overview

This chapter provides an overview of the main research and design activities conducted throughout the project. Each phase follows an approach with Methods and activities to explore, define, develop, and validate key aspects, leading to a final deliverable: a demo tool. The main activities are outlined in each phase in the overview below.

Discover

- Analysed how stakeholders approach sustainable fuels and which factors influence their behaviour.
- Investigated existing decision-making processes, and regulations and their impact on fuel choices.
- Identified what obstacles and motivations play a role in switching to sustainable fuels
- Reviewed the decarbonizaiton landscape, existing tools and behavioral theories to determine implementation strategies.

Define

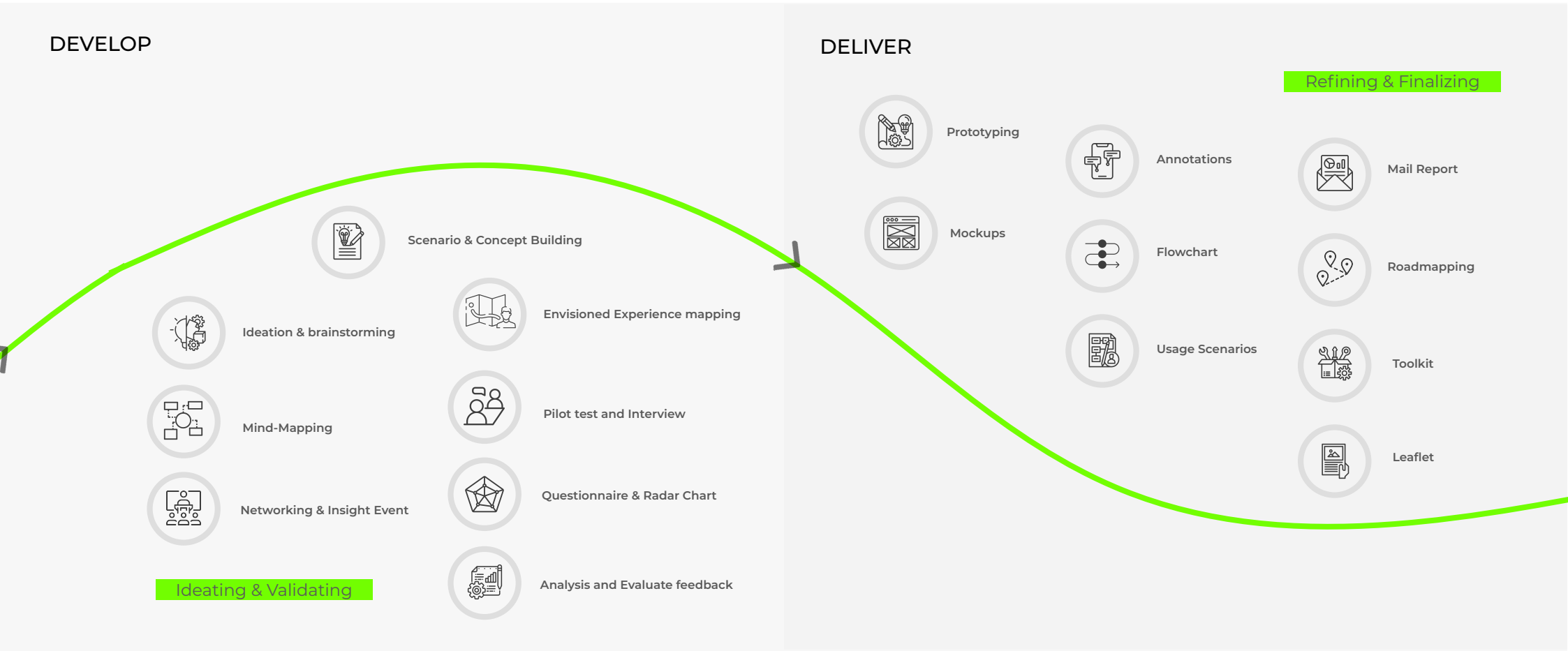
- Gathered and defined which factors and barriers play a role in adoption and where opportunities exist.
- Defined context and user requirements to support design decisions.
- Drawn up how the tool should connect to work processes and communication between stakeholders.
- Formulated which requirements and design goals are needed as guidelines for the development of the tool.

Develop

- Brainstorming sessions and activities are performed to form envisioned scenarios, concepts, and functionalities.
- Storyline writing and scenario mapping to explore the tool across use cases.
- Interviews and questions were conducted to validate scenarios and concepts.
- Insights tested and evaluated via quantitative and qualitative analyses to gain insight into interaction preferences and to substantiate (further) design choices.

Deliver

- Iterative prototyping to optimize the (data) visualizations and mock-ups.
- Mock-up designs that integrate findings and ensure an effective and user-friendly interaction.
- User flow mapping to visualize the tool processes.
- (Technical) annotations to clarify understanding, decision-making, and tool impact and verify technical needs.
- Usage scenarios developed to demonstrate real-world applications.
- Supporting materials (Mail Report, Toolkit, Roadmaps, and leaflet) designed to enhance tool implementation and communication.



2. DISCOVER

In this chapter, conducted research and insights are presented that originate from the discover phase of the design approach.

2.1 Discover Overview

This introductory chapter illustrates how the following chapters contribute to and analyze how a dashboard can stimulate sustainable fuel communication and adoption. This is needed because the transition process is influenced by various aspects.

This chapter explores various aspects to define the role of a simulation dashboard. The goal is to understand how a fuel-trading company can seamlessly communicate sustainability efforts using a dashboard, so that the adoption of low-carbon fuels is stimulated and emissions reductions are achieved (MRQ). This is analyzed based on the main question and three sub-questions accordingly in the following chapters.

Chapter 2.2.1 - Stakeholder Analysis

To understand how a simulation dashboard could enhance communication about sustainable fuels between the target users, it is necessary to examine the interactions between stakeholders in the bunker purchasing process. This analysis helps to answer the question of how stakeholders' trust and decision-making processes can be influenced to stimulate biofuel adoption (SUBRQ1). In addition, it helps to identify which decision-making structures and relationships between parties are relevant for the implementation of a dashboard that supports the deal-making process (SUBRQ2).

This analysis includes stakeholders that *(1) influence the adoption of sustainable bunker fuels, (2) are involved in the deal-making process or fuel choice, and (3) play a role in the communication about fuel options and sustainability*. In addition, it identifies the key figures that have the largest role in the process and for the development of the dashboard. This analysis was carried out independently by qualitative and visual methods, including:

- **Stakeholder Mapping (Figure 2.1)** – To visually represent relationships, communication flows, and influence structures and define stakeholders sustainability impact.
- **Literature Research** – Utilizing industry reports and academic sources to back up conclusions with sector-wide trends, regulatory constraints, and market impacts.
- **In-house Expertise** – Defining practical insights from my position at Osprey Energy to develop a greater understanding of decision-making processes and real-world interactions across stakeholders.

Chapter 2.2.2 - Purchasing Process

The bunker purchasing process plays a crucial role in the transition to sustainable fuels because this is where decision-making takes place about which fuels are purchased and used by shipping companies. This process is complex, negotiation-intensive, and depends on efficient communication and reliable information exchange between various stakeholders, such as traders, suppliers, and shipping companies. Because the simulation dashboard needs to be integrated and play a role within this process, it is essential to gain insight into:

- How does the bunker procurement process proceed, and how does information flow between the parties involved?

This provides insight into the roles and responsibilities of stakeholders, the interaction and information between parties, and the dependencies within the process. This insight is necessary to determine where and how a dashboard can play a role (covering SUBRQ2)

- What barriers and inefficiencies can occur within this process, and how can these influence the acceptance of sustainable fuels?

Identifying bottlenecks is necessary because these barriers can also form an obstacle to the use of the dashboard. By understanding these factors, the dashboard can be designed in such a way that the bottlenecks are prevented and that hindrance to sustainable decisions is reduced (linked to SUBRQ1).

In order to effectively map the information and decision-making flows within the bunker procurement process, the following methods have been applied independently by me:

- **Literature research** – Industry literature was consulted to provide an in-depth illustration of the traditional bunker procurement process, and visual representations of this source were used (Draffin, 2011).
- **In-house expertise** – reasoning obtained from practical experts within Osprey Energy has been added to the process that can be valuable to identify real-world frictions and optimization opportunities.

- **Bottleneck Analysis** – Identify where bottlenecks occur and how they impact the process. This is incorporated into the visualization of the bunker purchase process.

These research methods enable the identification of both process and strategic improvement opportunities. This provides a solid basis for determining in the following phases where and how the simulation dashboard can add value.

Chapter 2.2.3 - Regulations

The maritime regulatory landscape can be perceived by some as demanding and complex. Within, it has been chosen to focus solely on the FuelEU Maritime regulation. This has been chosen because this regulation explicitly promotes the uptake of cleaner fuel. This objective is strongly aligned with the project's goal of achieving greater emission reductions by stimulating the uptake of low-carbon fuels (MRQ). Due to feasibility and time restrictions, other regulations were neglected for the development of the initial Demo Tool. The regulation was considered vital for the project because it has direct relevance to fuel traders and shipping companies by incentivizing and forcing biofuel uptake over the coming years, and it impacts the decision-making as shipping companies now seek compliance-driven solutions influencing trader-client relationships because of these new enforced needs (Linked to all SUBRQS).

Analyzing this regulation and utilizing it as an embedded framework throughout the tool is needed to make sure the right benefits can be communicated (MRQ, SUBRQ1). The regulatory impact and the implications have been analyzed independently by the following methods:

- **Regulatory Analysis** – Official documents from the European Commission and industry reports were reviewed to extract key implications that needed to be understood or utilized.
- **Regulation evaluation** – Other regulations were evaluated to gain a general understanding of all implications and their interrelationship with FUEL EU Maritime.
- **Industry Analysis** - Research from Transport & Environment (2023) was analyzed and used to identify how shipping companies are responding to FUEL EU Maritime.

These research methods give directions for possible (tool) requirements, incentives and the positioning of compliance biofuel insights.

Chapter 2.3 - Transition Drivers

The main drivers and barriers that influence decision-making around sustainable fuels have been examined. This has been done in the context of the deal-making process between key stakeholders: physical suppliers, trading companies and shipping companies, because this is where decision-making takes place and where misunderstandings, missed opportunities or resistance often occur. This is due to poor coordination or communication and the complex decision-making processes that require knowledge and are dependent on individuals.

By identifying the risks and actions, the tool can be better designed to fit into the existing interactions and be relevant and strengthen the dialogue for both traders and shipowners (SUBRQ2). This makes the tool not just an information platform, but a strategic tool within the processes that drives collaboration. By identifying barriers, the tool can support traders to overcome them through communication and reduce perceived risks. The drivers and risks have been identified independently with the following methods:

- **Report Analysis** – Reviewing reports to identify key actions and risks in the maritime industry.
- **Survey Data Analysis** - Analyzing survey results to understand how shipping companies perceive future fuels and low carbon fuel adoption (SUBRQ1).
- **Mapping exercise** - Gathered insights from the report, survey analysis, first-hand insights and previous chapters have been integrated into a visual overview depicting the actions and risks among the key stakeholders that influence the decision-making process when adopting alternative fuels.

With this approach, a holistic view of the transition landscape could be formed that highlights the key actions, risks, and dialogues between the stakeholders influencing the decision-making process for adopting alternative fuels.

Chapter 2.4.1 - Decarbonisation landscape

The decarbonization landscape was explored to identify key players that offer reduction initiatives and their motives. This broad and exploratory phase focused on understanding how companies are approaching decarbonization, as well as, uncovering best practices, and identifying gaps that could inform the design of the future simulation dashboard. This analysis was done individually by leveraging my

industry participation and accumulated knowledge to identify relevant companies and tools (see Appendix A). The following methods were used to guide this analysis:

- **Independent Online Research -** Identified key players, decarbonization strategies, core features, incentives, and relevant tools/ digital offerings within the market (linked to SUBRQ1 for understanding stakeholder decision-making).
- **Tool assesment challenges and opportunities -** Evaluate current tools or digital offerings and identify and assess core features, challenges and gaps (SUBRQ1+3)

This analysis provided a foundational understanding of what works, what doesn't, and where opportunities lie. While these tools are not specifically designed for maritime contexts, they share relevant overlaps regarding the Decarbonisation solution space. It informed the key goals and strategic direction for the dashboard, supported stakeholder decision-making (SUBRQ1), and identified roles and design opportunities (SUBRQ3). To move from more general insights to actionable input for the design, the following chapters will present a deeper analysis (using PMI and quantitative research).

Chapter 2.4.2 - Dashboard Analysis
Building on the exploratory research, this section presents a more detailed analysis of 13 decarbonization dashboards, categorized into Decarbonization Assessment & Analysis Tools, Decarbonization Tools, and Bunker Management Tools. Although these tools have not been applied to maritime contexts, they offer important overlaps and necessary features regarding emissions tracking, reduction strategies, and data visualization that can lead to valuable insights. This analysis was conducted individually using:

- **Tool selection and categorization** - Based on relevance to decarbonization, core functionalities, and ownership categories (SUBRQ1+3).
- **Core functionalities, end user and impact analysis -** Identified key functionalities, target users and intended impacts for each dashboard category to understand their role in supporting decarbonization efforts (see Figure 2.6) (SUBRQ1+3).

These findings formed the basis for deeper analysis through PMI and quantitative research, with a focus on identifying key functionalities and gaps to support future dashboard design.

Chapter 2.4.3 - Plus, Minus, Interesting
In order to identify the strengths, weaknesses, and unique features of existing decarbonization tools, a PMI (Plus, Minus, Interesting) analysis was conducted. This qualitative analysis was used because it could show what works well on relevant dashboards, what can be improved and what innovative elements could inspire the future simulation dashboard. The analysis was necessary as the engagement of many different stakeholders was not feasible, making existing tools valuable reference points regarding decarbonized wishes, needs, and requirements. In addition, it is efficient because the wheel does not have to be completely reinvented, and this analysis takes into account strengths that increase adoption and have already proven success.

This analysis was conducted individually, focusing on one well and visual documented example from each dashboard category (see Appendix D). In addition, usage scenarios and tool functionalities were analyzed to ensure a deeper understanding of how the dashboards operate in practice. The following methods were used to perform the PMI analysis:

- **Strengths Evaluation (Plus)** -Useful functions that facilitate decision-making and drive emission reduction were identified (SUBRQ1).
- **Weaknesses Evaluation (Minus)** - Identified limitations and areas where current tools fall short in terms of user experience and functionality (SUBRQ3).
- **Unique features Evaluation (interesting)** - Innovative elements were captured that increase engagement or address needs (SUBRQ3).
- **Use case and functionality analysis** - Examined how tools are used in real-life contexts, focusing on user interactions, workflowsd and decision-making processes to evaluate tools in depth (SUBRQ1+3).
- **Concluding analysis** - A concluding analysis has been performed to reflect on the PMI analysis and evaluate the different categories that were present. This helped to give direction, conclude and suggest a direction, and form key takeaways.

These insights formed a basis for identifying design opportunities and informing how the dashboard can improve decision-making and user engagement.

Chapter 2.4.4 - Quantitative Research
A quantitative study was conducted to identify critical features, functionalities, layout components and metrics that could guide the design of the future simulation dashboard. This study provides an overview of essential components and helped identify relevant and proven features and insights (SUBRQ3). In total, 10 of the 13 dashboards were analyzed because variable counting was identifiable and possible. The results were presented via pie charts that show the relative frequency of each variable (see Appendix D).

This analysis was performed individually and focused on identifying common patterns and data-driven insights that complement the qualitative findings of the PMI. The analysis consisted of the following methods:

- **Feature and function analysis** - Determine which features and functions are common in dashboards so that they can be considered (SUBRQ1+3).
- **Layout element assessment** - Analyze interface structures to understand which design elements are common for clarity and usability (SUBRQ3).
- **Evaluation of metrics** - Identified commonly used KPIs to assess and consider their role in decision-making (SUBRQ1).

These insights help design a tool that simplifies decision-making, reduces complexity, and presents clear, actionable data to maritime industry stakeholders (elements required for successful tool adoption and implementation based on the behavior model analysis in chapter 2.5 and that were widely present in the collection of dashboards). The collected data may be utilized in the ideation and design phases for the tool's adoption.

Chapter 2.5 - Behaviour Models
In order to understand and influence stakeholder decision-making with regard to the adoption of more sustainable fuels, three behavioral models were studied. This included the Green Nudges, the Com-B model, and the Transtheoretical Model (TTM). When combined, the models aid in determining the factors that influence behavior change, how it happens, and how interventions can be created to support long-term decision-making. This analysis was done individually by conducting internet research and analyzing academic sources. This made it possible to understand the principles of each model and analyze how they can help support sustainable fuel adoption.

The following methods have been used:

- **Literature Review** - behavioural science sources (internet, academic) were reviewed to understand the theoretical foundations of TTM, COM-B, and Green Nudges and how they have been applied in sustainability contexts (SUBRQ1+3).
- **Model Application Analysis** - Each model was analyzed to identify key components relevant to fuel adoption:
  1, TTM: Mapping stages of behaviour change and identifying actions to move stakeholders from awareness to consideration (the insights here contributed to shaping SUBRQ1).
  2. COM-B: Identifying the necessary conditions (Capability, Opportunity, Motivation) for sustainable behaviour change (SUBRQ3).
  3. Green Nudges: exploring behavioural strategies to make sustainable choices easy, attractive, social and timely (SUBRQ3).
- **Cross-model comparative analysis** - evaluating the overlaps and complementary insights between the models and examining them on shared principles to create an integrated approach for behavior change and drawing an overarching conclusion (SUBRQ1+3).

A summary table of the activities carried out, and their details can be seen on the next page, Table 2.1. All activities and methods form a coherent strategy to facilitate sustainable decision-making, ensuring that the simulation dashboard not only informs but also motivates and guides users in the adoption of low-carbon fuels.

Activities							
Activity	**Chapter**	**Method Used**	**Materials**	**Executed by**	**Participants**	**Linked RQ(s)**	**Contribution to RQs**
Stakeholder Analysis	2.1.1	Stakeholder mapping, literature research, in-house expertise	Miro, industry reports, Osprey Energy insights, Canva	Me	N/A	SUBRQ1, SUBRQ2	Examines stakeholder relationships, decision-making influence, and trust-building for biofuel adoption. Identifies key figures for dashboard integration in the deal-making process.
Purchasing Process Analysis	2.1.2	Literature research, in-house expertise, bottleneck analysis	Industry literature, Miro, Canva	Me	N/A	SUBRQ1, SUBRQ2	Identifies decision-making flow, barriers, and inefficiencies in the bunker purchasing process to determine dashboard integration points.
Regulatory Analysis	2.1.3	Regulatory analysis, regulation evaluation, industry analysis	European Commission reports, Transport & Environment research	Me	N/A	MRQ, SUBRQ1	Examines FuelEU Maritime's impact on compliance and trader-client relationships. Identifies regulatory requirements for the dashboard.
Transition Drivers Analysis	2.2	Report analysis, survey data analysis, mapping exercise	Industry reports, survey data, Miro, Canva	Me	N/A	SUBRQ1, SUBRQ2	Identifies decision-making drivers and barriers, improving tool alignment with trader-shipowner collaboration.
Decarbonization Landscape	2.3.1	Online research, tool assessment	Industry reports, tool evaluations, Miro, Canva	Me	N/A	SUBRQ1, SUBRQ3	Assesses decarbonization strategies, gaps, and opportunities in the maritime industry to guide dashboard design.
Dashboard Analysis	2.3.2	Tool selection and categorization, core functionalities, end-user analysis	Dashboard reviews, categorization framework, Miro, Canva	Me	N/A	SUBRQ1, SUBRQ3	Evaluates key functionalities and gaps in existing dashboards to inform simulation tool design.
PMI Analysis	2.3.3	Strengths, weaknesses, unique feature evaluation, use case analysis	Dashboard case studies, PMI framework, Miro, Canva	Me	N/A	SUBRQ1, SUBRQ3	Identifies effective features, limitations, and innovation opportunities from existing tools.
Quantitative Research	2.3.4	Feature/function analysis, layout assessment, KPI evaluation	Data visualization, dashboard metrics, Excel, Miro, Canva	Me	N/A	SUBRQ1, SUBRQ3	Determines commonly used dashboard elements, KPIs, and usability features relevant for tool adoption.
Behavioral Model Analysis	2.4	Literature review, model application analysis, cross-model comparison	Academic research, behavioral science models, Miro	Me	N/A	SUBRQ1, SUBRQ3	Applies behavioral science models (TTM, COM-B, Green Nudges) to support sustainable decision-making and dashboard engagement.

Table 2.1 Activities performed in the Discover Phase.

2.1 Industry Research

This chapter delves into the role and influence of the stakeholders, fuel purchasing progress, and the regulatory landscape of the maritime industry. By doing so, a better understanding can be grasped to align the project's goals, needs, and expectations.

2.1.1 Stakeholder Analysis

Figure 2.1 shows the stakeholder map representing the actors involved in the fuel acquisition process. It emphasizes the flow of communication, with traders acting as important intermediaries between physical suppliers and shipping companies. To achieve more sustainable practices, all actors should collaborate (Hausmann et al., 2022) (World Economic Forum, 2023). For example, Suppliers and traders could communicate more with each other about the possibilities, needs, and uptake of biofuels, and traders could promote the biofuels and benefits more to their clients.

The request for sustainable practices comes from external forces that have a direct influence on shipping companies. Most importantly, by regulations that directly affect the shipping companies (see Figure 1.2). Shipping companies are obliged to reduce their emissions over time through regulatory initiatives (Zero Carbon Shipping & Maersk, 2022). Furthermore, cargo owners are pushing shipping companies to become more sustainable as they increasingly receive and exert societal pressure to minimize their scope 3 emissions (Jameson et al., 2024). Finally, end consumers may prefer environmentally friendly goods or pay a higher fee for more sustainable goods, which will also put some pressure on the supply chain (Price Waterhouse Coopers, 2024).

For the stimulation of the adoption of biofuels, key players for a transition in this stakeholder map are: the physical suppliers, trading companies, and shipping companies. The other forces are market enablers.

- **Physical suppliers:** Large/mid/small fuel companies that play a role in the availability and supply of biofuels. They are and need to be pushed by the industry to provide more sustainable options. The trading company should be aware of the possibilities at various suppliers, big and small. There is relationship building between traders and sales managers of the suppliers through networking and work-related activities of contact, such as email and telephone, regarding inquiries and delivery options. The strength of this relationship influences the quality and effectiveness of the information exchange.

- **Trading companies:** Act as middlemen, and relationship building is their main priority. They also bring value and are able to offer competitive and available offers. They communicate fuel availability, price, and options to shipping companies and request possibilities with multiple suppliers. Furthermore, they can communicate the needs of the shipping companies to the suppliers and push for change.

- **Shipping companies:** are the decision makers. They receive regulatory pressure and need to keep their costs low as they want to offer competitive prices to their customers as well. They need to comply with reporting and reducing their emissions if they sail to European ports. If they don't, they might face penalties or costs, and hence, they can not neglect sustainability anymore. They are also motivated to reduce emissions as their customers value this more. They have vessel operators in their team who manage the day-to-day operations of the fleet, including fuel bunkering, options, route planning, and efficient operations. Vessel operators mainly communicate their needs to traders. Vessel operators build a relationship with traders which could lead to favouring a specific party. Or a specific trading company could be assigned as directors to establish relationships with one another.

Therefore, the relationships between all parties are important. Strong connections can lead to priority or exclusive access and deals, as well as be favourable for one's position, leading to more competitiveness in one's own market due to more access to resources, better pricing, and more tailored solutions.

STAKEHOLDERS FUEL ACQUISITION

Involved in maritime bunkering and the existing external stakeholders sustainability incentives & forces on the key stakeholders.

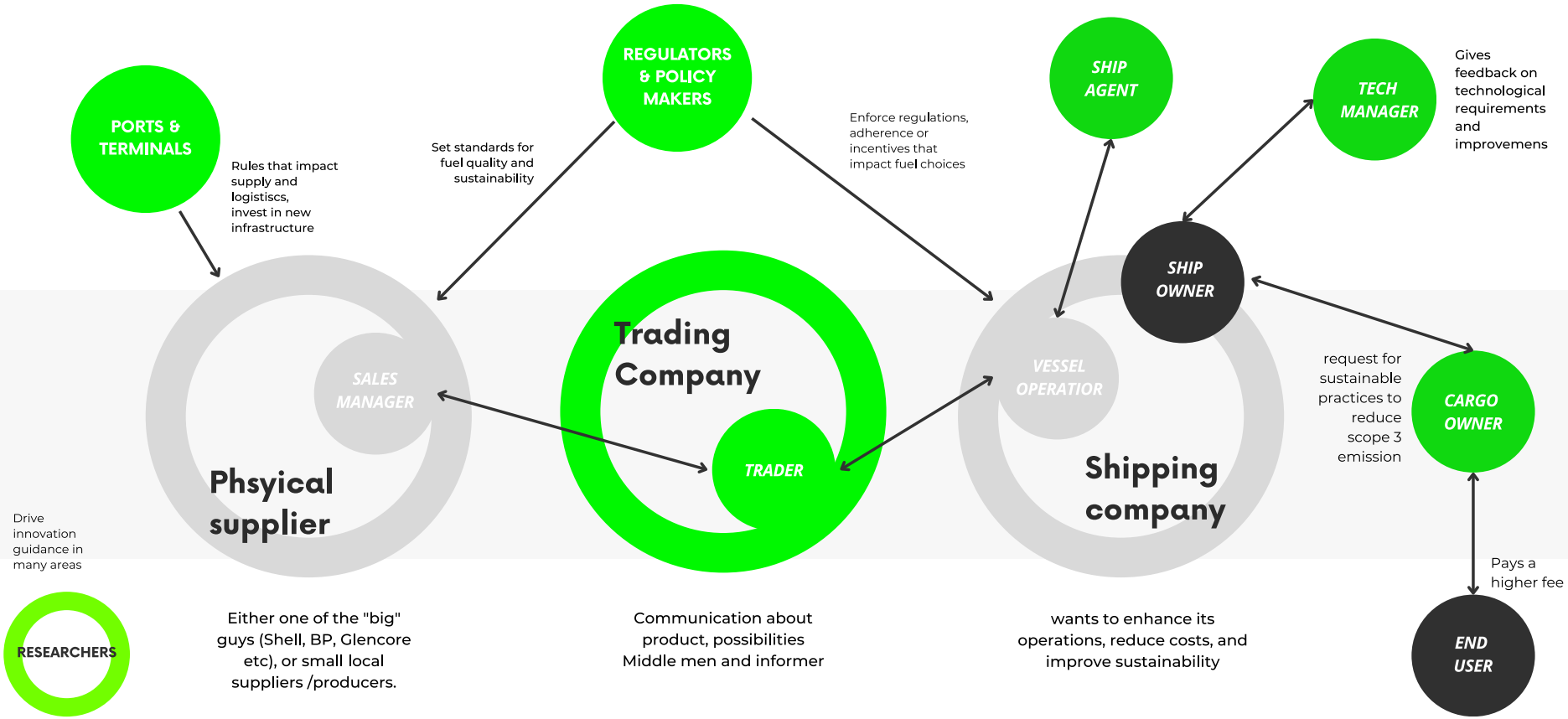


Figure 2.1 Visual representation of the stakeholders in the maritime fuel acquisition process, formed by in-house expertise (OEM), Zerocarbon, Maersk, mcKinsey & Company

2.2.2 Purchasing Process

Figure 2.2 shows the purchasing process and information flow during a bunker inquiry. It is important to understand these interactions as the design solution, a simulation dashboard has to be integrated within this process. The dashboard has to align in a way with the steps and communication between the stakeholders.

The process starts with an inquiry from the shipping company or a vessel operator of the company to a broker or trader, communicating the needs and requirements. The broker/ trader acts as a middleman and negotiates with the suppliers. They facilitate the exchange. The personal effort and quality of relationships determine the outcome. The best offering gets presented to the shipping company. If this is the best or most favourable deal, the deal gets confirmed, and the supplier is nominated. Here, the fuel price, requirements, and logistics are being sorted and finalized.

This inquiry process can take anywhere from a few hours to 1/2 day. After nomination, the chosen supplier coordinates the distribution with the ship's agent (who is responsible for clearing and handling services for ships within a port). The agent arranges the fuel delivery with the supplier. The delivery is planned on a specific date and there is still some communication around this day to supply in good order. Delivery can be a few days later after the inquiry or 1/2 weeks. Long-term contracts are also possible. When the delivery is completed, this gets confirmed, documented and reported back to the trading and shipping company.

The goal is for everything to run smoothly, but there may be bottlenecks during the process that need to be resolved as quickly as possible because delays can lead to high and increasing costs. These bottlenecks are also shown in Figure 2.2 and are mainly dependent on smooth-running communication. In addition, the bottleneck also concerns efficiency with regard to time and information.

Within this process, there are crucial decision points (see the so-called "points of intervention" in chapter 3.3.1) that could optimize the decision-making process to incentivize choosing more sustainable alternatives. Additionally, the relationship of both the supplier and shipping company with the trading company influences the performance of possible reductions and the decision-making. However, this is a traditional and limiting process, as the trading company can influence the shipping company and suppliers.

Moreover, 3.3.1 builds in further detail on this process by including the phase before receiving enquiries, known as customer acquisition. It focuses more on the structured back-end process and indicates touchpoints for intervention with the client, with the idea of integrating (autonomous) incentives.

The following shows the flow of information during a typical bunker enquiry.

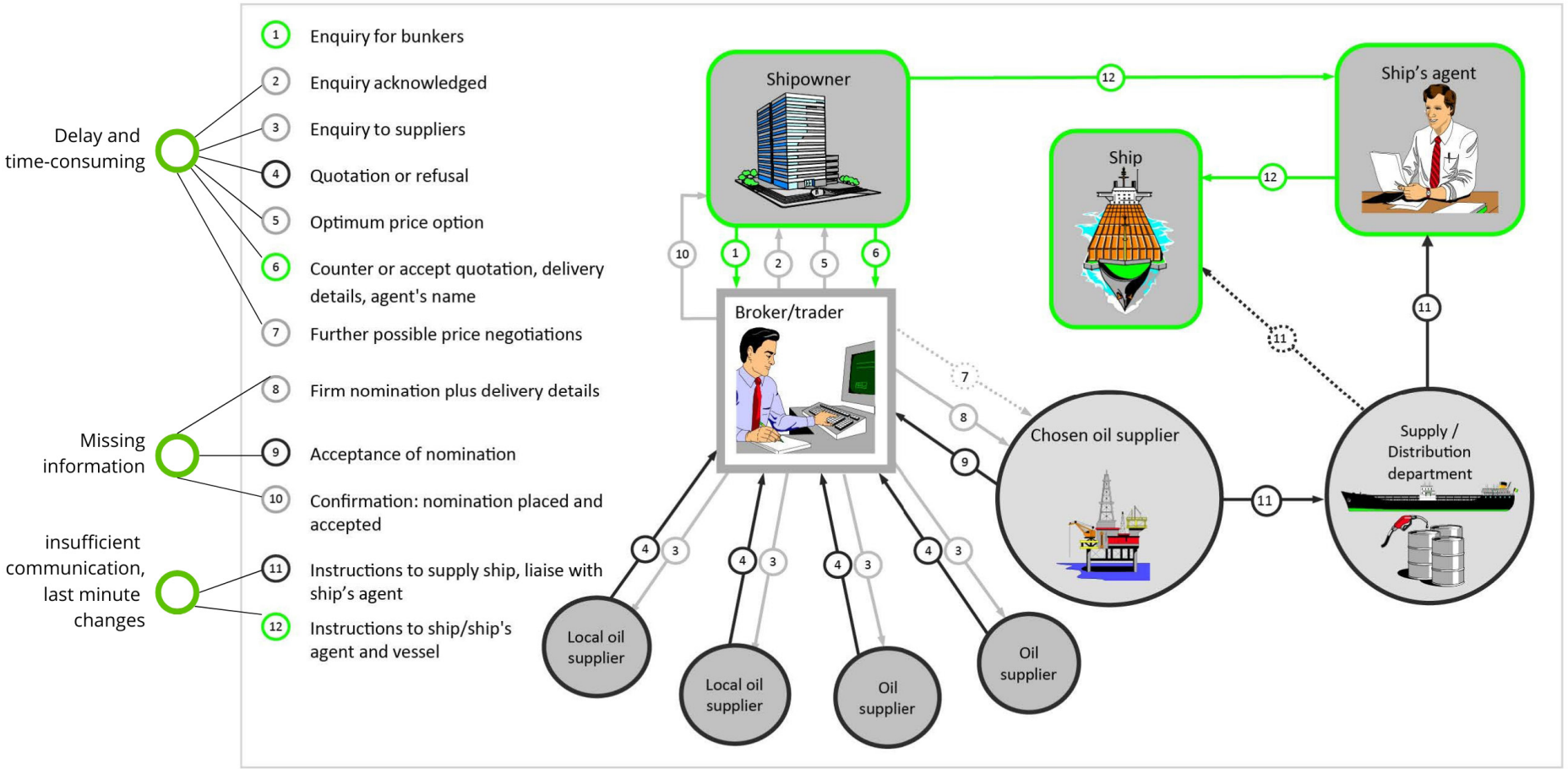


Figure 12. A typical bunker delivery

Schematic courtesy of Cockett Marine Oil Ltd (www.cockettgroup.com)

Bottlenecks

Figure 2.2 - Visual found in Commercial Practice in Bunkering (Draffin, 2011) with added and indicated bottleneck during the bunker enquiry process.

2.2.3 Regulations

A complex and growing regulatory environment has emerged within the maritime industry to reduce greenhouse gas (GHG) emissions and meet Europe's 2050 climate targets (European Council of the European Union, 2023).

Figure 2.3 presents an overview of the regulatory rules that apply to the shipping industry. The rules are set by the International Maritime Organization (IMO) or the European Union.

The IMO has set targets for 2030: 40% improvement in carbon intensity and, by 2050, a 70% reduction, with the goal of being net-zero (IMO, 2021). They enforce and measure this with various regulations and measurement protocols (EEXI, CII, and MRV).

Within the European Union, from 2025, the EU ETS applied to the shipping industry targeting large vessels (>5000 gross tonnage) that operate in and between EU ports (European Commission, n.d.-a). With this regulation, shipping companies need to buy carbon allowances for a portion of their yearly emissions, which they need to monitor, report, and verify.

Additionally, the EU introduced the FuelEU Maritime initiative, which promotes the use of cleaner fuel to decarbonize the shipping industry (European Commission, n.d.-b). FuelEU Maritime also applies to the larger ships operating in European ports. Ships must reduce their GHG emissions by compulsory use of onshore power supply (OPS) at berth, and it sets reduction targets at a 5-year interval starting from 2024 from 2% to 80% well-to-wake GHG intensity reductions by 2050 (European Commission, n.d.-b). Companies that do not meet the targets will face financial penalties. These targets oblige and force shipping companies to switch to cleaner fuels, as it is (financially and uptake-related) impossible to achieve these emission reductions by 2050 with traditional fossil fuels alone (Transport & Environments, 2023).

The EU ETS and IMO regulations are out of scope due to time constraints and the amount of time needed to delve into each regulation. That is why it was decided to first focus on stimulating decarbonisation based on one regulation: FuelEU Maritime, and to create a suitable solution for this. All regulations overlap in the goal of reducing emissions, nevertheless.

FuelEU Maritime encourages the uptake, demand, and innovation of cleaner fuels. This principle was a source of inspiration and a foundational element for the initiation of the design brief of this project. After learning about this regulation and its impact, the idea arose to start a graduation project on this topic.

The objectives and scope of FuelEU Maritime form the basis for this project by embedding these emission reduction targets into the final design proposal. By communicating these targets as reductions goals towards clients and incorporating them in the dashboard. With the aim to facilitate compliance and promote the adoption of cleaner fuel options.

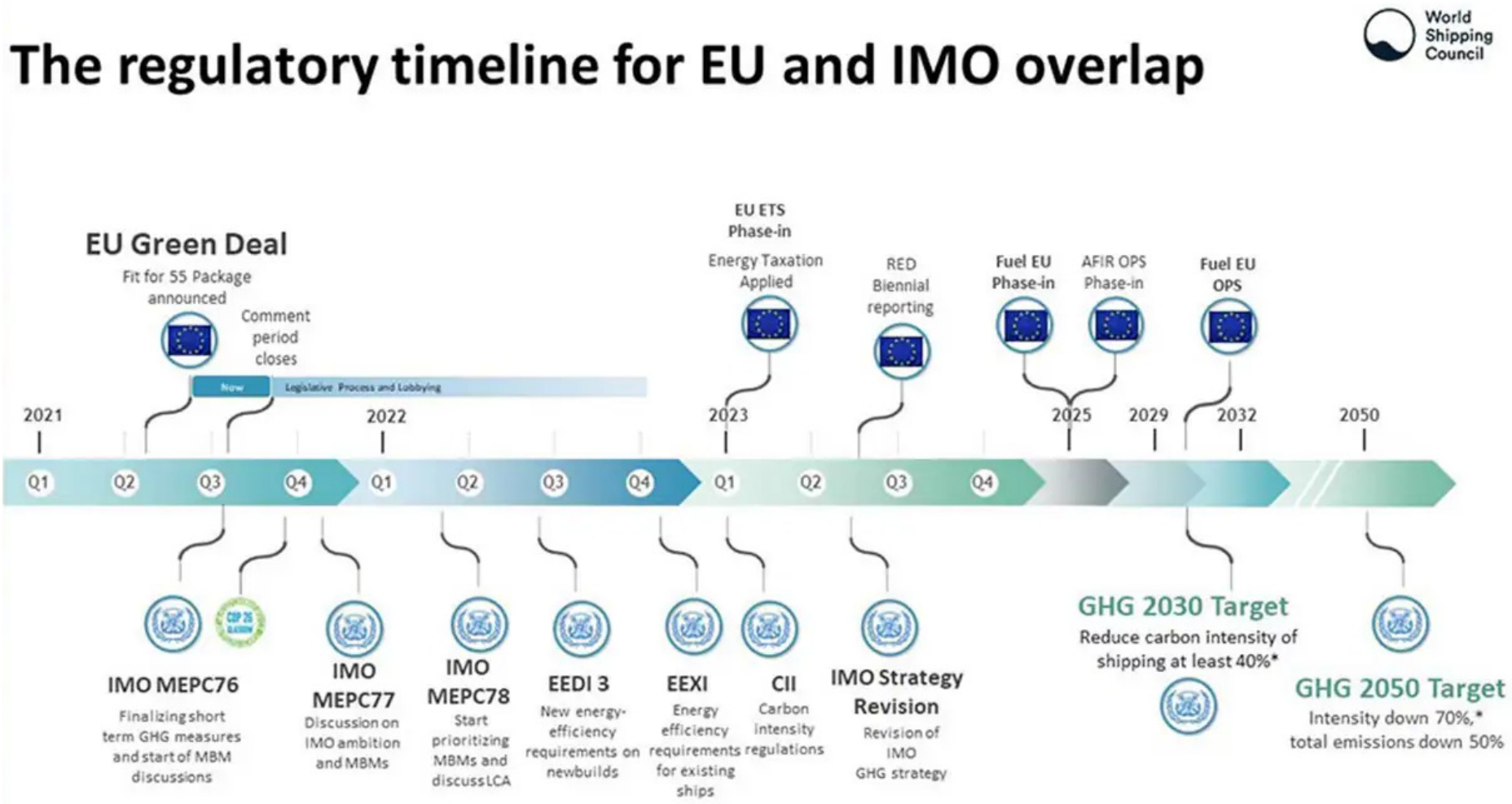


Figure 2.3 - Regulatory timeline maritime industry (Doedee, 2023)

2.3 Transistion Drivers

This chapter identifies drivers and barriers that influence the decision-making process for sustainable fuel adoption for key stakeholders.

To support the decarbonization in the maritime industry, various reports and studies have been published focusing on requirements to meet the net-zero emission challenge. Research from Zero Carbon Shipping & Maersk (2022) recommends, based on experiences with first movers in the industry and partners that are working towards the transition, actions, and risks for fuel producers and vessel operators. While there are various stakeholders and actions vital to achieving this, not all are directly relevant to this design brief. Actions and risks that can influence the decision-making process when opting for greener fuel have been listed below and visualized in Figure 2.4. This is based on the Zero Carbon Shipping & Maersk (2022) research and additional insights from in-house experience at Osprey Energy:

1. Actions: fuel suppliers and traders should:
- unlock barriers to enable alternative fuel pathways in line with regulations (from the IMO and EU).
- promote and scale the commercial availability of alternative fuels
- Deepen the dialogue with vessel owners to ensure transparency on fuel options and demand.

2. Actions: vessel owners should:
- maximize energy efficiency (operational & technological)
- send a demand signal to fuel producers or traders by for example communicating fuel demand specifications, fuel preferences, reduction targets and compliance requirements.
- deepen the dialogue with their customers regarding their scope 3 emissions.

3. Risks: Main risks for vessel owner:
- Uncertainty regarding pathways of alternative fuels and fuel options
- Dependency on fuel providers for availability, pricing and information
- Unknown costs
- Uncertainty about regulations and evolving targets and rules

The main takeaway from this is that fuel producers and vessel operators have to collaborate to overcome challenges and create opportunities to drive decarbonization. If fuel producers provide insights on costs, availability, and road maps, this can boost shipping companies' confidence and speed in the adoption of greener fuels (Maersk for Zero Carbon Shipping et al., 2023). Additionally, the Global Maritime Forum, in collaboration with In addition, the Global Maritime Forum, in partnership with Maersk, Zero Carbon Shipping and supported by McKinsey & Company, conducted a survey in 2022 to gain insight into shipping companies' mindsets regarding fuel use. The results show that 13 out of 26 respondents have not (significantly) embraced the use of low-carbon fuels and a third had no idea what their fuel use will look like in 2030 and 2050 (Maersk for Zero Carbon Shipping et al., 2023). Among those who did, 66% expected to still use (fossil) fuel oil in 2030.

This highlights the need for a shift in mindset to encourage early adoption and action. If the demand for biofuels can be increased, immediate reductions can be achieved as they can be blended in with traditional fuels without requiring modification for the ship (acquired knowledge from Osprey Energy). Primary challenges lie in the availability and accessibility of biofuels. However, this also emphasizes the important role fuel providers can have, as their involvement and potential impact can stimulate the shipping companies towards the adoption of biofuels; their influence can help overcome challenges/risks. However, the providing companies depend on the communication of their employees, the traders. Having observed traders during the introduction of regulations, one cannot solely rely on traders acting as advocates. This is because they often lack the knowledge and personal traits that can prevent this.

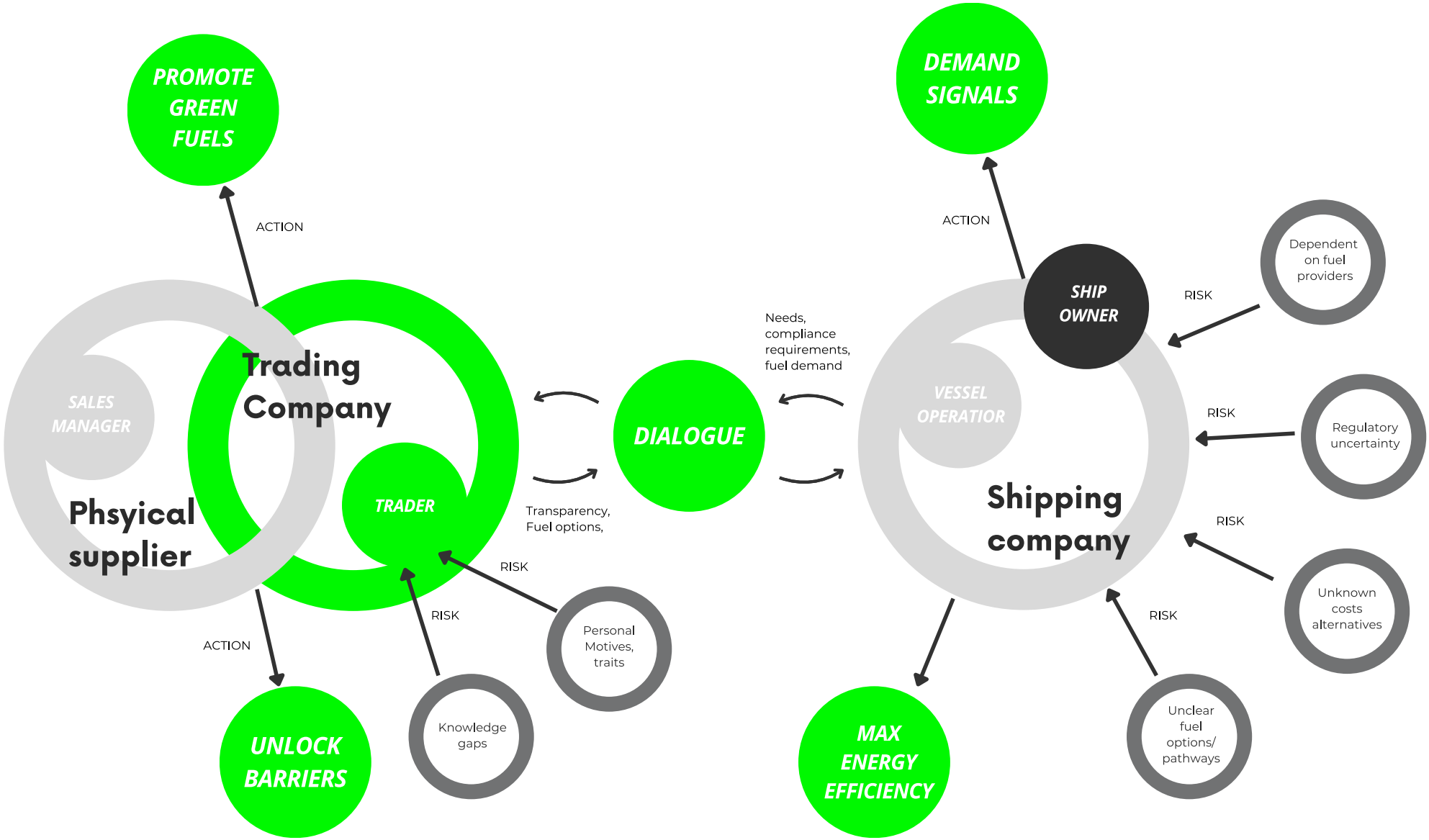


Figure 2.4 - Actions and risks that influence the decision making process when adopting alternative fuels.

2.4 Decarbonization Tool Benchmarking

This chapter presents insights into the reduction landscape to understand and leverage other market players. Followed by a PMI analysis and quantitative research to evaluate existing tools and identify functionalities relevant for future implementation.

2.4.1 Decarbonization Landscape

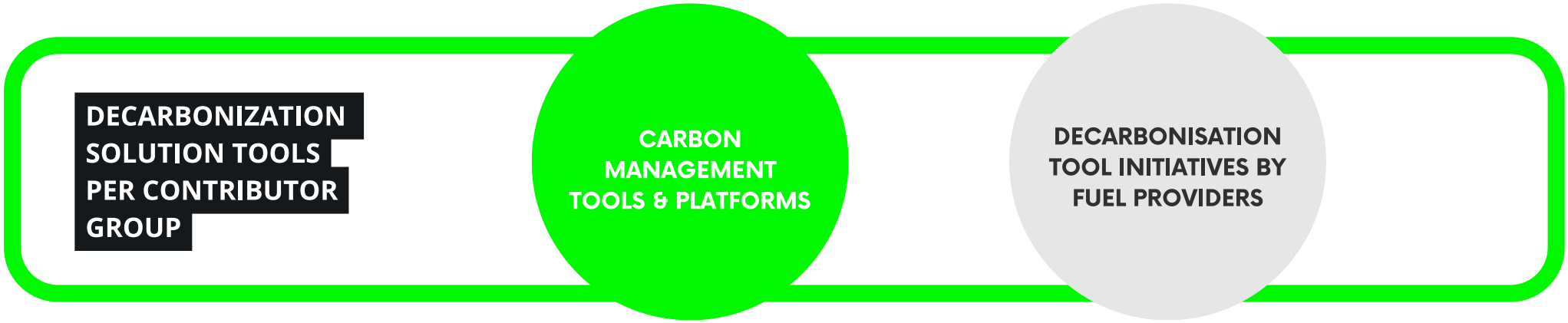
Leveraging my industry participation and accumulated knowledge, key players and related terms were identified through independent online research with the aim of building a broad collection of companies implementing decarbonization strategies (see Appendix A). The primary objective of this analysis was to learn from existing approaches, identify best practices, and discover gaps that could inform the development of a more effective simulation dashboard. This phase was intentionally broad and exploratory, providing a comprehensive understanding of the market, industry, and sectors pursuing similar decarbonization tools. By taking an open approach, it was possible to determine which areas were most interesting and suitable for further research and to get a broad understanding of the initiatives that were already established.

This exploratory exercise established the groundwork for more focused research. The broad scope helped create a clear focus, allowing the subsequent phases (PMI and quantitative research) to target specific tools and markets that were valuable to analyse. Significant knowledge was gathered that will guide the subsequent design process by investigating how other people are addressing the challenges of decarbonization.

The exploratory research revealed that many companies offer online tools that focus on emission reduction strategies and emissions tracking, which shows the increasing role of online tools in enabling decarbonization efforts. Based on these findings, it was decided to conduct a deeper analysis to map the available tools and better understand their functionalities, impact, and relevance for the project. Using the collected material, a first analysis was conducted to assess the impact, incentives, challenges, and opportunities associated with these tools. Understanding what is happening in the market allows the research to put insight into what is available, what is effective, and where improvements may be made. By identifying essential components for later incorporation and the primary goal of increasing emission reduction initiatives, this analysis ensures that dashboard design in the future will be both inventive and responsive to actual needs. The main insights from this analysis are presented in Figure 2.5 and in the below text follows a clarification. Two categories can be used to group the identified companies:

1. **Fuel providers** (suppliers and fuel trading companies) mainly focus on providing tailored fuel solutions, such as emission calculations, reduction measurements, and consulting services. This work generally falls under the category of carbon management solutions. Within the Netherlands and Europe, suppliers sometimes expand their offerings by collaborating with companies that provide digital solutions or by developing in-house tools to enhance their services. Tools that suppliers sometimes provide are carbon calculators, emission tracking tools, dashboards that track orders and show statistics and carbon offset platforms. With these tools, clients can monitor CO2 emissions for their reporting, identify areas where emissions can be reduced, get operational insights, or get access to verified offset projects

2. Platforms/Tools tend to be more tailored to a target group. They focus mainly on measuring, tracking, and reporting emissions. They assist by providing tools that enable emission calculation management and reduction programs.



Core Role	Stimulate decarbonization, Measure & report, Reduction Programs	Stimulate decarbonization, Support tailored fuel related emission solutions, indetifying emissions
Incentives	Regulatory compliance, Sustainability credentials, value adding services, enabling competitive advantage for clients in a transitioning market.	
Challenges	Data heavy requiring significant user input, statistical, complex	Minimal/no guidance for maritime regulations, limited/specific use case offerings/features
Opportunities	Simplification (complexity reduction), Regulatory Integration, tailored for the project maritime fuel context, accessibility (mobile friendly).	

Figure 2.5 - Landscape Analysis - Decarbonization solution tools

The main takeaways that can be gained from this analysis are that digital tools or platforms are a viable option to stimulate decarbonization, and that these are often tailored solutions for specific client groups. Additionally, measurements and reporting solutions are offered, as well as reduction programs. On top of that, it shows that suppliers are supporting their customers in reducing their emissions, which confirms the demand, need, and benefits for this. In conclusion, the main focus lies on providing solutions that make emission management comprehensible with an **emphasis on measuring, reducing and compensating emissions.**

However, by looking at the alternatives, we can also see adverse properties and gaps for the potential dashboard to fill in. Mainly the Platform and Tools, category 2, are data-heavy and too statistical, making it less straightforward. This also requires more input, user steps, and effort, increasing complexity, which is less efficient for the high-paced relationship-building and deal-making processes. Categories 1 and 2 are also not tailored for alignment with these processes and, therefore, do not assess the needs correctly and are more designed for independent client use, not using or integrating with communication processes. (If Fuellink is disregarded, as it is the only one that is more suitable for the processes). All, as found so far, lack mobile accessibility and don't have options for traditional and sustainable fuel comparisons. This is because most tools focus more on identifying emissions, and tracking them for potential reduction. There also is little to no guidance or integration of specific Maritime regulations. Filling these gaps provides opportunities for the tool to enhance the decision-making process.

These insights provide a basis for understanding the decarbonization landscape and demonstrate how relevant players are tackling customer emissions reduction needs. By analyzing their offerings, incentives, and the impact of their tools, insights were gained on motives, key functionalities, and existing gaps in the market. This broad analysis helped to identify what works, what doesn't work, and where opportunities lie, and laid the foundation for defining the key goals, core functionalities, and strategic direction for the development of the simulation dashboard. In addition, elements that build stakeholder trust or challenges that reduce trust were identified (SUBRQ1) as well as roles and opportunities to consider in the design (SUBRQ3).

However, while this exploratory analysis established a strong basis (identified key players and their incentives and the impact and challenges of their tools), it remains broad and high-level. To move from general insights to concrete design insights, further in-depth research is needed. This will be addressed in the next chapters, where a deeper analysis of the specific tools will be shown, as the dashboard cannot be established on broad trends, insights, and trends. This allows for a more detailed understanding of the components of the competitor's tools.

2.4.2 Dashboard analysis

Building on the exploratory research from the previous chapter, this section moves on to a more detailed analysis of decarbonization tools (see Appendix B). The broad study acted as a catalyst and enabled targeted research by identifying key categories (emissions platforms and fuel supplier tools). This helped to map relevant dashboards, some of which had already been identified in the earlier phase, and facilitated a further search and selection process. From this, a total of 13 decarbonization dashboards were identified and categorized into three groups based on ownership and focus (see Figure 2.6): Decarbonization Assessment & Analysis Tools, Decarbonization Tools, and Bunker Management Tools.

While these tools can provide insightful information, they should be observed in a way that they are not designed and intended specifically for the project context. The usage context differs due to the stakeholder's unique needs, regulations, and decision-making requirements related to the maritime indus-

try. However, there is relevant overlap in areas such as emissions tracking, reduction strategies, and data visualization. These shared features provide a useful basis for understanding best practices, while the differences highlight opportunities to tailor the future simulation dashboard to specific maritime needs.

To guarantee relevance and alignment with the project's objectives, the following criteria were used to guide the tool selection:

- **Relevancy** - Tools were chosen based on their capacity to support decarbonization strategies.
- **Functionality** - The tools needed to focus on (a combination of) the following features: data visualization, emission impact analysis, and decision-support capabilities.
- **Ownership** - Tools owned by separate emission management companies, fuel/bunker trading companies were included to capture diverse approaches and strategies.

In total, 13 decarbonization dashboards were visually gathered, analyzed, and documented. Either by using the tool or by finding relevant documentation and stating insights, see Appendix C. Subsequently, the first insights were gathered, which are presented in Figure 2.6. The three groups could be determined, which differed based on ownership, intended end users, core feature capabilities, and the tool's impact. Although the intended impact differs among the groups due to their use cases, they all try to make complex data more accessible, enhance decision-making, and facilitate emission reduction.

Defending this helped to provide a framework for the following studies PMI and quantitative dashboard research, provided a broad understanding, and allowed comparison between the groups. The 13 dashboards were analyzed based on the following questions:

- What core features and functionalities are essential for supporting effective emission management and decision-making, and how are they currently implemented across tools? (Covered in Quantitative Research, PMI, and Initial Research)
- What are the key strengths and weaknesses of existing tools, and how can these inform the design of a more effective maritime-specific dashboard? (Covered in PMI, and Initial Research)
- What motivates users to engage with these tools? (Covered in PMI, and Initial Research)
- What impact do current tools have? (Covered in PMI, and Initial Research)
-What gaps or limitations exist in current tools that the future simulation dashboard could address? (Covered in PMI, Quantitative Research, and Initial Research)

These questions aim to identify core features, business and engagement strategies, opportunities, and gaps, all of which support decarbonization and inform further development. This directly answers how stakeholder decision-making can be improved (SUBRQ1) and which functions enhance and drive engagement for sustainable fuel adoption (SUBRQ3). To answer these questions an initial analysis was done (Figure 2.6) and it was chosen to conduct 2 studies:

1. PMI (Plus, Minus, Interesting) Analysis - A qualitative method which I used to analyze the most valuable dashboard of each category regarding its strengths, weaknesses and interesting elements. This analysis helped to uncover what worked well across the categories, what were elements to improve or leave, and what innovate elements could inspire the future tool. On top of that, the usage scenario and steps of each tool and functionality have been analyzed first, to make sure the dashboards could be evaluated in depth.

2. Quantitative Research - Ten out of the thirteen sufficiently documented dashboards have been examined to determine essential features, functions, layout elements, and metrics. With this approach, commonalities across tools (frequently used features, KPIs, etc.) could be identified to provide a data-driven foundation and recommendations for the future dashboard.

These initial insights (Figure 2.6) provided the necessary context to conduct a more detailed evaluation, starting with the PMI (Plus, Minus, Interesting) analysis presented in the following section.

Figure 2.6 - Overview of three categories of decarbonization dashboards with a focus on core functionalities, end users and intended impact.

2.4.3 Plus, Minus, Interesting

The PMI analysis is used to identify strengths, weaknesses, and unique features of other available tools. PMI was used to utilize the users' needs and determine what factors could be crucial to shaping the final design. This was necessary as direct engagement with multiple stakeholders was not feasible. Instead, existing alternatives have been analyzed as they were widely available to avoid reinventing the wheel. This is also supported by research findings supporting the role of fuel producers and third parties in collaborating towards the future set reduction goals.

By understanding aspects of current available tools, valuable insights can be integrated into the outcome and focus can shift more towards enhancing the decision-making process.

The PMI analysis has been done for one well-adequate example out of each category. The detailed analysis can be found in Appendix C.

The concluding insights from this analysis are shown in Figure 2.6 and mean the following in relation to the design brief:

- Category 1: Focuses on insightful features that drive CO2 reduction
- Category 2: Also drive CO2 reduction while prioritizing user-friendliness by offering clear insights and (visual) overviews.
- Category 3: delivers meaning through tailored value-bringing functionalities

Additionally, insights from the PMI analysis showed overlap with the behaviour models (Chapter 2.5). A good example was category 2, as it is a user-friendly tool that facilitates for easier decision-making and presents visual simulations that provide a clear overview to support the decision-making process. Elements of this can also be found in categories 1 and 3, as all tools tried to reduce complexity by presenting data in a clear and user-friendly way, aiming for users to grasp actionable insights. Additionally, all showed motivational triggers, making the process more attractive and incentivizing adoption. This is, for example, done by benchmarking, showing benefits, tracking progress, and stating impact/results.

The ideal outcome, also presented in Figure 2.7, should incorporate the basics of a carbon management tool, while incorporating tailored functionalities through a concise, visual appealing tool to support the decision-making. However, research and ideation could lead to additional improvements being implemented as well.

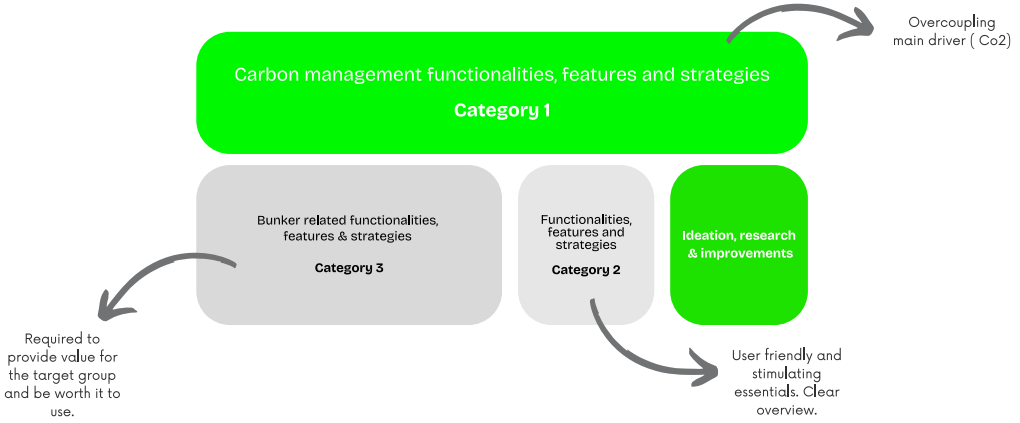


Figure 2.7 - Ideal outcome for a potential tool basde on insights from the PMI.

2.4.4 Quantitative research

Next to the PMI analysis, a quantitative analysis was performed to determine essential features, functions, layout elements, and metrics. This to get a comprehensive overview and determine the key components that inform the design of a future simulation dashboard and indentifying opportunities for SUBRQ3. The complete outcome of the analysis can be found in Appendix D. In total, 10 adequate dashboards of the original 13 were analyzed. Pie charts reflect how commonly the variable appears across the 10 dashboards (displayed by using relative frequency). During the analysis, additional interesting findings were listed as well, which can serve as inspiration during the ideation phase.

Figures 2.8, 2.9, and 2.10 show the main overlapping features, functions, and layout elements. Features are related to functions because functions describe how users interact with the tool's features in terms of tasks or actions.

Figure 2.11 shows all quantifiable metrics present across the dashboards, for which it cannot be said that certain variables can be considered "essential." This is because metrics (KPIs) are targets that inform and provide insights to make better decisions (Qlik, n.d.) and, therefore, must be tailored for the specific user group and behaviour goal. However, some often appear, making them crucial metrics to consider.

Similarities emerge when connecting the quantitative analysis's findings to the PMI findings. Features and functions (such as emission data, trends over time, data over time, and more) help reduce complexity by providing clear and actionable insights. This aligns with the outcomes of the Behaviour Models Analysis (chapter 2.5), supporting SUBRQ1.

Additionally, the visual elements and aspects motivate due to attractiveness and clarity, which aligns as well. Lastly, metrics are often and widely used, which incentivize and motivate to act on the insights.

By executing the PMI analysis, a critical foundation can be set for the envisioned simulation tool in line with the design brief. Overlapping features, functions, and metrics across the existing dashboard have been identified, which can be integrated into the next steps to address specific user needs. This contributes to shaping a tool that simplifies decision-making, reduces complexity, and presents clear and actionable data for traders and shipping companies.

These insights support **SUBRQ1** - *"How can stakeholders' confidence and decisional balance be stimulated to encourage the adoption of low-carbon fuels?"* by identifying features and functions that motivate and build trust and metrics that reduce complexity.

Additionally, the insights support **SUBRQ3** - "*What dashboard features and insights can enhance engagement and improve (autonomous) decision-making for sustainable fuel adoption?*" by identifying features, functions, and metrics that engage and support the decision-making process.

Through these insights, the tool effectively supports decarbonization, engages stakeholders, and contributes to achieving emissions targets, which directly ties in with the **MRSQ**.

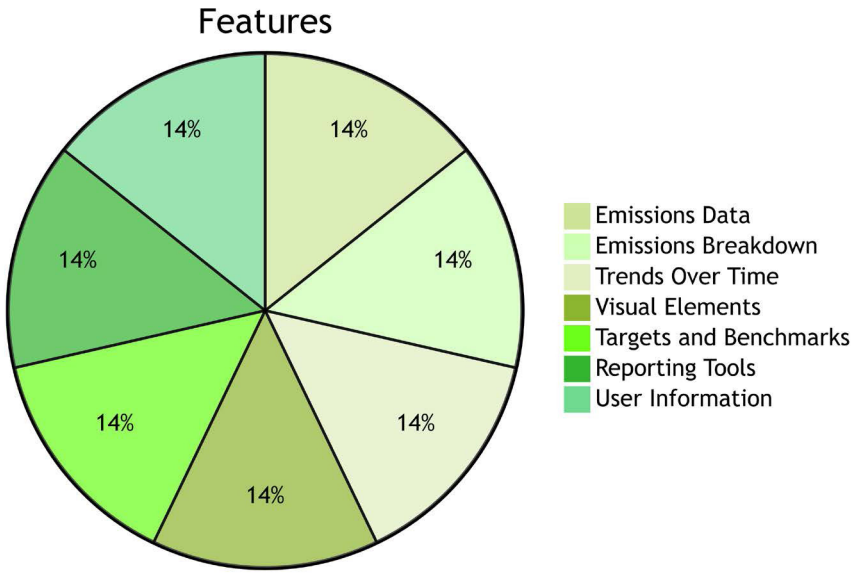


Figure 2.8 - Pie Chart Features

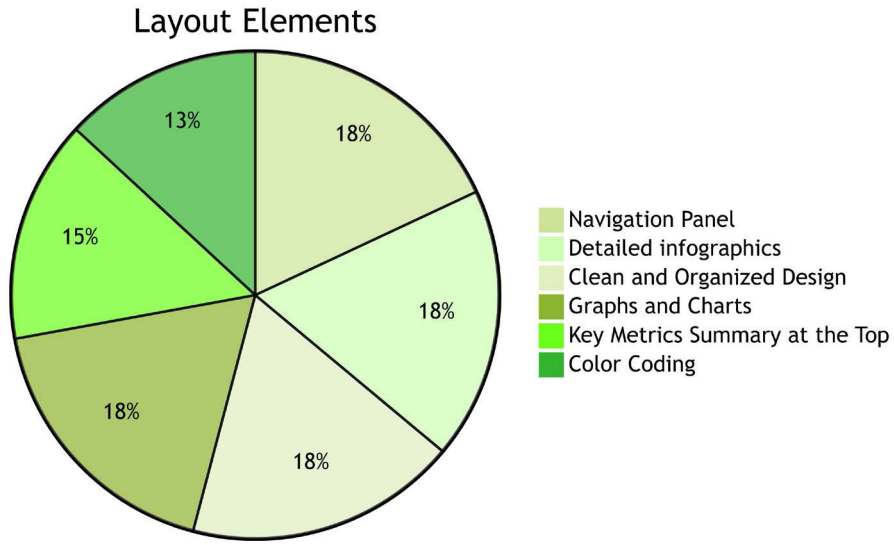


Figure 2.9 - Pie Chart Elements

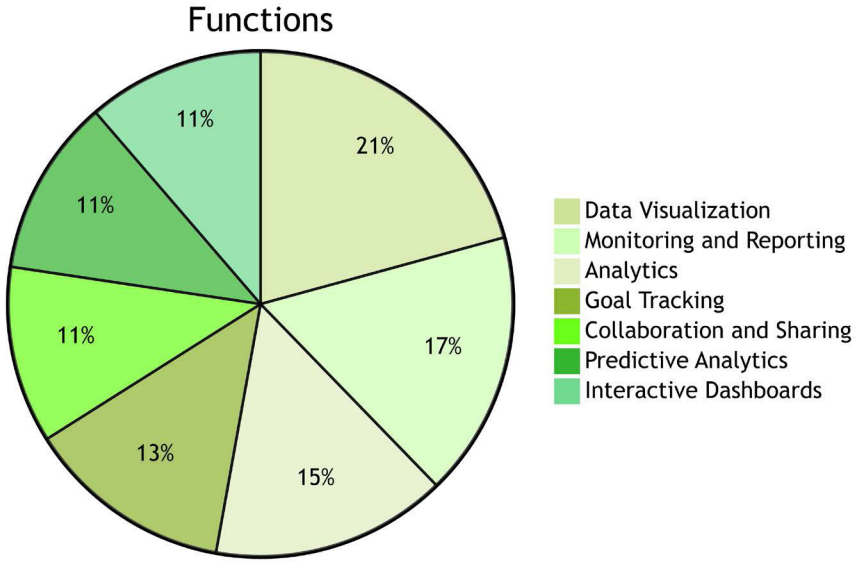


Figure 2.10 - Pie Chart Functions

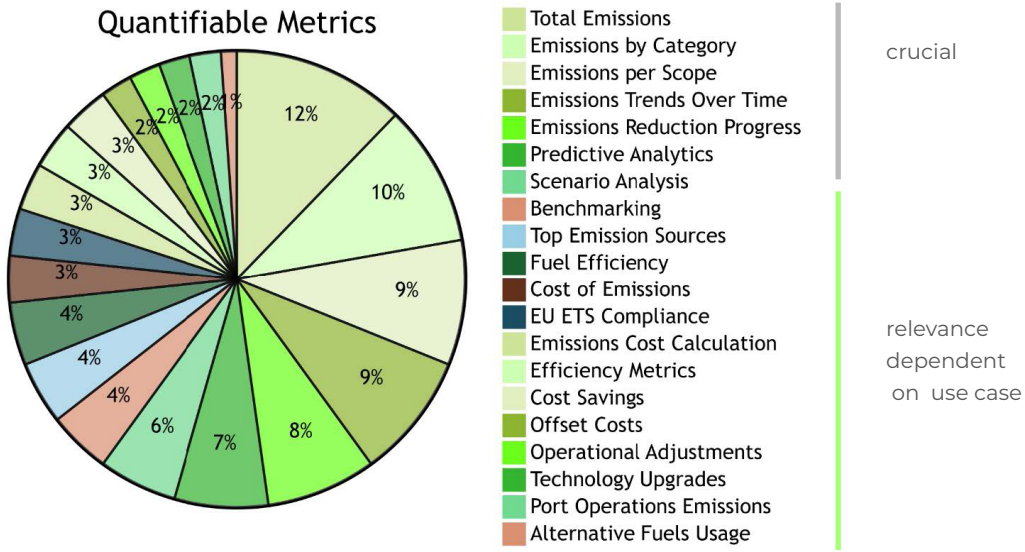


Figure 2.11 - Pie Chart Quantifiable Metrics

2.5 Behaviour Models

As part of the main research question, stakeholder behavioral change must occur to enable emission reduction. Therefore, behaviour models that support behaviour shifts have been identified and analyzed, resulting in Sub-Research question 1.

2.5.1 Transtheoritical Model

The transtheoretical model (TTM) has been incorporated in the original design brief with Natalia Romero Herrera's expertise. Her interest lies in social innovation and energy transitions.

TTM was integrated as a framework to support stakeholders' readiness for (behavior) change by moving them from the pre-contemplation stage (where there is no awareness and understanding) to the contemplation stage (where they are able to consider decarbonization strategies) (Heller et al., 2012). This moving from stages can be done by consciousness-raising (Friman et al., 2017), raising awareness, and improving the accuracy of their understanding of decarbonization options, benefits, and regulatory implications.

Key factors for moving people through the stages are someone's decisional balance, which means weighing the pros (benefits) and cons (barriers) and cons of behaviour change and their confidence in adopting the new behaviour (Chatzopoulou, 2018). By taking into account the benefits and barriers when designing a solution, behaviour change can be facilitated depending on the context. This insight has been utilized and integrated into Sub-Research Question 1 (SUB-RQ1).

To move someone to the next phase in alignment with the design brief, the following actions can be incorporated into the design process:

1. Actions that stimulate the decisional balance (the benefits must outweigh the cons):
- Showing **positive benefits** that come with choosing for low carbon fuel
- communicate **clear and concise information** that supports the decision-making
- Use **visual tools and analysis to simplify** and present complex data.

2. Actions that stimulate the confidence:
- **Reminding** them about the benefits, leading to more reassurance
- **Simplifying** the decision-making process, let it feel approachable and transparent.
- Making the process **accessible**, ensure that they have the tools and relevant information easily at hand to navigate through the decision-making process with clarity.
- **Visual progress tracking combined with key insights and supporting data** to stimulate encouragement for adoption and understand impact and implications.

2.5.2 COM-B

The COM-B model helps identify what needs to change for a behaviour intervention to be effective by analysing Capability, Opportunity, and Motivation (sources of behaviour), which together drive behaviour. The model has also often been used for behaviour change in businesses.

To change behaviour towards the adoption of low-carbon fuels, key elements of the COM-B model (capability, opportunity, and motivation) have been analysed for their practical application:

- Capability: Ensure vessel operators have the relevant skills and knowledge resources to form the decision-making or **educate** if needed.

- Opportunity: **Simplify** the decision-making process, make it easy, **clear** and **resources** and support systems available.

- Motivation: Provide tailored **incentives** and highlight the **benefits** to boost adoption and **foster positive emotional response.**

2.5.3 Green Nudges

Lastly, the main takeaways that could apply to the project of the Little Book of Green nudges have been evaluated. The book shows its main interest in persuasion on campuses, but the behaviour science behind it can also be applied to different target groups. The use of green nudges could be beneficial to the project, as nudges work better than solely raising awareness does (Grid-Arendal & Team, 2020). Awareness and intentions matter as they facilitate for behaviour change, but nudges guide towards the change and help overcome adoption. Especially when sustainable choices are more complicated, it is hard to move people from motivation to concrete action. Nudging can remove barriers and facilitate quicker actions.

The main strategy is that if you want to encourage a certain behaviour you need to make it Easy, Attractive, Social and Timely. Within these 4 categories, there are different nudge strategies that can be implemented to facilitate change through these categories (See Appendix E). When the target behaviour and context are determined, you can select and consider which nudge will be most effective to overcome barriers or optimize potential drivers to facilitate change. However, the effectiveness and outcome of the nudges should be tested.

An example of possible nudges within the design context is that timely reminders with tailored sustainability insights for a customer can, for example, help traders to integrate sustainability (more) into discussions, increasing the likelihood that biofuel options are considered. In addition, another nudge strategy could be to frame sustainability choices with standard options, such as pre-selecting biofuel blends in a comparative tool, reducing the effort needed to make a more sustainable decision. During the ideation phase, specific nudge strategies are further explored and ideated, integrating relevant behavioral mechanisms and value-added nudges.

2.5.4 Role of The Models

The three stages of the behaviour models address behaviour change in distinct but complementary ways, focusing on different aspects of the decision-making process.

TTM helps to identify at which stage change is needed, COM-B focuses on what needs to change to enable the transformation, and Green Nudges shows how to drive change by implementing interventions or strategies to overcome the identified barriers. When implemented together, they form a solid strategy to address and facilitate behaviour change in the given context.

Despite their distinct purposes, the models noted shared principles in some way:

1. Showcasing benefits - TTM highlight benefits in the contemplation stage to motivate. COM-B covers benefits under motivation to enhance willingness. Green Nudges use strategies to make benefits clear.
2. Incentivizing action - COM-B addresses motivators under Opportunity to reduce barriers. Green nudges use incentives to create action or reduce complexity.
3. Informing - TTM highlight raising awareness in early stages. COM-B covers the knowledge under Capability. Green nudges can help simplify complex data.

COM-B and TTM emphasize the importance of confidence, decisional balance, capability, opportunity and motivation to drive behaviour change. Whilst Green nudges support this by creating interventions. This shows that the models together lead to an approach to **make actions easier and more attractive.**

2.6 Discover Outcomes

In this chapter key insights from the chapters derived from the Discover phase are presented.

The key insights for each chapter are listed, along with their implications for the tool and links to the research questions.

Chapter 2.2.1 Stakeholder Analysis - Key insights

- External forces (such as regulation and end users or cargo owners) are accelerating the transition to sustainable fuels. As a result, shipping companies are increasingly less able to ignore emission reductions.
  ↠ Implication for the tool: The simulation dashboard could provide insight into compliance and market pressure by visualizing regulatory requirements, emission reduction targets and the financial impact of non-sustainable choices. This makes it easier to consider sustainable fuel options.
  ↠ *Link to RQ's: The external forces increase the need for emission reductions, which advocates decision-making for sustainable options(SUBRQ1).*

- Traders play a key role in the transition, but do not yet communicate sufficiently with customers about the sustainable options. They act as middlemen and should have a more active role in boosting emission reductions in the supply chain.
  ↠ Implication for the tool: The dashboard should help traders fulfil their function as information brokers by clearly and convincingly outlining the benefits of biofuels.
  ↠ *Link to RQ's: Traders are in the position to influence shipping companies' decisions and can use this to present sustainable options more attractive, clear, and actionable (SUBRQ1+2).*

- Trading companies can build (strong) relationships with customers and suppliers, which can lead to better access to (sustainable) resources, stronger strategic positions and faster adoption of sustainable fuels.
  ↠ Implication for the tool: The dashboard should facilitate the relationship and deal-making processes in addition to providing insights. It can help in assisting traders to effectively communicate sustainable fuels this way.
  ↠ *Link to RQ's: Relationships, communication and collaboration play a key role in the adoption and consideration of sustainable alternatives (SUBRQ2).*

Chapter 2.2.2 Purchasing process - Key insights

- Delays, inefficient communication, and incomplete information create bottlenecks.
  ↠ Implication for the tool: The tool should enable for quick access to relevant insight to make sure the decision-making process is efficient (SUBRQ3). By eliminating bottlenecks, it ensures that the processes are in-time and well-informed for the fast-paced environments, which is inline with the deal-making and relationship processes (SUBRQ2).

- Traditional decision-making limits the adoption of sustainable fuels.
  ↠ Implication for the tool: The tool should present sustainability insights to enable stakeholders making sustainable decisions. As providing attractive sustainability insights can be negotiation leverage for traders to present sustainable options more appealing and are beneficial to the relationship and deal-making processes (linked to SUBRQ 1+2).

- Key intervention points exist where sustainability choices can be optimized.
  ↠ Implication for the tool: These intervention points should be utilized to embed sustainability into the decision flow. This integrates considering biofuels in a more proactive way (SUBRQ1).

Chapter 2.2.3 Regulations - Key insights

- FuelEU Maritime directly incentivizes cleaner fuel adoption.
  ↠ Implication for the tool: The tool should help trader to understand and show how fuel choices impact regulatory compliance over time, track reductions en allow for recommendations to meet (future) reduction targets (Covering all RQs).

- FuelEU Maritime gives traders strong leverage client conversations as it is an enforced reason for shipping companies to consider biofuels due to set reduction targets and penalty costs. (Covering all RQs).
  ↠ Implication for the tool: make sure that the tool incorporates elements that provide leverage in relation to FuelEU Maritime. This can be done by integration features such as cost-compliance

simulation (financial impact), projected savings, impact overviews and alignment with compliance targets, and education or awareness features.

Chapter 2.3 Transition Drivers - Key Insights

- There is a lack of demand for sustainable fuels from shipping companies, slowing the adoption of alternative fuels.
  ↠ Implication for the tool: Because shipping companies are not significantly adapting, the tool must stimulate demand (MRQ).

- Traders currently have limited in-depth knowledge about regulations to advocate for sustainable fuels.
  ↠ Implication for the tool: the tool should help traders communicate relevant insights, guide and provided the needed information. This to put less dependency on the individual and to provide them with the necessary resources (ALL SUBRQ's).

- Stronger collaboration between traders and shipping companies can enable the transition.
  ↠ Implication for the tool: the tool should play an important role during communication moments, in which it improves the cooperation between traders and shipping lines and effectively remove obstacles (SUBRQ1+2).

- Regulatory uncertainty, knowledge gaps, unclear costs and options, and consequences for stakeholders lower the adoption.
  ↠ Implication for the tool: The tool should make these aspects clear and insightful so that barriers are lowered(SUBRQ1+3).

Chapter 2.4.1 Decarbonization landscape

- Decarbonisation tools are already quite widely available, but not yet well aligned with the new maritime regulatory needs.
  ↠ Implication for the tool: The simulation dashboard should address these specific maritime challenges (such as regulatory compliance and operational integration) (SUBRQ1+3).

- There are two categories of providers of decarbonization tools: fuel suppliers (which offer carbon management solutions) and emissions platforms (which offer tools for tracking and reporting emissions).
  ↠ Implication for the tool: The dashboard should integrate computational decision support and practical emissions tracking to provide a well-supported solution for the maritime context (SUBRQ3).

- Existing tools are often data-intensive and complex, limiting their usability in rapid decision-making processes.
  ↠ Implication for the tool: The design must be developed with clarity, ease of use and minimal input as requirements to efficiently support traders and shipping companies (SUBRQ1+3).

- There is a lack of mobile accessibility and integration of traditional versus sustainable fuel comparisons.
  ↠ Implication for the tool: The dashboard should integrate calculation-based decision support as well as practical emissions tracking to provide a well-supported solution within the maritime context (SUBRQ3).

- Existing decarbonization tools require significant user input and are often complex, while fuel supplier tools (currently) provide only limited assistance in the area of maritime regulation.
  ↠ Implication for the tool: To simplify the simulation dashboard interaction and user input while implementing regulatory guidance tailored to the maritime fuel context (taking into account regulatory insights and obligations to enable customers to navigate these) (SUBRQ1+3).

Chapter 2.4.2 Dashboard Analysis

- Dashboards were categorized into three different groups: Decarbonization Assessment & Analysis Tools, Decarbonization Tools and Bunker Management Tools.
  ↠ Implication for the tool: Understanding these categories allowed for a structured comparison of functionalities, user needs and areas for improvement (SUBRQ3).

- Ownership shaped the dashboard analysis: Decarbonization platforms prioritize analytics, whereas fuel providers focus on providing a tool as a service.
  ↠ Implication for the tool: The future dashboard should capture some of the analytical depth of the decarbonization platforms, while ensuring that the practical applications (the focus of the fuel provider's tools) are aligned with the decision-making process (SUBRQ3).

- The dashboards were evaluated based on their key functionalities, end users, and impact on decision-making.
  ↠ Implication for the tool:This study provided a framework to determine which features are critical and which gaps can be addressed (SUBRQ1+3).

Chapter 2.4.3 Plus, Minus, Interesting

- Overlapping functionalities across the categories are opportunities for integration, with CO2 reduction being the overarching motivation.
  ↠ Implication for the tool: The dashboard should merge carbon management, usability improvements, and operational value into a cohesive solution (SUBRQ3).

- Carbon management tools focus on CO_2 reduction but lack usability for fast-paced decision-making.
  ↠ Implication for the tool: The simulation dashboard should integrate strong emission tracking while maintaining a clear and intuitive interface (SUBRQ1+3).

- Providing functions that address unique user needs increases a tool's value and relevance.
  ↠ Implication for the tool: The dashboard should be designed with a clear focus on the stakeholder needs, which ensures that functionalities align with real-world applications (SUBRQ1, SUBRQ3).

Chapter 2.4.4 Quantitative research

- Certain features appear consistently across all tools, such as emissions data, trends over time, reporting tools, and visuals.
  ↠ Implication for the tool: These elements should be included to ensure relevance and usability, while refining their implementation for maritime-specific needs (SUBRQ3).

- The layout elements focus on clear navigation, infographics and structured data presentation to improve understanding.
  ↠ Implication for the tool: These elements need to be implemented to ensure relevance and usability and will need to be refined for specific (maritime) contextual needs (SUBRQ1+3).

- Data visualization, monitoring, and analytics are dominant dashboard functions and support decision-making through structured insights.
  ↠ Implication for the tool: The dashboard should integrate real-time analytics, trend tracking and predictive insights to guide fuel-related decision-making (SUBRQ3).

- Quantifiable metrics such as total emissions, emissions by category and reduction progress are often used, while other metrics depend on the specific use case.
  ↠ Implication for the tool: Key Performance Indicators (KPIs) must be tailored for the maritime context, ensuring that regulatory compliance and operational decision-making are adequately supported (SUBRQ1).

- PMI and quantitative findings show overlap in that actionability and clear insights drive engagement.
  ↠ Implication for the tool: The simulation dashboard should simplify complexity by structuring information clearly and providing both high-level summaries and analysis options (SUBRQ3).

Chapter 2.5.1 Transtheoretical Model

- Stakeholders are still in the early stages of behavioral change. They are not yet aware of it and are not ready to switch to low-carbon fuels.
  ↠ Implication for the tool: The dashboard should include phased communication strategies that raise awareness so that users can move from low awareness to informed decision-making.

- Decision balance plays a crucial role in changing behaviour, as stakeholders weigh the perceived benefits and drawbacks of fuel transition.
  ↠ Implication for the tool: The tool should explain the benefits of sustainable fuels while addressing obstacles to establish a favourable decision-making balance. (SUBRQ1).

- Increasing customer confidence is essential to encourage the transition to sustainable fuel use.
  ↠ Implication for the tool: Providing visual insights, tracking progress, and offering clear, attainable guidelines can help build confidence and commitment to change (SUBRQ1)

- Raising awareness and providing clear and organized information and data are vital to achieving behavioral change.
  ↠ Implication for the tool: Interactive functionalities and well-structured, easy-to-understand emissions data should be explored to raise awareness and promote informed decision-making (SUBRQ1).

Chapter 2.5.2 COMB

- Lack of capacity (knowledge and skills) can hinder fuel adoption.
  ↠ Implication for the tool: clear educational information, data-driven and actionable insights should be implemented to support decision-making and fill knowledge gaps.

- Opportunities shape behavior by making sustainable choices simpler and more accessible.
  ↠ Implication for the tool: The tool should simplify the decisi-

on-making process by reducing complexity, ensuring clarity and offering structured guidance.

- Motivation is crucial to adoption, which requires both incentives and perceived benefits.
  ↠ Implication for the tool: The tool should emphasize positive reinforcement through visualization of benefits, insights into cost savings, and tailored incentives to drive behavior change.

Chapter 2.5.3 Green Nudges

- When it comes to encouraging behavioral change, nudges work better than awareness alone.
  ↠ Implication for the tool: The dashboard should include subtle behavioral prompts that encourage sustainable fuel adoption without requiring much effort from the user.

- Sustainable decisions often require more effort and direction to turn motivation into action.
  ↠ Implication for the tool: Features that simplify decisions, lessen cognitive load, and offer detailed instructions should be created to reduce barriers.

- The effectiveness of nudges depends on whether they are easy, attractive, social, and timely (EAST framework).
  ↠ Implication for the tool: The tool should present information in an attractive and intuitive way. In addition, consider using social elements and sending timely or repetitive signals to maximize impact.

Chapter 2.5.4 Role of Models

- The three behavioral models complement each other by addressing different stages of decision-making process
  ↠ Implication for the tool: In the tool the elements from all models should be integrated to provide a complete framework to help users move from awareness to action.

- Shared principles among the models highlight the importance of benefits, motivation, and reducing complexity.
  ↠ Implication for the tool: Features should be designed to clearly communicate benefits, incentivize action, and present information in a way that reduces cognitive effort for users.

- Confidence, decisional balance, and ease of action are critical in driving sustainable behavior change.
  ↠ Implication for the tool: The tool should incorporate elements that build trust, simplify decision-making, and encourage gradual progression toward sustainable fuel adoption.

TAKEAWAYS

SUBRQ1 (Decision-Making and Insights)
→External forces (such as regulations and market expectations) increase the need for emissions reductions, making it more difficult for shipping companies not to consider sustainable fuel options.
→ The more traditional decision-making processes restrict the adoption of sustainable fuels. Whereby sustainable options or emission reductions are not automatically included in fuel decision-making.
→ Existing decarbonisation tools are often too complex and data-intensive and do not address context-specific needs, making it difficult to make fast and well-considered decisions.
→ Intervention moments in the purchasing process offer opportunities to structurally integrate sustainability into decision-making.

SUBRQ2 (Traders & Process Integration)
→ Traders are in a position to play an important role as intermediaries in the transition, but currently communicate (not enough) about sustainable options and emission reduction options to their customers.
→ Strong and collaborative relationships between traders and shipping companies lead to faster adoption of sustainable fuels, as strategic partnerships better transfer resources and knowledge and are more likely to lead to action.
→ Inefficient communication, uncertainties and incomplete information create bottlenecks, delay decisions and limit effective consideration of sustainable options.

SUBRQ3 (Behaviour Change & Usability)
→ FuelEU Maritime forces the sector to make cleaner fuel choices, giving traders a strong negotiating position to address sustainability.
→ Existing tools often lack mobile accessibility and usability, hampering rapid decision-making in dynamic environments.
→ Regulatory uncertainty, lack of knowledge and unclear costs are major barriers to the adoption of sustainable fuels.

MRQ (Strategic Communication & Transition Impact)
→ Lack of demand for sustainable fuels among shipping companies slows down the transition to alternative fuels.
→ Traders do not always have sufficient and correct knowledge of regulations, which makes them less effective in promoting and communicating sustainable options.

3. DEFINE

In this chapter, conducted research and insights are presented that originate from the discover phase of the design approach.

3.1 Define Overview

This introductory chapter illustrates the reason and value of the following chapters.

The define phase builds upon the insight gained during the discovery phase, since the problem space is established by taking into account the exploration outcomes. The goal of this phase is to convert those findings into specific design decisions that inform the development of the future tool.

By structuring key analyzes and activities, this chapter ensures that design decisions meet user needs, industry standards, and market dynamics. Each analysis and activity in this phase has been selected for the value added in this phase and performed (mostly) independently to validate design choices, refine functional requirements, and ensure that the solution meets real-world and user needs. The following activities have been carried out for these reasons:

- **Design Context:** Analysis and framing of all factors that define the problem domain. This ensures that there is a thorough understanding and framework for the solution domain.
- **Deal-Making Process Analysis:** Insight into the back-end dealmaking process determines how the tool can be integrated into the workflows and where there are opportunities for intervention.
- **Customer Acquisition:** focuses on the likelihood that customers will embrace and integrate the dashboard into their decision-making. This is done by identifying the reasons for the relationship between the merchant and the customer and the customer's motivating business drivers.
- **Personas:** To achieve a personalized and desired solution, this activity defines the needs, pain points and motivations of the stakeholders based on research and observations
- **Project Scope:** Clearly defining project boundaries that prevent scope creep and ensure targeted and feasible implementation.
- **List of Requirements:** This activity identifies requirements from all findings and objectives, ensures alignment and set priorities for the most promising proposals to implement.
- **Design Vision:** This activity synthesizes insights into a guiding vision that informs every aspect of the development process.
- **Design Goals:** The next steps in the project can be executed in a more targeted and feasible manner by making clear statements and defining them.

These activities provide consistency in design choices and contribute to a systematic, research-based decision-making process. Table 3.1 summarizes the main activities, methods, materials used and their relevance to the overall design development. By performing these activities, design decisions will be informed, practical, and aligned with both user needs and industry requirements. The following sections discuss the findings and outcomes of each activity.

Activities							
Activities	**Chapter**	**Method Used**	**Materials**	**Executed by**	**Participants**	**Linked RQ(s)**	**Contribution to research questions**
Design Context	3.2	reflected on insights Chapter 2, WWWWH Framework, Visualisation	Miro, findings research, Canva, Delft Design Guide	Me	N/A	SUBQ1, SUBQ2	Identifies and sets external influences, regulations, and trends impacting the design phase.
Deal-Making Process Analysis	3.3.1	Mapping current deal-making process, flowdiagram, identifying intervention points,	Miro, Bunker procedure	Me	N/A	SUBQ1, SUBQ2	Understanding the back-end deal-making process determines how the tool can be integrated into the workflows and where intervention opportunities lie.
Customer Acquisition Reasoning	3.3.2	categorization of acquisition factors, linking relationship strenght and adoption	insights from client meetings, Miro, Canva	Me	N/A	SUBQ1, SUBQ3	Examines how easily clients adopt the dashboard, how decision-making is influenced by their relationship with traders, what motivational business factors encourage engagement, and how likely they are to adopt the tool because of this.
Personas	3.4	stakeholder analysis, persona development, visualization	Persona templates, observations, vacancies	Me	N/A	All SUBRQs	Defines different user groups and their specific needs.
Scope	3.5	defining in scope requirements and allignment with project brief , scope visualistaion	Canva, Miro	Me	N/A	SUBQ1, SUBQ2	Establishes project boundaries and sets priorities.
List of Requirements	3.6	Indetified requirements by insights and outcome from Chapter 2, 3 and 4, Categorization and priorization of the requiments, linking to vision and activities.	Miro, findings research, Excel, Delft Design Guide	Me	N/A	All SUBRQs	Defines functional and non-functional requirements, identifies gaps and improvement areas, and set directions for the project.
Design Vision	3.7	Synthesizing previous findings, defining attributes and key vision elements, refinement and elaboration	Canva, Miro, Word, AI, Coach feedback, Delft Design Guide	Me	Coaches	SUBQ1, SUBQ2	Defines the core principles and long-term objective for the desired future state of the tool
Design Goals	3.8	Analyzing design vision extracting key attributes, forming goals, linking goals to	Miro, Word	Me	Coaches	All SUBRQs	Target statements for design work and experience that will be integrated in the future tool.

Table 3.1 Activities performed in the Define Phase.

3.2 Design Context

Understanding of the design context was formed by using the WWWWWH method. Applying this ensured that all relevant aspects were considered and framed.

Assessing previous research and insights shaped the design context. Key elements could be framed in Figure 3.1 using the WWWWWH (Who, What, Where, Why, When, and How) method. This method was executed by following the WWWWWH problem analysis in the Delft Design Guide, plotting and improving a draft in Miro, and creating a final visual diagram in Canva.

The primary users will be vessel operators, but the simulation dashboard will be a resource provided and managed by the trading company and utilized by traders. Implementation will be across online mediums during the deal-making process, including document exchanges and e-mails, to maximize incentivizing and adaption. In this case, the tool plays an active role in informing vessel operators about its existence. This means visibility and adoption are not dependent on human intervention or interactions.

This is important, as relying on traders as advocates will most likely result in low efforts due to most traders' limited knowledge, personal motives, and traits, as stated in Chapter 2.3, transition drivers. The tool can also help and inform during the relationship-building process to capture initial interest and deliver value early. Early incentivizing increases the opportunity, initial interest, and potential impact.

As low-carbon fuels are not widely adopted or requested yet and regulations are just starting, there is space for meaningful Interventions, especially in the deal-making process, which is key for the adoption and implementation of low-carbon fuel supplies between both stakeholders.

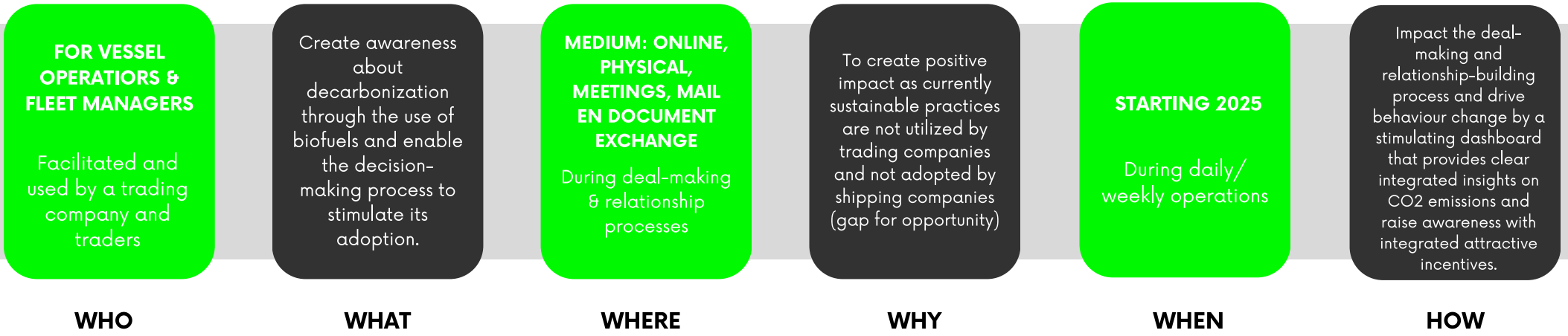


Figure 3.1 - WWWWWH Method applied for the design context.

3.3 Current Scenario

In this chapter, an overview of the deal-making process has been illustrated, which includes the current decision-making scenario between stakeholders. This chapter also covers client acquisition factors.

3.3.1 Deal-making Process

The current deal-making process plays a critical and driving role in the decision-making of fuel purchases between traders and vessel operators. Figure 3.2 illustrates an overview of this process. The analysis was carried out by mapping the current deal-making process in Miro to develop the back-end deal-making procedure, which enabled a structured visualization of the existing workflow.

The flowchart was used to identify critical intervention points within the inquiry process (section 2.2.2) and back-end work activities (derived from carrying out these activities at Osprey Energy), where the tool could seamlessly deliver value and intervene. This approach ensured that intervention points were aligned with stakeholder needs and workflow procedures and that the tool could be incorporated accordingly.

This process offers touchpoints for integrated and attractive incentives to encourage considering biofuel options. By understanding the process, it becomes more clear where nudges could be incorporated, and a future dashboard should be integrated into this process. By making sure that the dashboard integrates into regular communication and business operations, it transitions from being an external tool into a core component for the decision-making that already takes place. This way, it becomes a natural extension of the process, and it is repeatedly shown, which increases the impact and chance for adoption.

In this process, lost deals were not considered, as in such cases, the opportunity to influence the client's decision-making does not exist, and the process ends with no further communication. However, during phases A—setting up the relationship and B - making a deal, the information presented to the client in advance about the concept and its offerings can influence their decision to proceed.

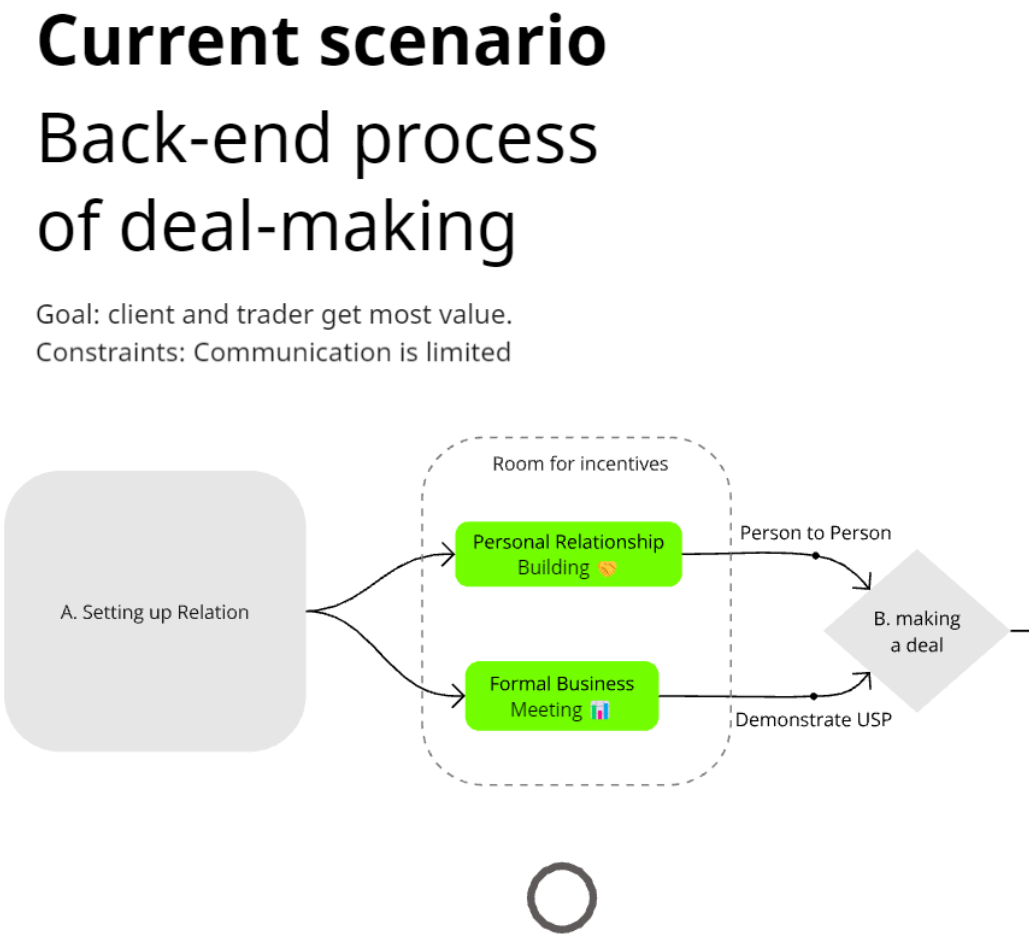
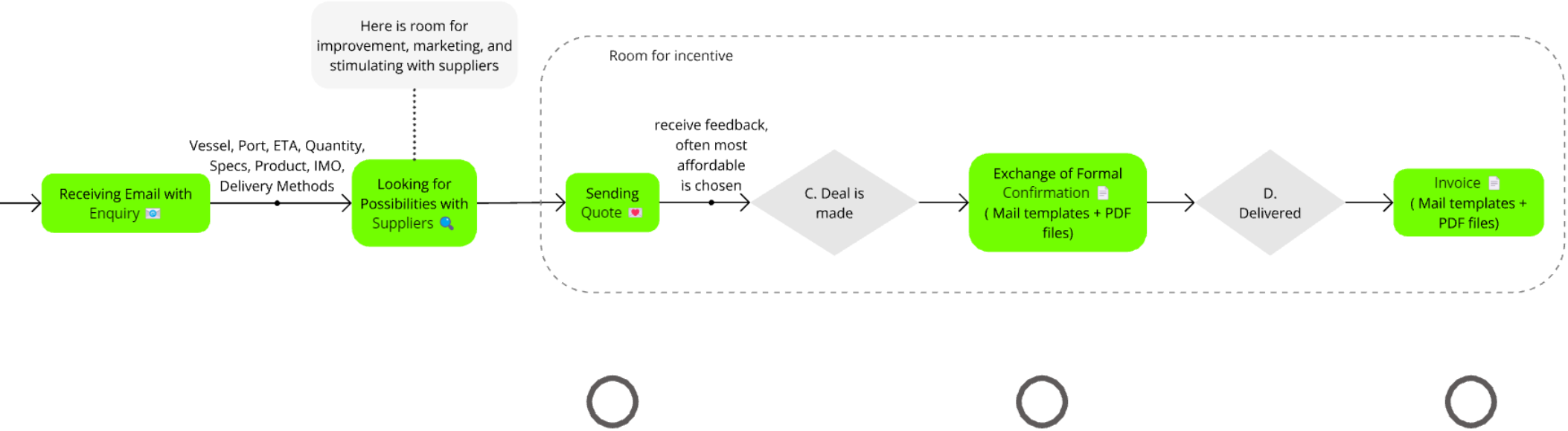


Figure 3.2 - Back-end process of the deal-making process and touchpoints for intervention

: touch points for intervention

: room for incentives



3.3.2 Acquisition

This analysis categorizes acquisition factors derived from insights from in-person customer meetings at Osprey Energy into visualization patterns, which are ranked and visualized in Miro. By linking the strength of customer-merchant relationships to adoption behavior, this study identified key business motivating factors that drive engagement. This helped determine how likely customers are to adopt the tool, highlighting the role of trust, incentives, and perceived value in decision-making.

The way in which the relationship is established in phase A (Figure 3.3) significantly influences the degree to which a client is willing to adopt a new concept.

The stronger the relationship, the more trust and engagement are feasible, providing a greater opportunity to adopt the new dashboard.
Figure 3.3 shows the different categories and reasons why customers would choose to work with you or your company.

The reasons are sorted from important to less important within each category. Additionally, the visual length of each reason indicates the importance across all 3 categories, allowing for comparison between them. The reasons have been formed based on acquired industry experience.

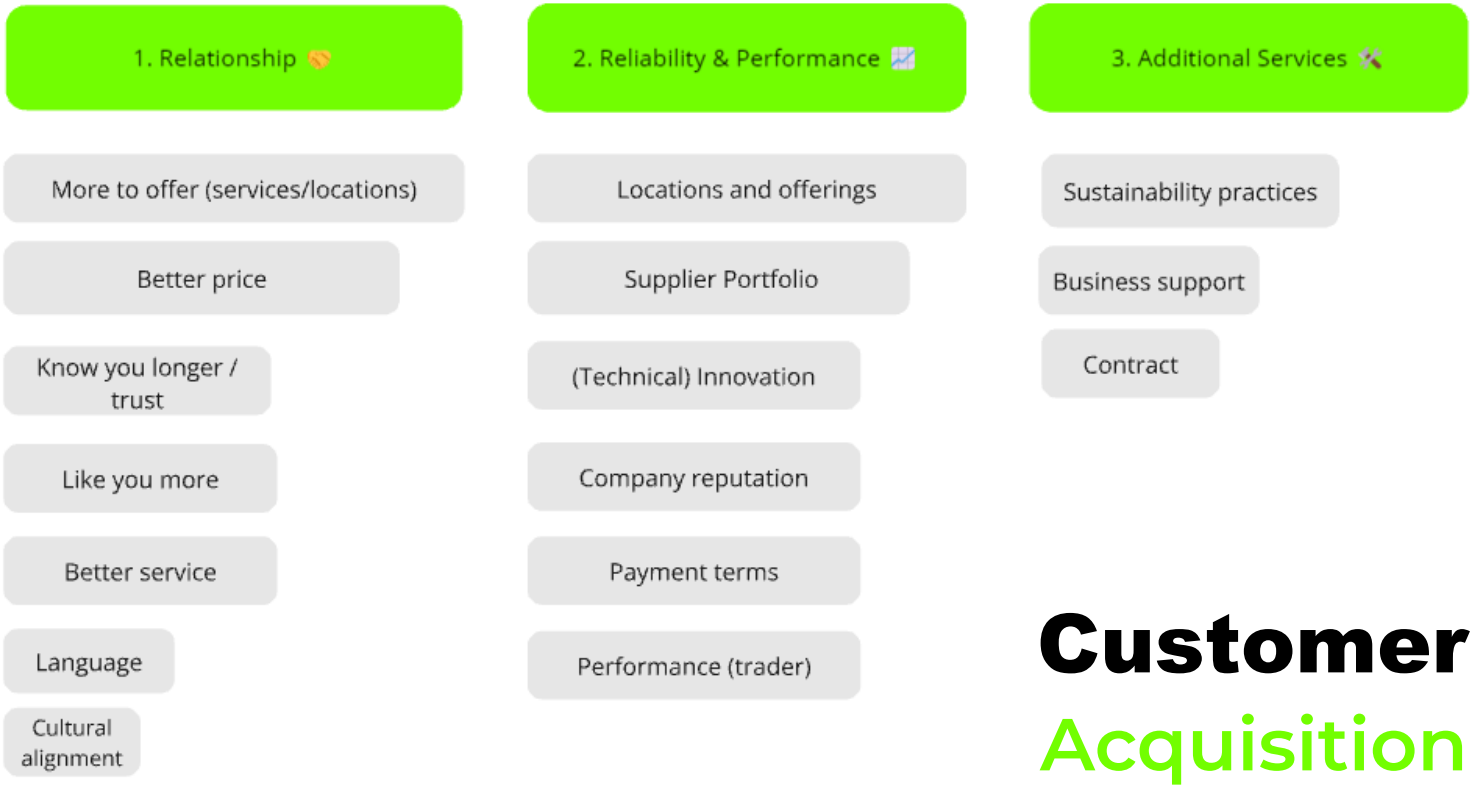


Figure 3.3 - Categories and hierarchical reasoning for client to enter into relationship.

3.4 Personas

For stakeholders who directly or indirectly interact with the dashboard, fictional personas have been developed based on insights and research.

The persona development process was carried out individually and shaped by insights from stakeholder analysis, observations, and vacancy analysis. The personas were developed by looking at online persona templates and combining the most valuable elements into a visual in Canva. The observations are based on personal encounters from work at Osprey Energy, which provided insights into stakeholders' behavior.

This activity defined fictional personas representing the main stakeholders (operators and traders) and their specific needs. This helped personalize the solution by identifying user pain points, motivations, and decision-making behaviors. The personas helped align the design with key stakeholders' experiences, requirements, behavior, and workflows, improving adoption and usability.

Two different personas were formed; see pages 56 and 57. This was chosen to generate for both as vessel operators will have direct interaction with the dashboard, and traders will encounter it indirectly, and it should not interfere with their work.

The personas represent their goals, needs, pain points, key activities, and traits. Having these visible helps generate a relevant user journey and create more tailored features and functions to meet users' needs and behaviours.

For Luuk de Groot (Trader and the 1st Persona), the dashboard could help to simplify and convey the use of biofuels to his clients. The dashboard could also educate him if he is unaware of emission reduction possibilities, as well as bring value to his deals, as it could be a distinctive sales point. In the distant future, it could possibly even help traders reduce the time and effort needed to assess and compare options of their own suppliers. However, within this project scope, they will not be designed for.

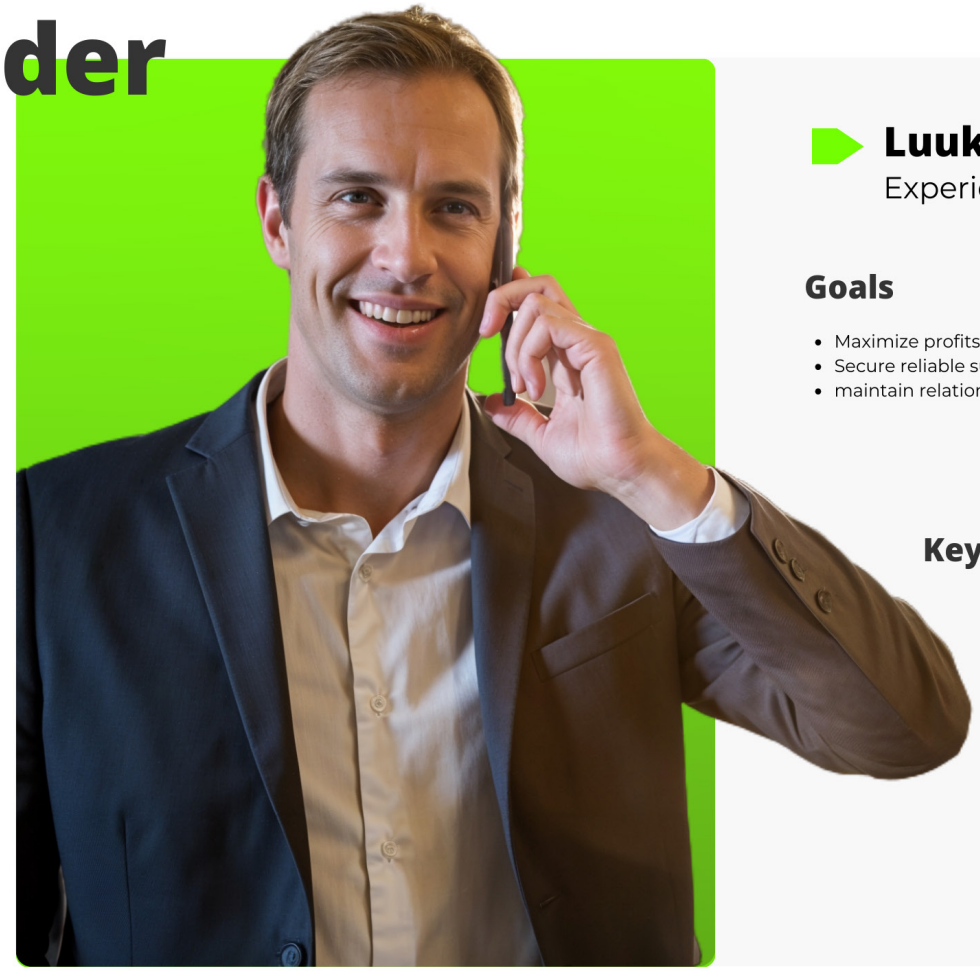
Luuk's main priorities are profit maximization and securing reliable supply. His decision-making process relies on market insights, relationships, and supplier negotiations.

For Thijs de Groot (vessel operator and the second persona), the dashboard could make his decision-making process regarding the adoption of biofuels more comfortable, easy, and insightful, helping him understand the potential impact it could have on his fleet.
Thijs's main focus is efficient operations and cost management. His pain points are time constraints and complexity, and he is resistant to change. The potential dashboard will impact two of his key activities: monitoring and scheduling fuel.

Both personas will benefit from an easy, pragmatic and quick assessment process taking into account factors such as time, efficiency and clarity. This is reflected in their needs and pain points.

Persona

Trader



Luuk de Groot - 35 - Dutch

Experienced Bunker Trader at Marine Fuels inc.

Goals

- Maximize profits
- Secure reliable supply
- maintain relationships

Needs

- Market insights
- Company resources & tools
- strong relationships & network

Pain Points

- Time constraints
- Loosing deals by pricing or availability
- Complexity of sourcing
- High pressure environment

Key activities

1. Responsing to inquires
2. Negotiating with suppliers
3. Managing deals
4. Monitoring the market
5. Linked-in network building
6. Visiting new and current clients

Traits

Social & outgoing
Pragmatic
Competitive
Overconfident
Lack of patience
Short terms focuses

*Fictional: Drafted from in-house experience

Persona

Vessel Operator

Thijs Mulder - 36 - Dutch

Seasoned Vessel Operator at Seaway Logistics.

Goals

- Efficient operations
- Good cost management
- Minimize downtime

Needs

- Straight forward information
- Quick responses
- Decision and Compliance support

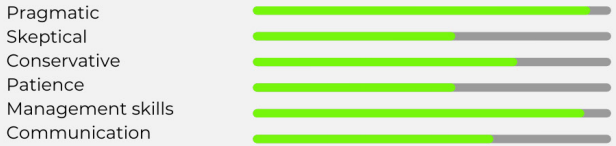
Pain Points

- Change
- Time constraints
- Complexity of sourcing and regulations

Key activities

1. Monitoring fuel consumption and costs
2. Scheduling and route planning
3. Communication with traders
4. Ensuring compliance
5. Reporting, administration and management
6. Communication with ports, suppliers and other parties

Traits



*Fictional: Drafted from in-house experience, vacancies, research findings and assumptions

3.5 Project Scope

The design scope defines the boundaries of this project. By visualizing this, key priorities are communicated, and clarity on what's in or outside the scope is provided, aiding in the right focus within the project.

To establish project boundaries and align requirements, the scope definition process was carried out individually in Miro before being visualized in Canva. This activity establishes clear priorities based on the insights previously obtained to ensure a structured and achievable implementation. This prevents the following activities from expanding uncontrollably to undefined or not-in-scope boundaries. By defining in-scope requirements, the process helped streamline design direction, keeping development efforts focused and aligned with project objectives.

After finalizing the list of requirements, it was possible to state what is inside and outside the scope of this design project. Visualizing the scope helped to comprehend and categorize the requirements into clear aspects that will be tackled within the project.

Figure 3.4 shows the scope of the project.

The first inner circle highlights the scope of this project. It was formed based on the condensed list of requirements (see page 62), trying to grasp all the requirements chosen for further development.

The first point, which is within scope, clarifies the project's outcome, which will be a clearly defined and tested visual prototype of a simulation dashboard that informs on the impact of using a low-carbon alternative and incentivizes achieving targets.

The other two points that are within scope focus on the main part of the brief: raising awareness by informing in an attractive and clear manner about the impact and actions that a low-carbon alternative could provide with regard to emission reductions. Additionally, incentives will be integrated that stimulate engagement and facilitate behaviour change by making it easier to consider options during the deal-making and the relationship-building process. See Figure 3.4 for a detailed elucidation of the meaning and impact of the points for the project.

The middle ring of the scope highlights recommendations that can be considered within this project. Due to feasibility restrictions, they will not be worked out in detail.

However, recommendations should be stated, as they are important for further development and play a role in making a final product effective. They mainly cover features, functionalities, and aspects that are discovered in the research phase but do not fit the brief and scope of this project.

Lastly, the outer ring represents aspects that are outside the scope because they are either too complex or distant for future steps.

Project Scope

Prototype development

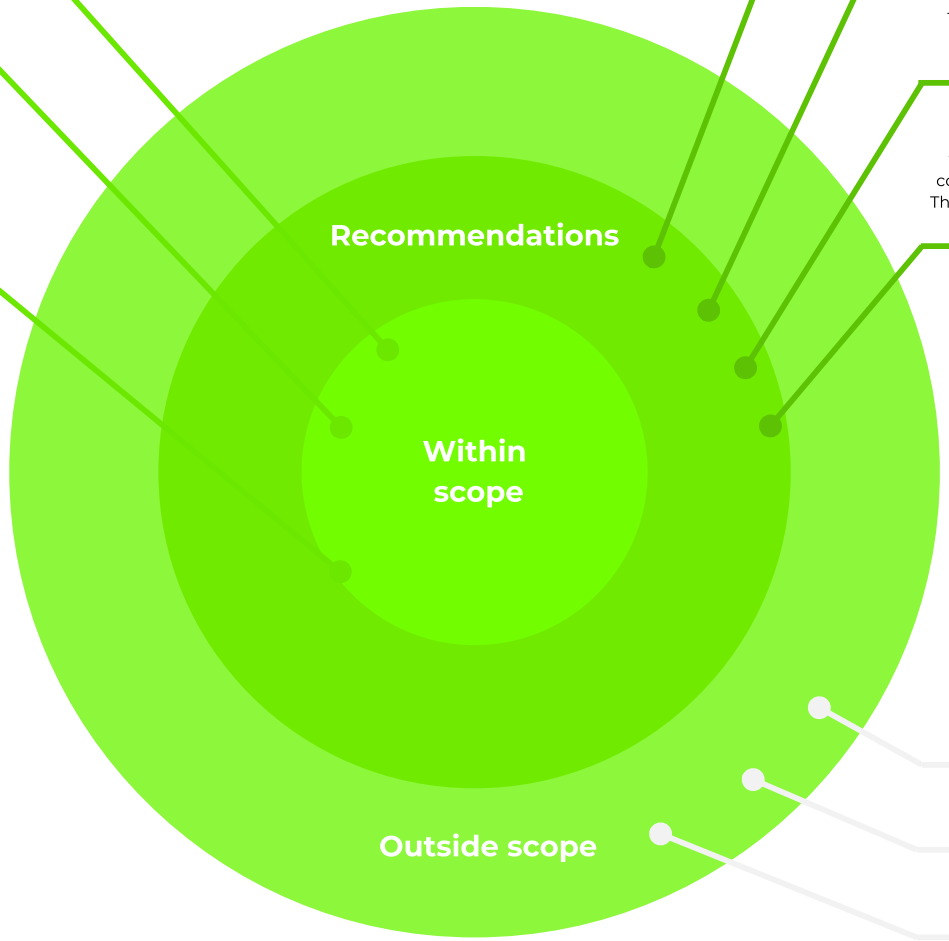
Creating a visual prototype dashboard that shows the impact biofuels have regarding CO2 emissions, reductions, costs, savings, and comparisons, as well as facilitating the setting, tracking, and achieving of reduction goals/targets. Both shown by data visualizations to interpret effectively.

Creating awareness by informing about impact and actions

Providing information about carbon impact, biofuels' benefits, and CO2 emission insights. The information should be presented in a way that motivates users to explore and engage with the content. Additionally, test the clarity, usability, and retention of the presented information.

Integration of attractive incentives to stimulate engagement, the decision making and relationship-building processes

Create a user experience that stimulates engagement with the dashboard and its information, fostering effective communication and generating a positive shift in attitude. The goal is to move decision-makers from unconscious to conscious consideration of biofuel options during both the deal-making and relationship-building processes



Advanced reporting

Features like reporting per company entity and facilitating detailed input/output assessments are valuable but not essential for the initial release.

Additional functionalities

Additional functionalities such as vessel tracking, personalisations, collaborations, certifications, interactivity, after sales support and more can be recommended but will not be developed and tested.

Technical feasibility and development

The technical features will not be developed at this stage.

User experiences

such as personalization, gamification, mobile friendliness, ease of use, onboarding programs could be strategies to boost motivation and use. They can be implemented along the way but will not be assessed or are necessary.

Fully functional tool

Carbon offsetting programs

Advanced calculations

Figure 3.4 - Project scope

3.6 List of Requirements

The list of requirements served as a foundation and guideline to make sure the futher design process aligns with the projects, research, findings, goals and needs.

During the first two stages, a list of requirements was formed, which has been redefined along the way and incorporates the outcomes of Chapter 2. The final version is included on the following pages (p. 61 and 62) and shows the connections to the projects' work, research resources, and the overarching vision.

This list has been created in Excel by implementing, prioritizing, and linking the formed requirements there. The basis of the requirements list has been formed by using the Delft Design Guide: *Checklist for generating requirements, design specifications,* as a reference starting point, and relevant improvements that had value for the project have been added as follows; see text below.

On top of that were the requirements categorized with priorities designated to determine which requirements would be integral to the project's development and which could be considered optional.

The priorities mean the following:

- "Low" - means that the requirement is unimportant within this project scope, as it provides limited value to the stated design brief.
- "Medium" - indicates that the requirements are beneficial; however, they are not considered core requirements to be developed in relation to the project's brief.
- "High" - implies that the requirements are strongly connected with the project brief.

Consequently, requirements have been labeled with the status "develop" or "nice to have" to prioritize which requirements will be implemented in the upcoming stages of the design process. This labeling helped to clarify which aspects are within the project's scope and which fall outside.

Some medium-priority requirements were chosen for further development; however, they are lower-priority items compared to high-priority items, meaning that they can be limited i depth if there are feasibility constraints in the following phases. Additionally, the requirements have been linked to the vision, previous research, analyses, and sources. Requirements with a strong connection to several areas of the project that were linked to the vision were chosen to be marked as project goals for development.

This process helps better define the project's scope, vision, and goals and serves as a guideline for the project's next steps. The condensed version of the list can be found on page 62.

List of requirements

Category	No.	Project Requirement or Wish	Project Priority	Project Goal	Description	Connected to vision	Connection to project Research	Source
Functional	**1.0**							
	1.1	Requirement	High	Develop	The dashboard should include core functionalities to asses carbon impact and costs.	✓	Stakeholders, Legislation, Literature, PMI analysis, Quantitative analysis,	Zero Carbon shipping, In-house, COM-B
	1.2	Requirement	High	Develop	The dashboard should faciliate for setting, tracking and achieving reduction goals/targets.	✓	PMI analysis, Quantitative analysis, Stakeholders, Behaviour models,	COM-B
	1.3	Requirement	High	Develop	The dashboard should Include data visualization tools to interpret data effectively.	✓	Quantitative analysis,	COM-B
	1.4	Wish	Low	Nice to have	The dashboard should be able to operate on its own.	–	Logical	
	1.5	Wish	Medium	Nice to have	The dashboard should inform users about current legislation and decarbonization steps.	–	Stakeholders, Legislation, PMI analysis	COM-B
	1.6	Wish	Medium	Nice to have	The dashboard must be laptop and computer friendly and core functions should be mobile friendly.	–	PMI analysis	
Experience	**2.0**							
	2.1	Requirement	High	Develop	The design should be intuitive, easy to use and understand and have a small learning curve.	✓	Behaviour models, Stakeholders, PMI	Transtheoretical,
	2.2	Requirement	High	Develop	The dashboard should not feel overwhelming or provide too much information in detail.	✓	Behaviour models, PMI analysis	Transtheoretical,
	2.3	Requirement	High	Develop	The dashboard should provide insights and not only data.	✓	Stakeholders, PMI Analsyis, Quantitative analysis,	
	2.4	Requirement	Medium	Develop	The dashboard should make it easy to see the impact of working towards the set goals.	✓	PMI analysis	Transtheoretical,
	2.5	Requirement	High	Develop	The dashboard should let users make informed choices by providing information that is clear and helpful.	✓	Stakeholders, PMI Analysis	
	2.6	Requirement	Medium	Nice to have	To enhance adoption incentives will be provided during the deal-making process to onboard clients	✓	Literature, WWWWHW, Scenario	McKinsey
	2.7	Requirement	High	Nice to have	The dashboard should not look like a trading dashboard.	~	PMI analysis	
	2.8	Requirement	Medium	Nice to have	The dashboard should make availability of alternative fuels visible to users	~	Literature, behaviour models, HVO Mapping	Zero Carbon Shipping, Transtheoretiucal, COM-B, Green Nudging, Argus
	2.9	Wish	Medium	Nice to have	The design should be usable for those who have limited technical skills.	–	Stakeholders	
	2.10	Wish	Medium	Nice to have	The experience should be personalized for their operations.	–	Competitors, PMI Analysis	
	2.11	Wish	High	Nice to have	The dashboard should have a onboarding program to help users getting started easyily.	–	Competitors, behaviour models	Transtheoretical, COM-B
	2.12	Wish	Low	Nice to have	The dashboard should have a education/FAQ page.	–	Competitors, Behaviour models	Transtheoretical, COM-B
	2.13	Wish	Medium	Nice to have	The dashboard should Support familiar, consistent interactions that make complex tasks simple and straightforward to perform.	–		Apple,
	2.14	Wish	Medium	Nice to have	The dashboard should provide personalized communication.	–	Competitors, PMI Analysis, Quantitative analysis,	
	2.15	Wish	Medium	Nice to have	The dashboard should have a guided experience	–	PMI analysis,	
Technical	**3.0**							
	3.1	Requirement	High	Develop	The dashboard should be interactive	✓	Quantitative analysis,	
	3.2	Requirement	High	Develop	The main dashboard page should show the most important functionalities and information.	✓	PMI, Quantative analysis,	
	3.3	Requirement	High	Nice to have	The user should be able to input necessary information for the assessment and output	~	Literature, PMI Analysis, Quantitative analysis,	NEA, EU ETS
	3.4	Requirement	Low	Nice to have	The dashboard should load quickly.	–		
	3.5	Requirement	Medium	Nice to have	The dashboard should calculate based on user input	~	PMI, Competitors, Quantitative research	
	3.6	Requirement	Medium	Nice to have	It should be possible to report per company entity and per ship	✓	Literature	NEA
	3.7	Wish	Medium	Nice to have	The managing company should be able to provide input.	–	Stakeholders, WWWWHW	
Environmental	**4.0**							
	4.1	Requirement	Medium	Develop	The design should inform and stimulate engagement to lower carbon impact.	✓	Literature, PMI analysis	McKinsey, COM-B,
	4.2	Requirement	Medium	Develop	The dashboard should facilitate for the insetting of carbon emissions.	✓	Literature, PMI analysis	McKinsey
	4.3	Requirement	High	Develop	The dashboard should raise industry specific sustainability awareness by providing information, visual metrics and trends.	✓	Stakeholders, Legislation, literature, Behaviour models, PMI analysis, Quantitative research	Zero Carbon shipping, Transtheoretical, COM-B, Mckinsey
	4.3	Requirement	Medium	Develop	The dashboard should comply to industry regulations.	✓	Stakeholders, Legislation, PMI Analysis	
	4.4	Wish	Low	Nice to have	The dashboard should facilitate for the off-setting of carbon emissions.	~	PMI analysis	
	4.5	Wish	Medium	Nice to have	The dashboard should calculate current and possible carbon footprints.	~	Competitors, PMI analysis, Quantitative research	Transtheoretical
Aesthethic	**5.0**							
	5.1	Wish	High	Nice to have	The dashboard should have a visually appealing and consistent look.	~	Competitors, PMI analysis, Quantitative research	
	5.2	Wish	Medium	Nice to have	The dashboard should have a sustainable branding.	~	Competitors, PMI analysis	Green Nudging,
	5.3	Wish	low	Nice to have	The dashboard should have space for incorporating visual identity of the managing company or users.	~	Stakeholders, PMI analysis	
	5.4	Wish	High	Nice to have	The dashboard have an informing and clean look.	~	Competitors, PMI analysis, Quantitative analysis,	
Operational	**6.0**							
	6.1	Requirement	High	Develop	The dashboard should include features for evaluating the environmental and (financial) impacts of different decisions.	✓	Stakeholders, WWWWHW, Behaviour models, PMI analysis, Quantitative research	Transtheoretical, COM-B
	6.2	Requirement	High	Develop	The dashboard should display and measure key performance indicators (KPI).	✓	Behaviour models, PMI analysis, Quantitative research	COM-B, Transtheoretical
	6.3	Wish	Medium	Nice to have	Provide benchmarking tools to compare against industry standards and best practices.	✓	PMI analysis, Quantitative research	COM-B, Transtheoretical
	6.4	Wish	Medium	Nice to have	The dashboard should include features to develop and monitor strategies for reducing emissions.	~	Stakeholders, Legislation, literature, PMI analysis	Zero Carbon shipping, In-house
	6.5	Wish	Medium	Nice to have	The dashboard should facilitate reporting.	~	PMI analysis, Quantitative research	
Behavioral	**7.0**							
	7.1	Requirement	High	Develop	The dashboard should provide clear and easy to understand CO2 insights and benefits	✓	Behaviour models, PMI analysis, Quantitative research	Transtheoretical,
	7.2	Requirement	High	Develop	The dashboard should let users make informed choices by providing information that is clear and helpful.	✓	Stakeholders, behavior models, PMI analysis,	Transtheoretical,
	7.3	Requirement	Medium	Nice to have	The dasboard should incorporate engagement strategies to strenghten willingnes of usage.	~	Literature, PMI analysis	McKinsey
	7.4	Requirement	Medium	Nice to have	The dashboard should increase users engagement to achieve sustainable practices.	~	PMI analysis,	Com-B, Green nudging
	7.5	Wish	Medium	Nice to have	The dashboard should include gamification elements for engagement	~	PMI analysis,	
Communication	**8.0**							
	8.1	Requirement	High	Develop	Design the dashboard to naturally fit into the deal-making process, enhancing rather than disrupting ongoing interactions.	✓	Deal making process, scenarios, interview results	In house knowledge, interviews
	8.2	Requirement	High	Develop	Design (communication) tools within the dashboard that promote positive and constructive dialogue between traders and fuel decision-makers.	✓	Deal making process, scenarios, interview results	In house knowledge, interviews
	8.3	Requirement	Medium	Nice to havae	Embed features that allow decision-makers to explore sustainable options independently, maintaining engagement without constant trader input.	✓	Deal making process, scenarios, interview results	In house knowledge, interviews

List of requirements

Category	No.	Project Requirement or Wish	Project Priority	Project Goal	Description	Connected to vision	Connection to project Research	Source
Functional	**1.0**							
	1.1	Requirement	High	Develop	The dashboard should include core functionalities to asses carbon impact and costs.	✓	Stakeholders, Legislation, Literature, PMI analysis, Quantitative analysis,	Zero Carbon shipping, In-house, COM-B
	1.2	Requirement	High	Develop	**The dashboard should faciliate for setting, tracking and achieving reduction goals/targets.**	✓	PMI analysis, Quantitative analysis,	COM-B
	1.3	Requirement	High	Develop	The dashboard should Include data visualization tools to interpret data effectively.	✓	Stakeholders, Behaviour models, Quantitative analysis,	COM-B
Experience	**2.0**							
	2.1	Requirement	High	Develop	The design should be intuitive, easy to use and understand and have a small learning curve.	✓	Behaviour models, Stakeholders, PMI	Transtheoretical,
	2.2	Requirement	High	Develop	The dashboard should not feel overwhelming or provide too much information in detail.	✓	Behaviour models, PMI analysis	Transtheoretical,
	2.3	Requirement	High	Develop	The dashboard should provide insights and not only data.	✓	Stakeholders, PMI Analsyis, Quantitative analysis,	
	2.4	Requirement	Medium	Develop	The dashboard should make it easy to see the impact of working towards the set goals.	✓	PMI analysis	Transtheoretical,
	2.5	Requirement	High	Develop	The dashboard should let users make informed choices by providing information that is clear and helpful.	✓	Stakeholders, PMI Analysis	
	2.6	Requirement	Medium	Nice to have	To enhance adoption incentives will be provided during the deal-making process to onboard clients	✓	Literature, WWWWHW, Scenario	McKinsey
Technical	**3.0**							
	3.1	Requirement	High	Develop	The dashboard should be interactive	✓	Quantitative analysis,	
	3.2	Requirement	High	Develop	The main dashboard page should show the most important functionalities and information.	✓	PMI, Quantative analysis,	
Environmental	**4.0**							
	4.1	Requirement	Medium	Develop	The design should inform and stimulate engagement to lower carbon impact.	✓	Literature, PMI analysis	McKinsey, COM-B,
	4.2	Requirement	Medium	Develop	The dashboard should facilitate for the insetting of carbon emissions.	✓	Literature, PMI analysis	McKinsey
	4.3	Requirement	High	Develop	The dashboard should raise industry specific sustainability awareness by providing information, visual metrics and trends.	✓	Stakeholders, Legislation, literature, Behaviour models, PMI analysis, Quantitative research	Zero Carbon shipping, Transtheoretical, COM-B, Mckinsey
	4.3	Requirement	Medium	Develop	The dashboard should comply to industry regulations.	✓	Stakeholders, Legislation, PMI Analysis	
Operational	**6.0**							
	6.1	Requirement	High	Develop	The dashboard should include features for evaluating the environmental and (financial) impacts of different decisions.	✓	Stakeholders, WWWWHW, Behaviour models, PMI analysis, Quantitative research	Transtheoretical, COM-B
	6.2	Requirement	High	Develop	The dashboard should display and measure key performance indicators (KPI).	✓	Behaviour models, PMI analysis, Quantitative research	COM-B, Transtheoretical
Behavioral	**7.0**							
	7.1	Requirement	High	Develop	The dashboard should provide clear and easy to understand CO2 insights and benefits	✓	Behaviour models, PMI analysis, Quantitative research	Transtheoretical,
	7.2	Requirement	High	Develop	The dashboard should let users make informed choices by providing information that is clear and helpful.	✓	Stakeholders, behavior models, PMI analysis,	Transtheoretical,
Communication	**8.0**							
	8.1	Requirement	High	Develop	Design the dashboard to naturally fit into the deal-making process, enhancing rather than disrupting ongoing interactions.	✓	Deal making process, scenarios, interview results	In house knowledge, interviews
	8.2	Requirement	High	Develop	Design (communication) tools within the dashboard that promote positive and constructive dialogue between traders and fuel decision-makers.	✓	Deal making process, scenarios, interview results	In house knowledge, interviews

3.7 Design Vision

A design vision statement has been formed as guideline to shape the development process.

The design vision was developed individually, integrating insights from previous findings. This was done by brainstorming and writing in Miro, Word, and AI. The Delft Design Guide was consulted for the guidelines for the structure of the Vision, which was applied in the formulation of the vision. The vision was subsequently improved several times based on coach feedback. This activity focused on defining key features and vision elements to ensure alignment with the core principles and long-term goals of the tool.

The design vision has been formulated as a statement that touched upon the main elements of the project scope, in alignment with the purpose of the original design brief: raising awareness and fostering behavior change. By addressing the elements of the project scope, the vision provides a framework for the next phase of the design process. Additionally, insights from the Discover phase have been implemented, ensuring values and objectives are reflected. This is to provide a clear direction for the next phases in line with the identified needs of the targeted stakeholders while addressing gaps in existing tools and enhancing the processes.

Design Vision

"Support traders with a digital simulation tool that engages maritime fuel decision-makers in the assessment of sustainable fuel options, by providing **clear insights** into **simulated data** (costs and emissions outcomes).
The tool enhances **engagement** in fuel decision-making by integrating **attractive** behavioural stimuli throughout the the **relationship-building process** between parties."

In the vision, the crucial pre-deal-making process is where the relationship-building process takes place (Chapter 3.3.1). The deal-making process is important as it is the foundation that serves as a central hub for all communication between traders and vessel operators, and initial decisions occur in the pre-deal-making phase. Here lies the opportunity to influence decision-making, introduce sustainable options, and facilitate early engagement. Therefore, this process should be considered, included, and designed for to ensure that the desired impact on decision-making can take place.

Furthermore, sustainability offerings need to be integrated early in the relationship-building process because if they are not introduced at this stage, they may never be considered, and the opportunity to influence the customer's direction and build a relationship may be lost, resulting in no change. Integrating the relationship-building process into the vision also provides traders with a strong selling point and differentiates them. This makes them more likely to build a relationship with the goal of increasing sustainability (as covered in Chapter 3.3.2). Traders can (are in a position to) inform customers about sustainable alternatives, reduce uncertainty, and help them recognize and address challenges they may not yet be aware of. This early introduction facilitates the transition to sustainable fuels and accelerates adoption.

1. Clear insights

"Clear information" - aligns with SUBRQ1 - because it enables stakeholders to increase confidence and optimize their decisions by providing easily available insights into environmental effects, fuel availability, prices, savings, and regulatory compliance. By reducing complicated data, the tool enables decision-makers to efficiently balance the pros and cons. This supports the transition toward sustainable fuel adoption.

2. Attractive Incentives

"Attractive behaviour stimuli" - directly address SUBRQ3 - to capture attention, motivate action, and make key messages more memorable, as well as encourage a shift in decision-making. The target group should find the incentives attractive to achieve the desired result and stimulate involvement. This supports traders and customers in making choices for sustainable fuels at an early stage.

3. Process Integration

The tool is designed to integrate the "pre-deal-making" and "relationship-building" processes - covering SUBRQ2 - by ensuring that value gets added where impactful decisions can be made. Utilizing these processes supports effective communication, and fosters collaboration and trust, which positively impacts the relationship between traders and vessel operators.

4. Enhanced Engagement

"Enhanced engagement" - directly supports SUBRQ3 - By embedding (behavioral) tools into the early deal-making and relationship-building processes, the tool encourages decision-makers to proactively evaluate sustainable options and apply them in their early decision-making. Clear, contextualized insights simplify comparisons, trade-offs, and impact assessment. Naturally, integrating these discussions into negotiations builds trust, increases awareness, and positions sustainability as a standard consideration, making it a recurring topic and increasing adoption in the long term.

5. Simulated Data

"Simulated data" - aligns with SUBRQ1 - by providing decision-makers with realistic and data-driven assessment insights (of costs, emissions, regulations, and other relevant outcomes) when considering sustainable fuels. The dashboard uses predictive calculations based on (adjustable) user input to create comparative scenarios, allowing traders and vessel operators to evaluate the immediate impact of their choices before committing. By presenting dynamic and actionable data in a clear format, the tool reduces uncertainty and enables stakeholders to make informed, confident, and strategic decisions in a complex and changing regulatory landscape.

To summarize, the vision attributes ensure that the dashboard effectively supports traders in communicating sustainability efforts by providing clear insights, attractive incentives, and adaptive data, which seamlessly integrate into the early deal-making and relationship process. This is to foster trust and drive the adoption of sustainable fuel choices (in the early stages, with a long-term transition as the end goal) —thereby collectively addressing the MRQ.

3.8 Design Goals

The overarching vision was analyzed and formed into actionable insights, presented in this chapter as design goals.

The design goals were formed by analyzing the design vision and extracting the key attributes in a session in Miro to form in-line actionable and goal-oriented guidelines for the future progress of the project. The guidelines were iterated upon individually and improved according to coach feedback sessions. These goals directly support the MRQ as they address all SUBRQs, by setting goals to implement in the future design that establishes stakeholder confidence and support that the decisional balance will positively be outweighed (SUSRQ1), aligning with the deal-making and relationship-building processes (SUBRQ2), and including features that enhance engagement and decision-making autonomy for sustainable fuel adoption (SUBRQ3).

Based on the vision, the following design goals are set:

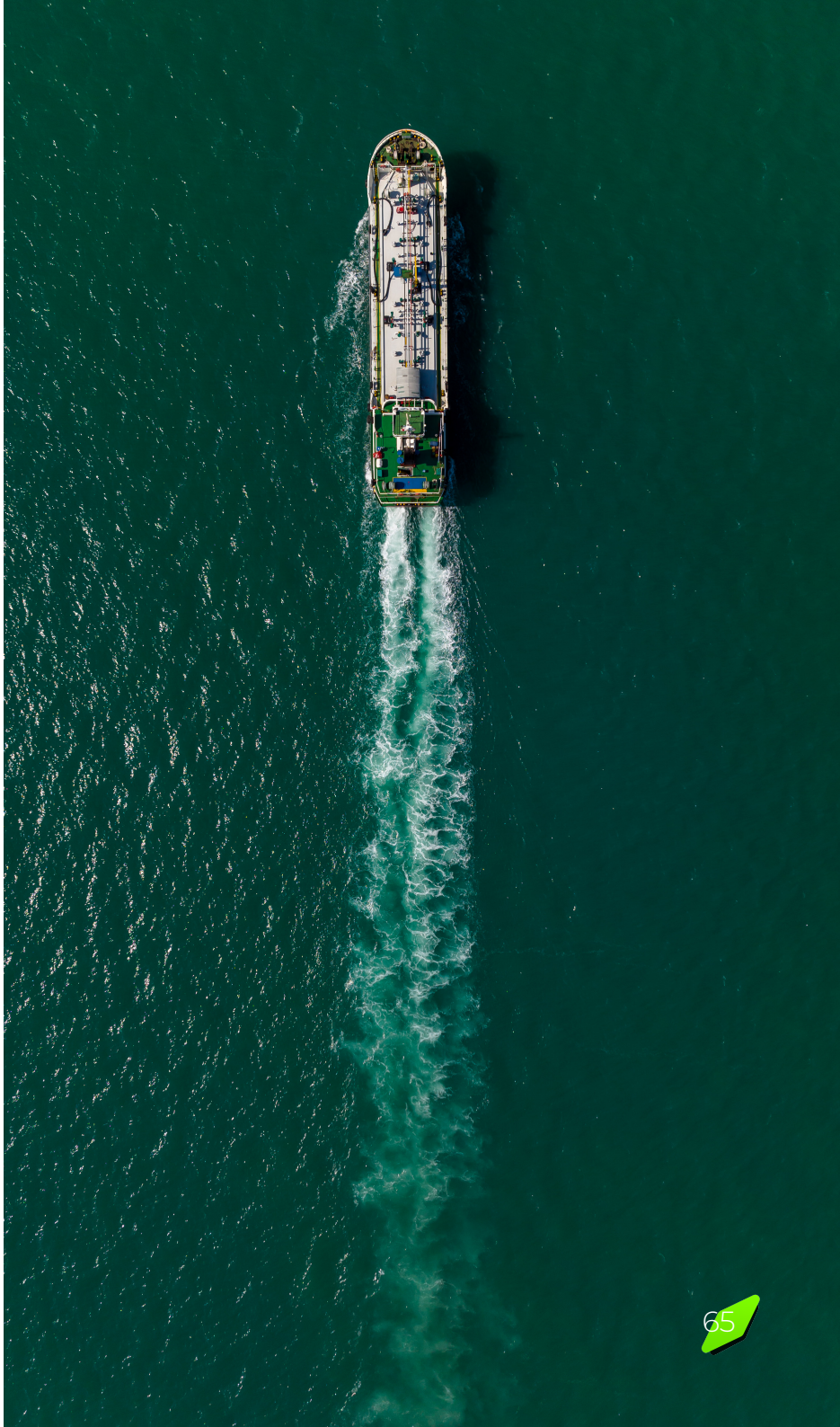
1.

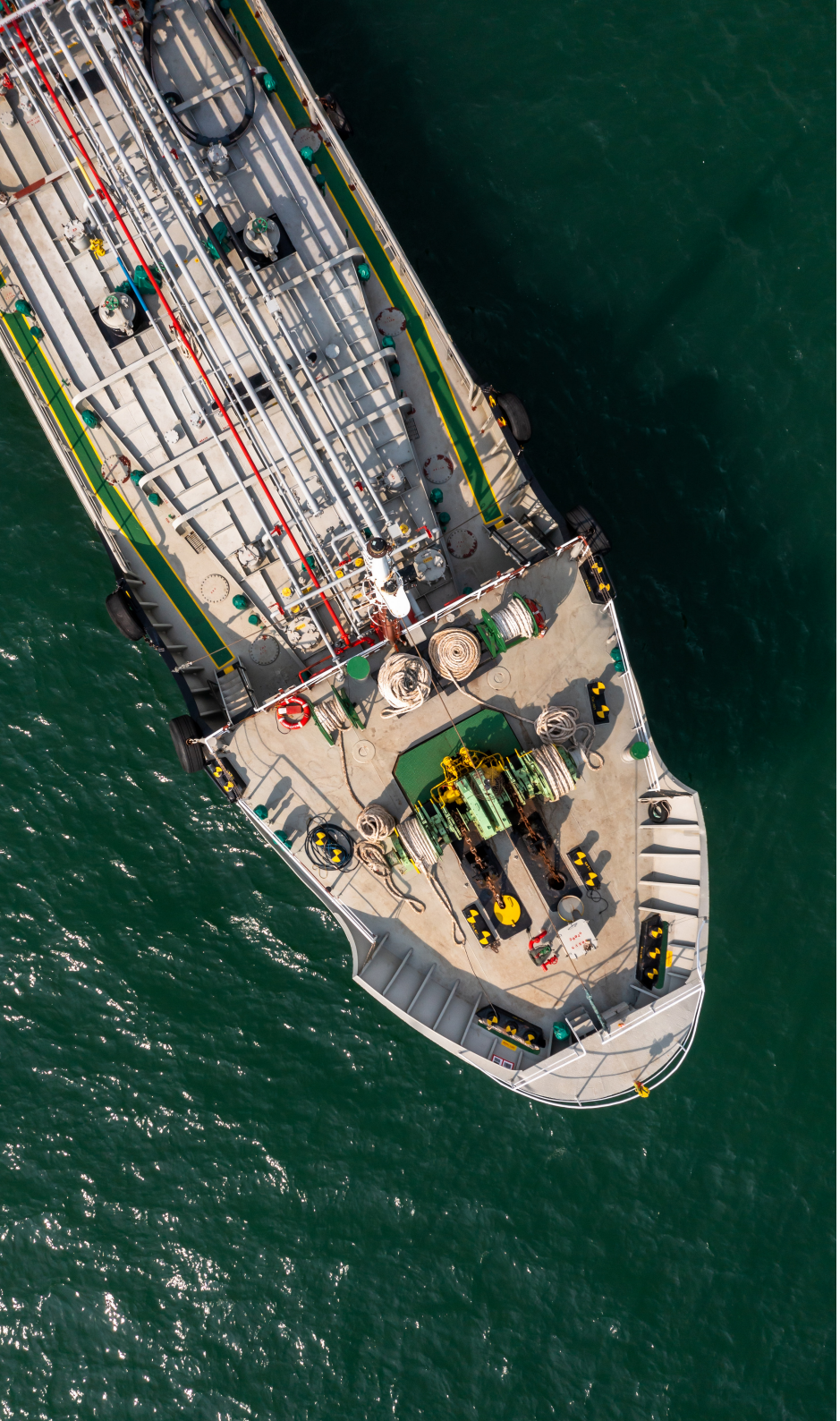
Provide Clear and Accessible Data Insights

Meaning: Clear insights - presenting information in a simple, intuitive, and actionable way so that stakeholders can quickly understand key insights. This also makes it easier and provides the resources for traders to present the insights and tool. Accessible - enhances user-friendliness and understanding, regardless of technical or sustainability expertise.

Linked insights to chapter findings:

- Need for compliance-related insights (2.2.3),
  Lack of clear information and knowledge for both stakeholders (2.2.),
  clear insights reduce knowledge gaps that are present (2.2),
  Existing tools do not present data optimally: they are not actionable enough or user-friendly (too complex) (2.3.2).





2. Integrate Attractive Behaviour Stimuli to engage Stakeholders.

Meaning: Integrate attractive incentives to encourage shipping companies to consider sustainable options more often by making options more attractive and feasible. This motivates action and increases commitment, which is necessary to move from the pre-contemplation to the contemplation phase.

Linked insights to chapter findings:

- Linking incentives to behaviour related goals makes sustainable options more appealing and actionable (2.4)
- Transitioning to sustainable alternatives can be enabled by incentivizing stakeholders with benefits, and lowering the barriers (2.4).
- Attractive stimuli help motivate action by reducing barriers to sustaining engagement in the transition process (2.2).
- Alternative dashboards do not integrate tailored incentives for the relationship and deal-making process, leaving a gap (2.3).

3. Ensure Positive Communication between Parties.

Meaning: Positive communication builds the relationship and facilitates the decision-making process, which is needed in fast-paced and socially dependent environments.

Linked insights to chapter findings:

- Effective communication should be ensured during the deal-making process and not be hindered (2.2.2).
- To transition, stakeholders should collaborate and have dialogue (2.2.) to gain confidence and positively outweigh the decisional balance (2.5, SUBRQ1).
- Social features (Nudges) provide an opportunity (COM-B) to build trust and alignment that aid the decision-making process (2.5)
- Alternatives lack features that enhance or integrate with communication processes (2.3).

4. Support Informed Decision-Making for Sustainable Fuel Choices

Meaning: The tool should function as a decision support system, helping stakeholders navigate their options by making sustainable choices visible, easier to assess and actionable. This will increase the acceptance of sustainable fuel and close gaps by providing insights at critical and early decision points. This is necessary as traders (often) lack time and knowledge and shipping companies have uncertainties.

Linked insights to chapter findings:

- Sustainable fuel options and their impact (costs/regulatory/sustainability) are often not visible or considered at an early stage of the decision-making process, leading to missed opportunities (2.1).
- Traders often do not have the time or in-depth knowledge to promote sustainability, which makes embedded decision support essential (2.2).
- Shipping companies experience uncertainty when evaluating sustainable alternatives, which hinders the adoption (2.2).
- Existing tools do not provide clear, actionable and comparable insights at early decision points making sustainability harder to integrate (2.5).

5. Ensure Seamless Integration into the Relationship-Building Process

Meaning: A tool that is seamlessly integrated into the relationship-building process enhances rather than disrupts the natural decision-making process, and sustainability becomes an inherent part of early interactions. The industry depends on long-term relationships for mutual success, and relationships should be built to foster trust and collaboration toward adoption. By ensuring alignment with the pre-deal phase, the likelihood of adoption by stakeholders is increased, and the stage is set.

Linked insights to chapter findings:

- The deal-making process is a vital daily occurring process between the stakeholders where decisions are made and can be influenced, integration there ensures value is added where needed (2.2.2).
- Sustainability regulations affect the deal-making process (2.2.3).
- Current dashboard to not utilize these processes yet (2.3)

The design goals serve as actionable guidelines for the development of the dashboard in alignment with the project's vision, research questions, and findings of the research phase. Collectively, the goals ensure that the envisioned dashboard is practical, engaging, and in line with stakeholders' needs. Implementing the goals supports the MRSQ and drives adoption toward emission reduction.

3.9 Define Outcomes

A design vision statement has been formed as guideline to shape the development process.

The Develop Phase translated insights from the Discover Phase into tangible design choices. This structured approach ensured that the tool is aligned with stakeholder needs, industry requirements and developments, communication processes, and market dynamics. Design activities were selected to define design decisions, refine functional requirements, and ensure feasibility.

KEY INSIGHTS
The following key insights are translated into project design guidelines:

- Design Context (3.2) → WWWWWH framework defined the problem space.
- Analysis of the dealmaking process (3.3.1) → Mapped the back-end workflow to identify incentive touchpoints. This ensured that the tool could be integrated into the processes of traders and vessel operators without disruption and identified the importance and starting point of the decision-making stages in the process.
- Customer Acquisition Analysis (3.3.2) → Examined trust, incentives, and perceived value, which showed that relationship strength directly impacts the likelihood of adoption.
- Personas (3.4) → Developed stakeholder personas (traders and ship operators) to align features with user needs, addressing key pain points such as time constraints, complexity and uncertainty in fuel choices.
- Project Scope (3.5) → Defined in & out-scope criteria that guide the development phase.
- Requirements list (3.6) → (Non) functional requirements have been categorized, and the most impactful features for development are prioritized.
- Design vision (3.7) → Focus shifted to the pre-deal phase, positioning the tool as a relationship-building support system that drives early commitment to sustainability and with the help of attributes that have been defined.
- Design goals (3.8) → Design Vision has been translated into actionable goals with emphasis on clear insights, engagement, incentives and seamless integration in the relationship building process.

TAKEAWAYS

- **SUBRQ1 (Clarity of Insights)** → This is addressed by integrating data visualization, compliance insights, and predictive simulations to enable clear and informed decision-making
- **SUBRQ2 (Process Integration)** → Ensured alignment with traders workflows, reduced friction and made sustainability a natural topic of conversation when building relationships (before closing a deal).
- **SUBRQ3 (Behavioral Engagement)** → Engaged by embedding attractive behavioral stimuli to boost motivation and encourage sustainable choices.

This chapter formed design decisions for tool development that ensure it meets user needs and industry practices. This was done with a focus on the relationship-building phase. The tool can introduce sustainable fuel alternatives at an early stage, reducing uncertainty and increasing the chance of adoption. The vision and goals form the basis for an effective, engaging, and seamlessly integrated solution that shapes the design iterations.

4. DEVELOP

In this chapter, the process and results that shaped concepts in the Develop phase are presented and tested to continue with a fitting solution.

4.1 Develop Overview

The Develop phase focuses on refining and ideating solutions to align with the overarching design vision and project goals.

The develop phase integrates findings and direction from previous chapters into actionable design elements for the next phase. Various activities that build on each other, were thoughtfully selected with the aim to answer the following questions:

Q1. How can engagement be enhanced through attractive behavioural stimuli in the deal-making and relationship-building process?
Tied to enhancing engagement (SUBRQ1)

Q2. How can clear and actionable insights into the CO_2 reduction potential of biofuels be effectively communicated (during the relationship-building and deal-making process)?
Tied to aligning with stakeholder processes (SUBRQ2) and providing actionable insights (SUBRQ3).

Q3. What design elements and functionalities are necessary to align with the deal-making and relationship-building processes?
Strongly tied to SURQ3, but are also necessary for SUBRQ1 and SUBRQ2.

Questions 1 and 2 emerged as main questions from a How-to session, and Question 3 was derived as ideation must take place in this phase to create a suitable tool for the stakeholder needs and processes. The questions aimed to stimulate creativity and discover opportunities and solutions aligned with the objectives (MRQ, vision and goals).

Table 4.1 below presents an overview of the activities. The table presents the method and material used, highlights the executor and participants who performed the activityand highlights the link to the research question and contribution to the above-mentioned questions (Q1, Q2, and Q3).

At the end of this phase, the goal was to develop a shaped and evaluated foundation for the subsequent Deliver phase. The insights and results of the activities must be translated into features and functionalities using the defined questions (Q1, Q2 and Q3) that enhance stakeholder engagement, communicate sustainability insights effectively, and align seamlessly with the deal-making and relationship-building processes.

Activities							
Activity	**Chapter**	**Method Used**	**Materials**	**Executed by**	**Participants**	**Linked RQ(s)**	**Contribution to Develop Questions (Q1,2,3)**
How-To Ideation	4.2.1	Ideation through brainstorming questions	Miro, board, text	Me	N/A	SUBRQ1, SUBRQ3	**Q1**: Identifies potential behavioural stimuli to enhance engagement. **Q3**: Defines preliminary ideas for functional elements.
Mind Mapping	4.2.2	Mindmapping: exploration of connections an ideation	Miro, board, text, lines	Me	N/A	SUBRQ1, SUBRQ3	**Q1**: Explores connections between incentives and engagement. **Q3**: Ideas on elements, features and functionalities.
Maritime Event	4.2.3	In-person expert and stakeholder discussion, Preentations from experts	Phone , iPad		N/A	MRQ, SUBRQ2,	**Q2**: Gathers insights to align tool with stakeholder processes. **Q3**: Highlights needs for tool carbon calculation tool.
Ideation Foundation Activities	4.2.5	Structured brainstorming session and input-output mapping	Miro, Digital Sticky notes, Canva	Me	N/A	SUBRQ3	**Q3**: Focuses on foundational elements and aligns functionalities to stakeholder needs and that there are multiple usage scenarios with different needs
Scenario building	4.3.1	Storyline writing	AI, Midjourney, previous Ideation findings	Me	N/A	MRQ, All SUBRQs	**Q1**: Ideas for behavioural stimuli. **Q3**: Generates ideas for engaging dashboard functionalities - all-in storylines for set scenarios
User Experience Mapping	4.3.2	Mapping envisioned scenarios	Journey mapping templates, Miro	Me	N/A	MRQ, All SUBRQs	**Q1 and Q2**: defines concepts in detail that support these questions for the scenarios. **Q3**: Identifies concepts ideas, features and tool steps for each scenario.
Pilot Test	4.2.8	Preliminary interview and feedback session	Interview questions, presentation, paper	Me	N/A	MRQ, All SUBRQs	Tests clarity and effectivess of the interview procedure to support all questions.
Stakeholder Interviews	4.3.1	One-on-one interviews	Interview questions, presentation, paper	Me	N/A	MRQ, All SUBRQs	**Q1**: Confirms relevance of behavioural stimuli. **Q2**: Evaluates clarity of communicated insights. **Q3**: Gathers stakeholder input for functional alignment with processes.
Radar Chart Analysis	4.4.1	Quantitative visualization and analysis	MS Forms, response data	Me	N/A	MRQ, All SUBRQs	**Q1**: Visualizes how engagement (motivation) is perceived. **Q2**: Demonstrates clarity and actionability of insights. **Q3**: Evaluates functional needs and objectives(measurable criteria).
Analysis of Radar and Interview Results	4.4.2	Analysis of qualitative and quantitative data	Radar chart results, interview transcripts	Me	N/A	MRQ, All SUBRQs	**Q1, Q2, Q3**: Synthesizes findings, providing actionable insights to answer all three questions.

Table 4.1 Activities performed in the Develop Phase.

4.2 Ideation Exploration

This section explores a range of creative techniques to stimulate creativity, uncover diverse opportunities and perspectives, and serve as a foundation and source of inspiration for the further ideation phase.

4.2.1 How to?

To start the develop phase with a structured base for further ideation and exploration that aligned with the design goals and vision, a How-To ideation session was carried out. The activity was performed by me on a Miro board to stimulate creative thinking and define the design direction and priorities within the development phase.

The activity started with reflecting on the vision and design goals. From that, two primary questions were formulated:

1. **How can engagement be enhanced through attractive behavioural stimuli in the relationship-building and deal-making process?**

2. **How can clear and actionable insights into the CO_2 reduction potential of biofuels be effectively communicated (during the relationship-building and deal-making process)?**

Subsequently, exploratory sub-questions were derived around these main questions. These sub-questions helped to look at the question from different angles and ensured that broader thinking could be done in the subsequent mind map process. By doing this activity, essential questions were formed and integrated into subsequent ideation processes.

Exploratory questions that arose during the how-to session that relate to the main question next to it:

- How to engage decision-makers in sustainable (bio)fuel choices during the deal-making process?
- How to stimulate behaviour to subtly encourage users to choose for biofuel options?

- How to allow users to effortlessly explore different biofuel acquisition and impact scenarios in a digital environment?
- How to design data presentations that highlight immediate, goal-oriented actions for biofuel implementation in a way that feels natural and empowering to users?
- How to create an experience that motivates users to fillin required input fields?
- How to deliver information in a way that not only informs but also encourages users to pursue sustainable biofuel choices?

4.2.2 Mindmapping

During the ideation phase, two mindmap sessions were held. Both mindmaps sessions were performed by me on a Miro board. The first mind map was formed around the first main question of the how-to activity. This mind map addresses one of the main topics in the thesis:

Engaging and stimulating sustainable fuel decisions.

This session aimed to stimulate creativity, inspire further development, and define and organize information and opportunities into an overview for reflection during the process. Final mindmap #1 is included Appendix F.

For the first mindmap, the following question was placed in the middle as a primary starting point of the project, with the main focus on ideation for Q1:

How to engage and stimulate decision-makers in sustainable fuel choices during the deal-making and relationship-building process?

For mindmap #1, engagement aspects were profoundly covered in the mindmap, which contained the following branches:

- Education
- Incentives
- Interactive Tools
- (Green) Nudges
- Rewards
- Gamification
- Visualisation
- Personalisation
- Socialise

Subsequently, I created a second mind map that concentrated specifically on the generation of ideas and the development of solutions, whereas mindmap #1 was more explorative. Mindmap #2 addressed the found how-to questions that were ideated during Mindmap #2 to facilitate the generation of initial ideas for future concepta while reflecting back on the previously formed how-to questions.

The following How-to questions were integrated:

How to...

make it more attractive?
encourage long-term commitment?
educate?
be able to make choices?
create engagement?
enable autonomous engagement?
Strengthen a connection?

The how-to questions were formed, to generate early ideas that could be integrated into later concepts. Each question branched out into several areas, resulting in a wide range of design elements that could be implemented into concept and ideas.

This overview of design elements served as inspiration and an overview for further steps in the process of forming design concepts ideas. Complete details of Mindmap #2 can be found in Appendix F.

4.2.3 METF Antwerp

The Marine Energy Transition Forum (METF) is an event where various parties discuss the future of sustainable shipping. This event is a valuable opportunity to connect with industry experts. That is why I contacted the event organizers and was fortunate to be invited to attend the forum as their guest.

The forum provided insights into subjects such as sustainable fuels, regulations, and technological developments, which are relevant to this research. It also offered me a good overview of the sector's current challenges.

The forum presentations allowed to identify and address key challenges and industries, which confirmed overlap with the Discover phase. In addition, it provided an opportunity to engage with one of the stakeholders (Shipping companies). The insights gained contributed to fine-tuning the tool to stakeholder workflows and highlighted the need to integrate carbon accounting functionalities.

After hearing all the presentations, I found it remarkable that the primary focus among all parties was on long-term solutions and advanced renewable fuels, while transition fuels and short-term solutions were not profoundly covered, despite their potential for immediate impact and deployment.

On the other hand, numerous experts highlighted the importance of creating stronger commercial incentives for greener alternatives, reducing complexity - especially relating to regulations, creating awareness for available possibilities, and fostering more collaboration among stakeholders. These themes also showed up in previous research (see Chapter 2) and are key drivers for the potential solution of this project.

During the forum, I had a productive conversation with a transportation manager from a large transportation company. The manager and the company are actively committed to innovation and sustainable development.

The iconic **Port House** in Antwerp, see picture above, was the location for the **Marine Energy Transition Forum 2024,** where the future of sustainable maritime energy was discussed.

In this photo, I am talking to a **fleet manager** at the METF about how sustainability and emission reduction are being addressed in the shipping industry.

We discussed the industry's challenges and approach to the energy transition. From this, I learned that they have a strong interest in transition fuels such as HVO. However, higher prices of biofuels currently limit their potential use.

Additionally, they are actively redesigning their customer communications to simplify green logistics. They are developing a digital portal that allows customers to request quotes, book services, track transactions and generate reports. With these features, the focus is on sustainable options and environmental impact.

One of their first and just-enrolled steps toward easier communication about greener options was implementing a carbon footprint calculation tool for their prospects. With this tool, clients can easily select and see the potential impact of their services.

In the research phase, I came across various transport and fuel-providing companies that introduced newly developed calculation tools. This led me to the realization that a calculation tool is the bare minimum and the first step in facilitating visual conversations with customers about consumption and sustainability impact that require little effort. A calculation tool should contain core data and inputs, and it should function as an MVP (Minimum Viable Product) to drive actionable and sustainable decisions.

Using a calculation tool as a starting point for the ideation phase is a logical and strategic choice. It forms the basis for designing a user-friendly solution and also lays the foundation for a future comprehensive dashboard. A calculation tool provides the necessary structure for input and output, which is essential and the absolute minimum for developing advanced functionalities and an integrated system that is scalable and effective.

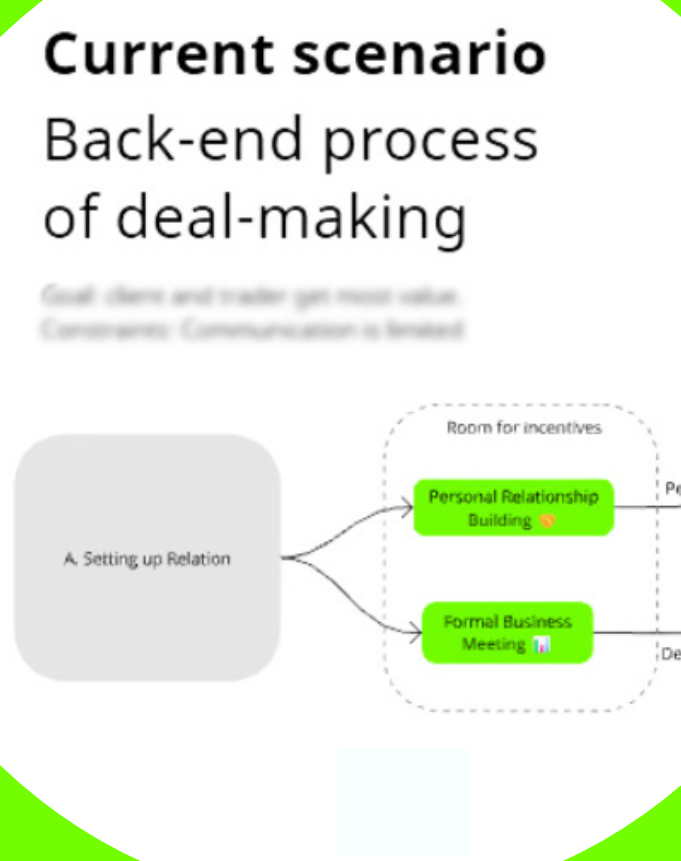
4.2.4 Early Design Choices

As highlighted in paragraph 4.2.3, my visit to the METF helped me recognize the importance of a calculation tool as MVP for this project. Companies in other industries also use carbon calculator tools to enable clients' sustainable decision-making (Shipping companies for cargo owners, large fuel suppliers, and logistics companies). Therefore, I decided that from now on, a calculation tool would serve as the new foundation for future ideation. Next, I also chose to design for one phase of the complete deal-making process outlined in Chapter 3.3.1: Phase A - Forming a relationship.

Selecting phase A was necessary to narrow the scope of the broad ideation space and address the fact that each phase required distinct elements and functionalities that could not be realistically and effectively developed within the project's timeline.

Additionally, Phase A was selected as the most important phase: it starts the dialogue and sets the foundation for the relationship. At this phase, clients are trying to navigate complex sustainability topics. It creates the opportunity to engage and secure their commitment to greener solutions and sets the tone for long-term collaboration with the aim of reducing emissions.

Focusing on later phases will be less effective because sustainability is not an essential part of the partnership without introducing it from the beginning. Furthermore, subsequent phases involve more complex interactions that build on phase A. Therefore, phase A should be prioritized and fully developed first to ensure effective implementation.



DESIGN CHOICES:

1. A calculation tool sets the groundwork for ideation
2. Phase A was selected for further design steps.

FOCUSING ON PHASE A

DESIGN IMPLICATIONS

Resulting from the design choices: A calculation tool as a basis and the focus on phase A.

1. **Clear Design Constraints -** Limits the tool to essential functions and data.
2. **Defined Design Space -** Narrowing down to the main purpose and maintaining focus.
3. **Specific Inputs and Outcomes -** These can be identified due to the design choices.
4. **Targeted Ideation -** That is still in line with the design vision and goals.
5. **Supports Relationship-Building -** With a focus on simplifying option exploration.
6. **Scalable Foundation -** This allows functions to be added later (outside the project's scope).
7. **Mutual Understanding -** Let stakeholders speak the same (visual) language.
8. **Feasible scope -** Achievable within the project timeframe, with emphasis on the essentials.
9. **Professional Visual Communication** - Communicating and simplifying key insights for traders and clients.

The design implications above provide a focused approach for the next phases of ideation that support the project goals and vision. In addition, it also provides a good basis for future development and progress.

4.2.5 Basis for Ideation

To structure the ideation process in alignment with the new design choices and the project's vision and goals, I started a brainstorming session by formulating key questions reflecting the project's objectives. The questions were answered in relation to phase A and partially integrated into Mindmap 2.

Questions that came up during the exploratory brainstorming session:

- *How to drive autonomous engagement for sustainable choices?*
- *How can the dashboard facilitate positive communication?*
- *How to provide clear and accessible insights?*
- *What kind of data/insights?*
- *What fuel options?*
- *What Metrics?*
- *What needs, stimuli, and functionalities at stage A?*
- *What behavior stimuli can encourage sustainable choices?*
- *How can a simulation dashboard facilitate meaningful, trust-based interactions between traders and decision-makers?*

Answering these questions, helped to clarify what was already known, what needed to be set, and where there was room for ideation. The questions marked with a green bullet point above provide an opportunity for ideation. How these questions have been answered can be found in Appendix F.

After this, I defined the core inputs, outputs, and functionalities for Phase A. This ensured that the next steps in the ideation process were aligned with the objectives while providing a clear framework for developing targeted and effective solutions. This was done by using digital sticky notes and canvas in Miro. This method facilitated the identification of stakeholder needs in the tool and the underlying calculation while considering use cases and data. After that, the outcome was evaluated , and a final visual was formed in Canva. This session provided a structured basis for aligning tool features with real-world applications, guiding further design iterations

This framework is visually shown on the next page (p.79) and additional functionalities can be added if desired.

After stating these fixed elements, it enabled the identification of areas that could be further ideated upon.

These areas for further ideation are:

1. Input and the calculation
2. Output
3. Functionalities
4. Autonomous engagements
5. Presented insights
6. Behaviour stimuli
7. FUELEU Integration
8. Relationship forming

Many factors need to be considered when trying to ideate around these areas. Therefore, I chose to use the areas as branches and did a brain writing session where I identified the key questions that needed to be considered across each branch in line with the project's vision and goals (see Appendix F).

Through this approach, I discovered that there are varying needs and requirements depending on different usage scenarios, such as various levels of complexity. These must be evaluated and addressed accordingly during the design phase because they cannot be solved with one approach. This is because there are most likely multiple usage scenarios resulting from different factors such as the context of the interaction, goals, and requirements.

Input, output and functionalities - Setting the base for ideation

Based on Phase A: Forming a relationship

Essential Input

Essential input data

- Fuel type: HVO
- Emission reduction factor of HVO
- Average Fuel Quantity per vessel (type)- estimated
- Fleet size
- Reduction goal
- Baseline emissions based on conventional fuel
- Estimated cost savings
- Location: N.A. with Osprey's Book & Claim

Essential output

Essential output data

- Co2 Savings per KG in total
- % towards the emission goals
- Estimated cost savings

Essential Functions

Essential Functions

- CO2 reduction Calculation
- Cost Savings Estimator
- Emission Goal Progress

Less essential

- Simulation buttons: for example HVO % use, fleet size etc.

4.3 Scenario Development

This chapter presents the development of three chosen scenarios, including storylines and user experience mapping, from which 3 fitting concept ideas were formed.

4.3.1 Three Key Scenario's

Since Phase A was chosen for further development, and the brainstorming process (see 4.2.5) identified a number of factors to consider, it became evident that specific scenarios should be addressed in order to ensure an effective solution across multiple use cases in Phase A. The reasoning resulted in the establishment of three scenarios that represent the key ways in which traders initiate and develop relationships with clients, which builds further upon Phase A of the deal-making process presented in Chapter 3.3.1.

Scenario building was performed through storyline writing, using AI for copywriting inspiration and refinement. Image generation was done by creating focused prompts for the Midjourney model in Discord. Both were created by integrating prior (ideation) insights and design directions to generate engaging and structured stories. This method helped explore behavioral stimuli (SUBRQ1) and define interactive dashboard functionalities within realistic scenarios (SUBRQ3) while improving communication in the relationship-building process (SUBRQ2). By creating detailed storylines, the activity ensured that the tool's functionalities aligned with the user's decision-making processes and engagement dynamics.

The three scenarios—1. Networking, 2. Cold Calling, and 3. Business Meeting—are presented in images generated with the help of Midjourney at the right. Scenario 3, the business meeting, was already covered in Figure 2.3, and Scenarios 1 and 2 stem from relationship-building activities that occur. These three scenarios were selected because they represent all the ways in which customers are acquired within the company.

1. Networking

2. Cold Calling

3. Business Meeting

Each scenario has its own characteristics as specified by the company (Osprey Energy):

Scenario 1 - Networking
Networking events are informal settings where traders can meet potential clients or partners and learn and share ideas. Being present also strengthens the company's presence in the industry and opens doors for opportunities. In this scenario, **face-to-face** interactions can be used to build a relationship, gain trust, and generate initial interest.

Regarding the vision and objectives, networking provides an opportunity to early introduce the tool, convey attractive insights, and lock in potential clients that have uncertain sustainability targets, which is the initial step of the main objective.

Scenario 2 - Cold Calling
Cold calling is a direct and challenging method to recruit potential customers. In contrast to this, it is a scalable and effective method for traders to introduce the company and its offerings, arouse curiosity and build credibility through **personal interaction.** However, it faces high rejection rates due to limited time or interest from the prospect. Therefore, the effectiveness of the call depends on external factors and the trader's ability to gain interest, understand needs, communicate value, and handle objections.

In relation to the projects, the cold calling scenario could help traders communicate decarbonization offerings in a concise and compelling way. They can introduce the sustainable possibilities of the tool as a unique service of the company, gauge interest, and gather data. Additionally, they can talk about the insights or send them via mail, allowing them to easily engage in a follow-up contact point. Empowering traders to address the complex sustainability needs better, focus more on the relationship-building aspects, and communicate trust and professionalism automatically.

Scenario 3 - Business Meeting
The third scenario is a business meeting in which the connection has moved beyond the original point of contact. A meeting has been scheduled to address particular client needs and discuss long-term strategies and options. This is a **formal interaction**, which can be idealistically physical or otherwise through an online meeting.

At this stage, the tool can play a role in supporting informed decision-making. In particular, at this stage, clients expect to receive valuable insights before committing to doing business. Especially, with the forced regulations to reduce emissions, clients need to have insights into how offerings can address their needs and concerns.

Storylines
For each scenario, a storyline was developed to design an envisioned usage scenario that incorporated the project's objectives and reflected its practical implementation into real-life interactions. Each storyline was based on actual client acquisition interactions encountered.

The storylines underwent several iterations, and some relevant design ideas from previous brainstorming sessions were integrated. These iterative developments, created an outline for ideation, allowing the tool to take shape in a realistic context while containing essential features.

The storylines were constructed to highlight the important interaction points with the trader and client or with the envisioned tool. Hereby, it could be explored how the tool could deliver value, create engagement, and drive sustainable decision-making while being effective in Phase A of the deal-making process. On top of that, the project's vision and goals have been integrated into the storylines for alignment and to be able to test and redefine these elements within each scenario.

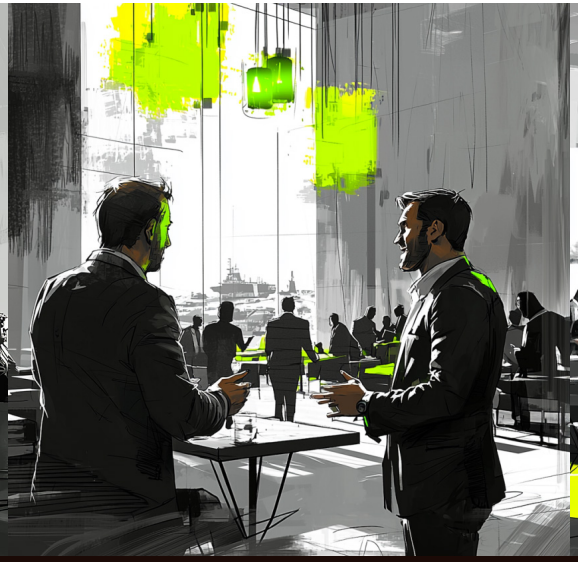
The storylines can be found on the next pages 82-84. The frames are envisioned and created with the help of Midjourney. The incorporated design elements are discussed in the following sections.

Envisoned Scenario 1: Network event

Impact: Brief interaction to foster initial interest and plan next meeting

1. First informal contact

Traders meet a prospect, a fleet or operations manager, at a networking event. They have an informal conversation, exchanging industry challenges.



2. Identifying Interest Areas

Now, the trader takes the discussion on a more strategic path by asking the prospect about his feelings in relation to emission regulations, renewable fuels and fuel costs. The prospect is interested in emission reduction and biofuels - but at the same time, he wants to assure profitability.

3. Introduction of the Tool

This is where the trader informs the prospect about his tool, which would be able to provide information about reductions and cost savings through the advanced services of the company in line with the identified areas of interest. In the interest of this, business cards get exchanged. The trader has added a QR code to his card to directly link to his profile, the tool, and the company's website for easy access to all the information.

4. Quick Demo

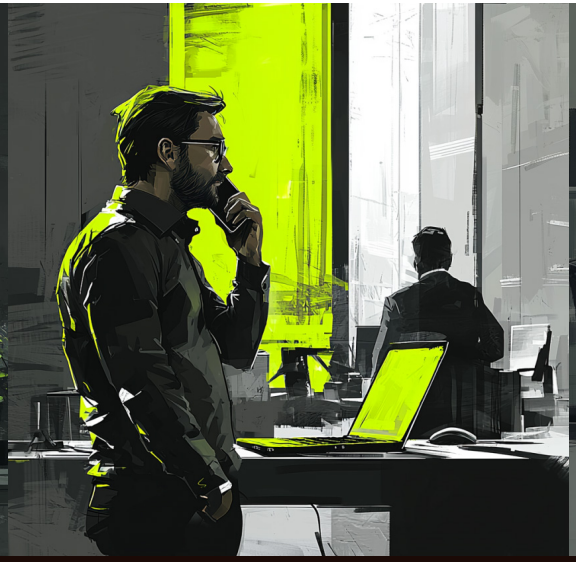
Sensing the prospect's interest, the trader quickly fires up the tool on his phone, enters some sample data, and swiftly walks him through how potential emissions and cost savings could look. He explains how the tool aligns with regulatory goals and can create personalized scenarios to give specific insights. The prospect shows clear interest in a follow-up meeting to discuss business solutions.

Envisoned Scenario 2: Cold Calling

Impact: brief interaction to introduce tool and strategy, gather data, and email tailored insights to deliver value and build interest for follow-up meeting.

1. Kickstarting a cold call

A trader calls a cold prospect, greets him, and introduces himself and his company: a global bunker supplier specializing in HVO. He mentions that they help shipping companies reduce fuel costs and emissions, “I thought this might be relevant given the industry’s standards to reduce over the years,” he adds. He gauges the prospect’s interest and hopes to keep the call going to explore how their services might be beneficial.



2. Gathtering input data

Seeing that the prospect is still on the line, the trader takes the opportunity to dive a bit deeper. He briefly explains how their company can provide insights into potential savings from emission reductions and costs when purchasing HVO fuel from them. He asks some quick questions to get a sense of the prospect’s current fuel setup which he puts in the tool during the call.

3. Presenting Insights

After the sample data is entered, the trader can quickly see and tell the key highlights through the tool. He shares these insights with the prospect, highlighting how this tool and strategy can have a sustainable and financial impact and can provide insight into considerations for meeting future emission reduction targets. He sees that the prospect is interested, but not yet fully convinced.

4. Prefilled Demo

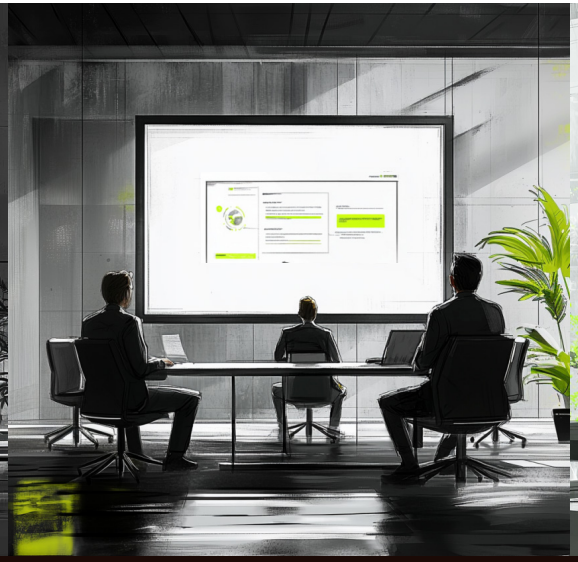
The trader saves the results of the tool, which can now be emailed directly to the prospect, allowing him to capture the prospect’s contact information and establish a clear line of communication for follow-up. The prospect looks forward to receiving the insights and the trader feels positive about the relationship they have built as he is able to offer value and professionalism through the tool which sets him apart from others.

Envisoned Scenario 3: In-Depth Meeting

Impact: Presentation to build trust, showcase customized tool insights, and plan trial supply

1. Warm Welcome & Agenda

The trader greets the prospect and his associate in the conference room, which has a big screen for their presentations. He outlines the agenda: a company and service walkthrough followed by an in-depth tool demonstration to illustrate the emissions reduction, cost savings, and FuelEU Maritime compliance impacts possible when working together.



2. Collaborative Data Entry

After the presentation, the trader transitions into the tool demonstration. The analyst sits alongside the prospect in front of the presentation screen, and together they enter fleet specs into the tool, including parameters like vessel type and fuel usage. Technically, it's an easy process, with interactive prompts and motivational cues to keep them engaged as they complete each field. This joint participation not only tailors the insights but also strengthens their relationship through the shared experience.

3. Presenting & Adjusting Key Insights

Once the data has been entered, the tool quickly and easily shows an overview of the possible costs and emission reductions. The trader can easily see and tell the key insights. Based on the results, he explains how HVO can be used to align with FuelEU Maritime and achieve their emissions and cost targets. The prospects take different scenarios into account, which the trader adjusts on the spot by adjusting some variables. The tool immediately shows how different choices influence the results. This interactive experience provides the prospect with real, actionable insights, building their trust and confidence in both the tool and the trader's expertise.

4. Saving and Next Steps

After reviewing the customized scenarios, the trader saves the results in a quick, shareable format to email to the prospect. It's a convenient recap they can easily look over later or pass along to their team. The trader suggests a trial period for HVO fuel and a follow-up meeting to assess the early results The trial gives the prospect a chance to see proven impact and results. With these personalized insights in hand, the trader leaves the meeting feeling good. They've built a solid connection and proven the tool's real value, making it a key piece in the prospect's journey toward sustainability.

4.3.2 User Experience Mapping

After establishing the storylines built on the envisioned interaction, the next step in the design process was to create envisioned user experience maps for each usage scenario. This goal was to define all the elements necessary for the tool to be effective in each scenario, in line with the project's vision and design goals. User experience mapping provides a clear overview, minimizes negative experiences, identifies decision points, and stimulates opportunities and innovation (Visual Paradigm).

The experience mapping template of Josh Zak (Zak, n.d.), and Turtle Design, was used as a starting point (Turtle Design, 2023). Josh also acknowledges that this template can be useful when prototyping or planning a product, as it guides the design and strategy. Each frame of the story served as a stage, and the template included key actions, touchpoints, emotions, and opportunities as building blocks.

I chose to give more depth by also adding the following building blocks to the map: Needs, decision points, and obstacles. I also included building blocks to shape the tool in more detail for each scenario: Interaction Flow (Interaction steps with the tool), Input metrics, output metrics, and data insights, and I added the building block "impact" - highlighting the impact regarding the design vision and goals in each stage—to make sure that these were acknowledged and incorporated. Lastly, I added additional building blocks for ideation and evaluation, which were: Provocations (how might we address user needs?), Design and feature ideas, Evaluation criteria metrics to test and validate, and design assumptions and hypotheses. The provocations inspired questions that were addressed through the design ideas. The envisioned Experience maps can be found in Appendix G.

The exercise resulted in minor changes or improvements to the storylines, as well as a deeper definition of the tool interactions, features, and input and output data. Each scenario was shaped by certain elements that distinguished each other, and subtle design ideas were integrated as intrusive ideas as the focus for the next phases should be on the primary functions and goals for each scenario. Dominant features could hinder realistic feedback in later stages, shifting the focus. Since the tool should assist the trader in supporting the client, the map was developed with input mainly from the perspective of the trader.

By finalizing the experience map, unique user requirements for each scenario resulted from the exercise:

Networking event - Instant high-level insights are crucial to capture attention in an informal setting. Sharing the tool via a QR code has been incorporated into the plot as an extra design idea for convenience, facilitating independent use afterward and stimulating curiosity by adding a novel element.

Cold Calling - Need for a streamlined, simple and quick system with either instant realized or sharable insights. An intuitive design idea for this scenario was adding an email summary to the interaction. This creates a touchpoint for communication, allows for follow-up, and allows the client to review later at their convenience.

Business meeting - Demand for an interactive tool that allows to explore personalized scenarios in real time and drive informed decision-making. As an additional design idea, saving and sharing of the results from the session has been integrated, to track impact, share it with the client's team and follow up.

These use cases and specific requirements resulted in three different concept ideas which are presented in 4.3.3.

4.3.3 Three Concept Idea's

The three concept ideas: **Quick Scan, Prefilled Demo and Meeting Demo,** were created directly from the insights and design features gained and emerged from the envisioned stories and user experience mapping sessions. The concepts have been tailored to the three scenarios stated in 4.3.1 to guarantee effective impact. These concepts address the challenges, requirements, and opportunities identified in each scenario while staying in line with the project's vision and goals.

The concept ideas naturally emerged from the sessions, as each concept captured the specific tool usage corresponding to the accompanying scenario. The graphic below presents a visual representation of the concepts, which are home screens with key messages representing each concept to communicate the core value of each concept. The core value of each concept idea is further clarified as follows:

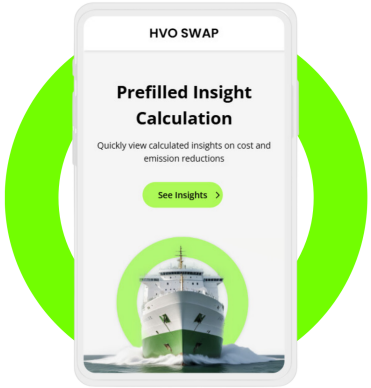
1. **Quick scan**
   Suits informal interactions, traders can quickly provide high-level insights and inform about sustainability opportunities that the company can offer.
   Key focus: lowering the barrier, sparking interest, and delivering the message.

2. **Prefilled Demo**
   Allows for minimal input of client data and generates real-time and shareable personalized insights
   Key focus: Efficiency, providing value, distinguishing.

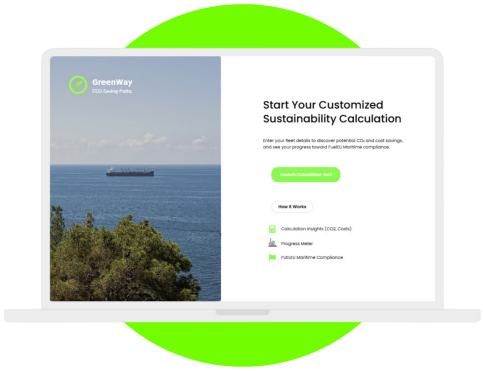
3. **Meeting Demo**
   For in-depth and collaborative meetings where clients and traders can explore scenarios together. Parameters can be adapted in real-time, and effects are visualized.
   Key focus: Trust building, informed decision-making, clarity, and future planning.

The components and working approach of each concept are further explained in Chapters 4.3.4 and 4.3.5.

Quick Scan



Prefilled Demo



Meeting Demo

4.3.4 Venn Diagram

A Venn diagram was developed to clearly depict each concept's core functionalities, which were determined during the user experience mapping exercise. This was necessary since the core functionalities needed to be easily understood to be validated, as this is not easily transferable from the content-dense user experience maps.

The completed Venn diagram is displayed on the right, with distinct, larger portions of the circle representing each concept idea's unique features. The overlapping sections between the two circles highlight features shared between the two respective scenarios. In the center, core features that are represented in all the scenarios are listed.

In addition to serving as a point of reference for analyzing the tool's performance during user testing (starting in Chapter 4.4), the Venn diagram provides additional insight into the core and distinguishing features of the concept ideas presented in this study.

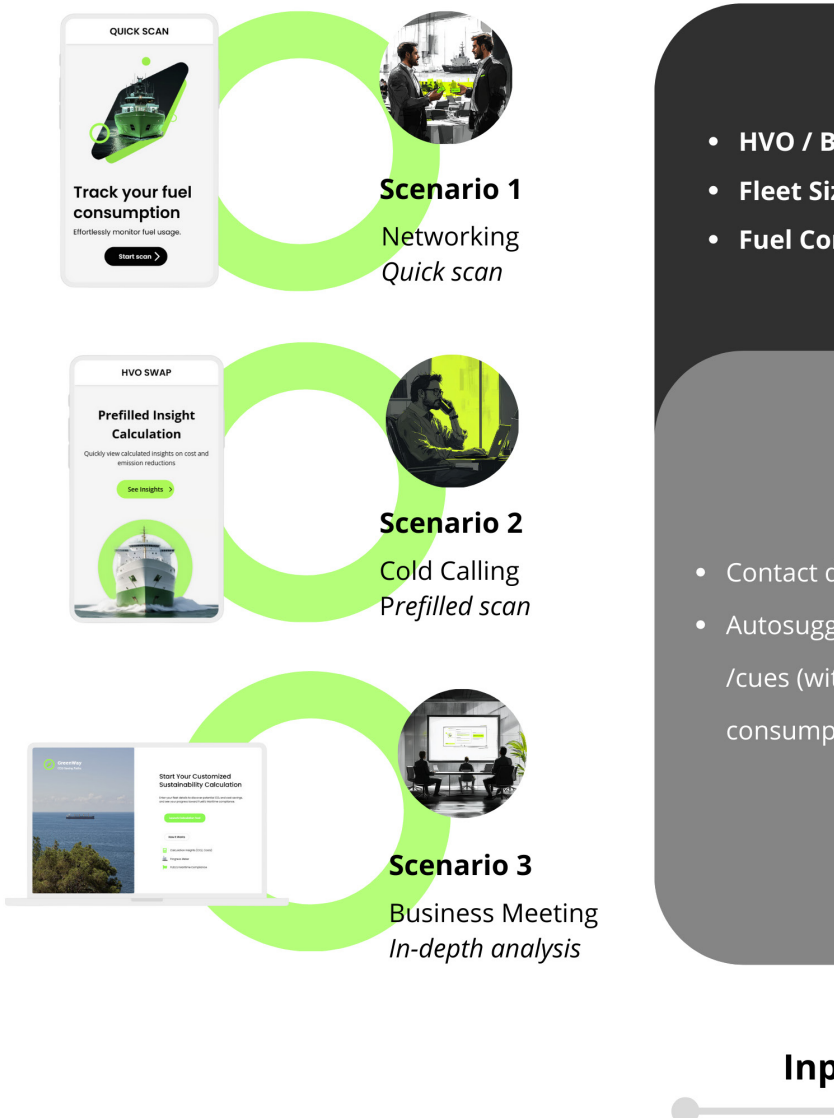
The diagram shows that scenario 1 focuses more on lightweight and high-level interactions. In contrast, scenario 2 contains more detailed and practical elements. Meanwhile, Scenario 3 builds on the features of Scenario 2, while delving more into strategic interactions.

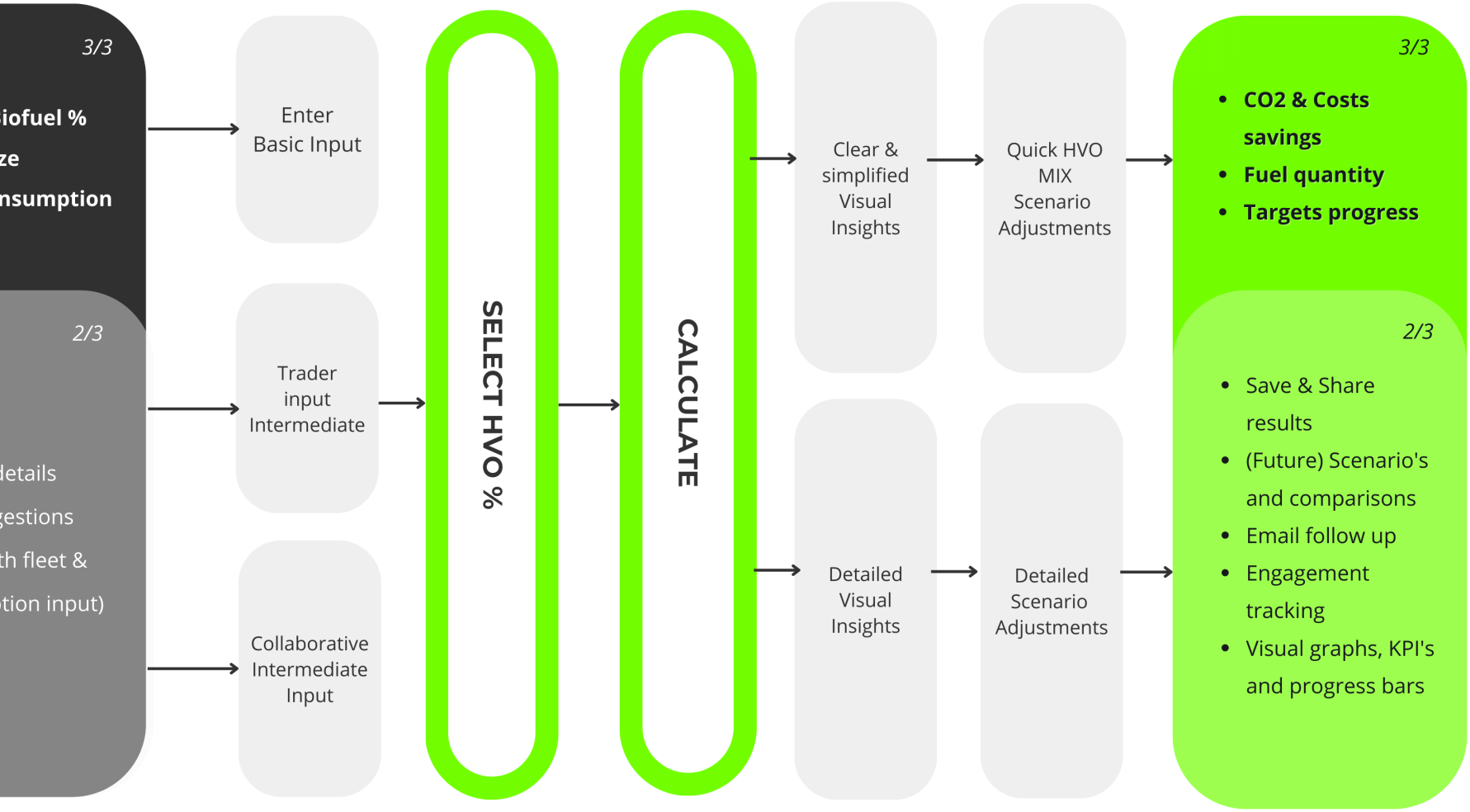
4.3.5 Flow Diagram

The Venn diagram, depicted in 4.3.4, clearly communicated the core values of the different concept ideas for each scenario. However, it did not go into detail about the use and functioning of the tool in each scenario. Therefore, a flow diagram has been created to validate the intended operation and design principles of each tool, as shown in the graphic at the right. The input, tool steps, and output have been visually mapped in a simplified manner. Hereby, it is possible to grasp the principles behind each concept idea that was determined during the user mapping exercise.

The essential input variables that support the tool's functioning in every scenario are fleet size, fuel consumption, and the percentage of HVO/Biofuel. These are crucial for providing concise insights into expenses and CO2 reductions, which are shown through straightforward graphics and key performance indicators (KPIs). By including these variables and insights in all scenarios, the tool ensures clarity and usability while allowing for higher levels of complexity and customization in Scenarios 2 and 3.

By adding intermediate features such as automated recommendations, personalized insights, and email tracking, Scenario 2 bridges the gap between the advanced features of Scenario 3 and the basic features of Scenario 1. These enhancements maintain the tool's usability while increasing efficiency. Scenario 3 builds on this with advanced features such as real-time event editing and interactive data entry, enabling deep analysis and strategic decision-making for complex interactions.





Tool steps

Output

4.4 User Testing Preparation

This chapter describes the approach used to validate the envisioned scenarios with Osprey Energy team members.

4.4.1 Testing Plan

A user testing plan was developed to ensure that the intended scenarios and concept ideas reflected the project goals and their practical applications. Besides this, the concept ideas could also be further analyzed for development improvements. To support traders in their daily tasks, the focus in this testing phase was on validating the functionality, usability, effectiveness and application of the design goals in each use case.

It was decided to conduct an interview with specific questions to determine whether the tool features and scenarios are representative and practically applicable, and how they can be improved. The questions were developed using both qualitative and quantitative methodologies in order to get focused answers for validation while also providing an opportunity to acquire extra qualitative observations. The interview consisted of four sections:

1. General - questions to evaluate the real-life applicability of the scenarios, the tool's impact on relationships, and the overall functionality.
2. Scenario Value - questions to assess each scenario's business impact.
3. Technical Requirements - questions to evaluate the tool's functionality and assess user needs.
4. Sustainability - questions to assess the tool's ability to support sustainability communication.

As you can see on the next page (p.91), I created an outline for the testing phase prior to the questions. By doing this, a transparent and efficient method of gathering feedback was guaranteed. I defined the requirements, duration, procedures, and what the aim would be. This made sure that the testing phase was well-planned and executed, minimized potential issues, and ensured that the anticipated components were tested.

A brief presentation about the project and tool was given before the interview to inform the participants. The interview and procedure were refined through a pilot test with a team member; the presentations and questions are in Appendix H. The implications of the pilot test are discussed in Section 4.4.4.

This presentation aimed to provide participants with the necessary context, highlighting the challenges, scenarios, and tool functionalities. This approach enables them to give informed and relevant responses to the interview questions. By explaining the context and challenges, participants could grasp the project's broader goals. This allowed them to connect with the tool's intended impact to facilitate effective feedback, deepen understanding, and increase their investment in giving meaningful feedback.

In addition to the digital presentation, the slides were printed and set on the table so that participants may refer to them for information about the scenarios and tool functionalities. This reduced cognitive load because participants did not need to remember everything and were able to clarify, consider, and critically think during the interview. This helped participants to assess and offer more constructive, meaningful feedback.

After the presentation, participants were given a link to an online form to fill out later, giving them time to reflect and provide informed feedback. Chapter 4.4.2 discusses this in more detail.

Presentation

+/- 5 Min
project introduction
Scenarios
Concept Ideas
Venn Diagram
Flow Diagram

Open questions

+/- 30 Min
recording
+ printed out presentation:
the scenarios &
tool interactions
(to reflect for test user)

Radar Chart form

+/- 30 Min
MS Form
score 1 - 10
Assess scenarios on
vision/goal criteria

+ Run pilot

4.4.2 Radar Chart

It was decided to evaluate each conceptual idea corresponding to the scenarios using a rating scale from 0 to 10, with each concept rated on questions based on criteria reflecting the project's objectives. The results were then generated into Radar Chart diagrams, enabling an evaluation of each concept's effectiveness and alignment with the project's vision and goals. This approach also allowed for the identification of weaknesses, strengths, and areas for improvement, and guided incremental improvements to support the purpose of the tool and better meet the project objectives.

As outlined in Section 4. 4. 1, participants were given a link to an MS Form following the presentation. They were instructed to complete this form a few days later to avoid feeling overwhelmed and distracted and to give time to reflect, with the aim of ensuring more meaningful responses.

The form was designed to assess each scenario in segments. Each storyline and the corresponding tool interaction steps were outlined at the beginning for clarity and reflection. Subsequently, the same page contained nine questions accompanied by a rating scale from 0 to 10, where 0 indicated "not at all" and 10 indicated "a lot. " This uniform scale was applied to all questions to enhance comparability and minimize cognitive load. The questions were consistent across all scenarios and formulated to evaluate the criteria necessary for assessing the project's objectives.

The questions and form are located in Appendix I, and the following criteria reflecting the project's objectives were measured within the questions:

Measurable Criteria

1. **Clarity** - Ease of understanding tool interactions and insights
2. **Relevance** - Value of presented insights/concept for decision-making
3. **Autonomous engagement** - Supports independent client use
4. **Relationship building** - Strengthens positive relationships.
5. **Early relationship integration** - Fits into early relationship-building phase.
6. **Deal-making Integration** - Fits in the deal-making process.
7. **Time savings** - Reduces time spent on decision-making of the client
8. **Sustainability assessment** - Effectiveness in evaluating sustainable options
9. **Motivation** - Encourages sustainable decision-making

For each measured criterion, Participants rated each concept idea a score on a scale of 0 to 10, representing how well they thought the criterion was applied or met. If done slowly, the examination should take no more than 30 minutes. Idealistically, it should take up to 15–20 minutes.

Participants, like those in the interview, were Osprey Energy employees who regularly dealt with fuel sales situations. Even if they were not direct traders, their experience qualified them for the study because it offered unique insights into client interactions and decision-making processes.

4.4.3 Set-up

The interviews were executed in professional and uniform settings to facilitate a concentrated and effective process, as illustrated in the images on the next page. The setup was carefully considered to optimize the quality of the session.

The following elements were taken into consideration:

1. **Using a presentation screen.**
   A presentation screen guided the audience through the context, scenarios, concept concepts, and questions in an appealing visual format, which provided a clear reference throughout the interview.

2. **Positioning**.
   Participants were situated comfortably, with all of the materials in front of them, to ensure that they could provide thorough and informed responses. The interviewer took the opposite seat.

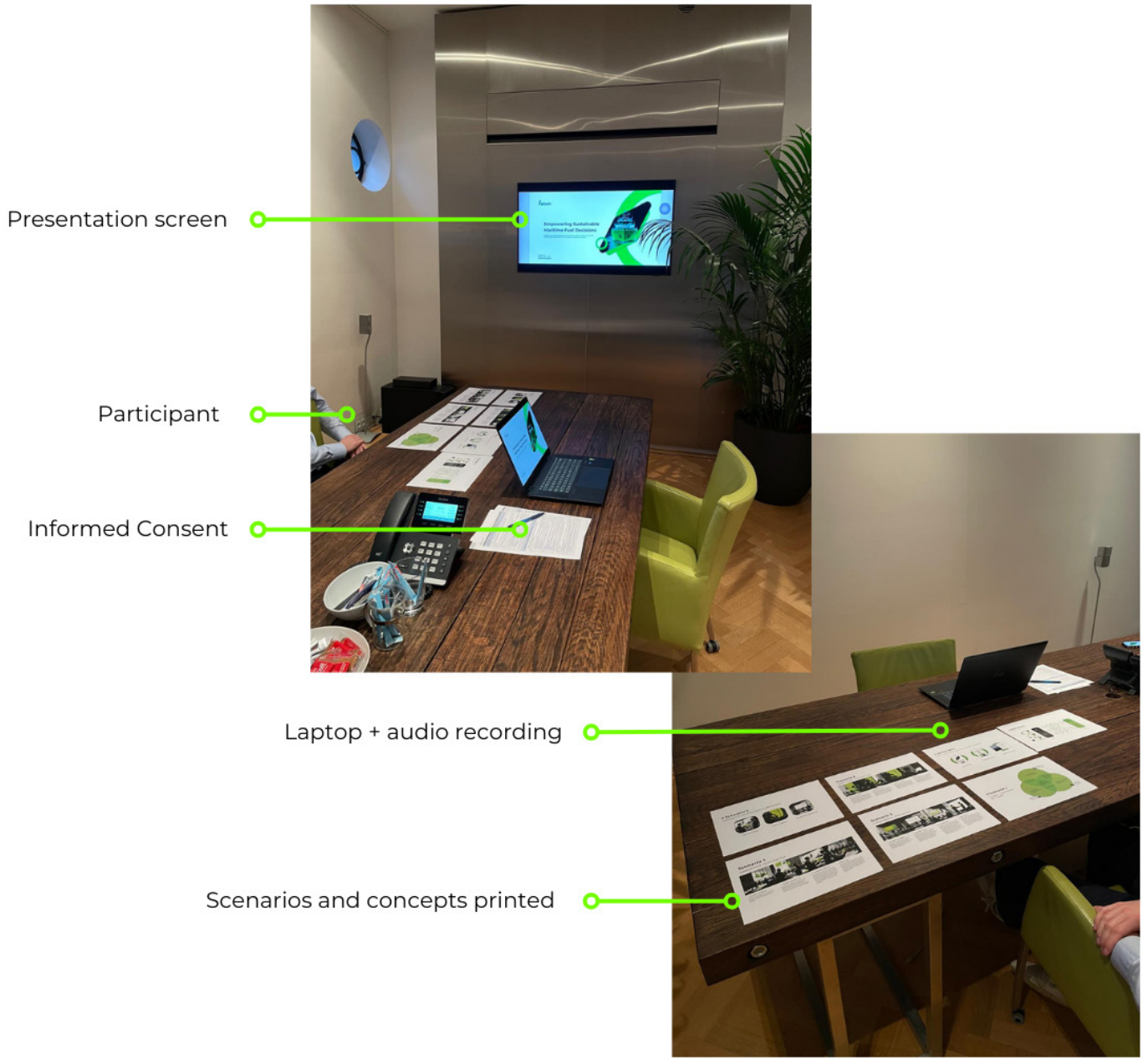
3. **Informed Consent Forms.**
   An informed consent form was supplied, clarified, and signed prior to the session.

4. **Laptop for audio recording.**
   A laptop was used to record the interview for later study. The meetings were recorded to ensure that key insights may be documented, not lost, and better interpreted.

5. **Printed Materials**
   Scenarios, concept ideas, and diagrams were printed and displayed on the table for participants' reference throughout the session. This facilitated participants' review of the information during the interview, minimized misconceptions, and promoted accurate responses.

The interview procedure started with signing the Informed Consent Forms. Followed by an introduction that outlined the project's objectives and value. Subsequently, participants were given time to read the three scenarios in their preferred language (Dutch or English) in a printed format. After that, the Venn diagram and Flow diagram were clearly and concisely explained to facilitate understanding of the key points, differences, and steps of the conceptual ideas. Next, the interview and recording began. The questions were displayed in English on the screen, allowing participants to follow, comprehend, and respond effectively. The interviewer asked the questions in their preferred language, either English or Dutch.

The interview included 6 sales experienced-participants, of whom the recordings were stored, transcribed and compiled into a single Excel sheet to easily review and compare responses per participant for the analysis, which can be found in Appendix J.

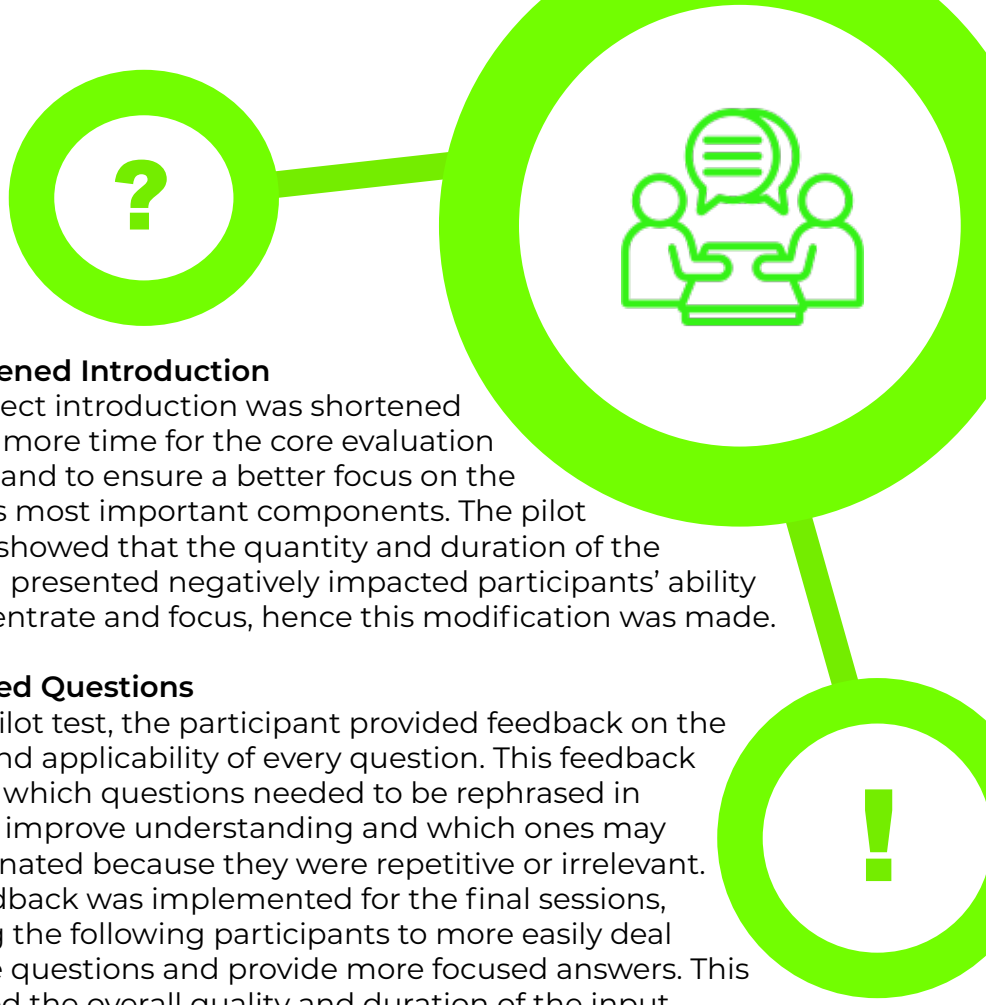


4.4.1 Pilot Test

A pilot test was conducted with one participant prior to the remaining interviews in order to assess the effectiveness and clarity of the presentation, interview questions, setup, and materials. This allowed for the identification of areas that required improvement and enhanced efficiency of the process for subsequent participants.

The pilot participant was asked to provide input on the clarity and applicability of each interview question as well as at each stage of the presentation. He was also asked for general input on the structure and flow afterward. In order to ensure that meaningful insights could be captured efficiently, the procedure needed to be interesting, simple to understand, and manageable in 30 minutes. The user test was modified in the following four ways based on the input collected during the pilot test:

1. Translation of the Materials
To suit the majority of test participants who speak Dutch, the stories and questions were translated into Dutch. This change made the scenarios more accessible and clear, hence accelerating the process. As a result, the sessions became less demanding, resulting in better overall outcomes and shorter session times. Furthermore, conducting the interviews in the participants' native tongue led to more in-depth conversations and mutual understanding. This change was initiated by observations made during the pilot test, which revealed that switching between English expressions and Dutch explanations caused unnecessary delays and less cohesive communication. By aligning the language of the materials and discussions, participants can concentrate on the content rather than the translation, resulting in more meaningful and accurate responses.



2. Shortened Introduction
The project introduction was shortened to allow more time for the core evaluation process and to ensure a better focus on the session's most important components. The pilot session showed that the quantity and duration of the material presented negatively impacted participants' ability to concentrate and focus, hence this modification was made.

3. Refined Questions
At the pilot test, the participant provided feedback on the clarity and applicability of every question. This feedback showed which questions needed to be rephrased in order to improve understanding and which ones may be eliminated because they were repetitive or irrelevant. The feedback was implemented for the final sessions, allowing the following participants to more easily deal with the questions and provide more focused answers. This improved the overall quality and duration of the input.

4. Timing
To preserve efficiency and give enough time for insightful comments, the session was planned to run roughly thirty minutes. Due to the significant feedback necessary for process refinement, the pilot session took twice as long. Nevertheless, the final sessions were significantly shorter because of the previously mentioned enhancements, resulting in an average duration of approximately 30 minutes. This strategy made sure that participants didn't get fatigued while still gathering insightful and targeted data.

4.5 User Testing Results

In this chapter, the findings derived from the interviews and the Online forms are presented and analyzed, to ensure that the appropriate features are incorporated into the tool in alignment with the actual needs and project objectives.

4.5.1 Analysis

After finishing the interview sessions in a week, the responses were transcribed and compiled into one Excel sheet. This functioned as a clear overview for each question as they were listed and the responses were organized alongside.

Based on the responses, the analysis was carried out in the subsequent columns, found in Appendix J. The responses to each question are evaluated based on the following factors:

- **Insights:** Key insights from participant responses.
- **Average score:** When a numerical rating is given, the score is the average of the group's observations.
- **Most Suited Scenario:** Determine which scenario best aligned to participant responses.
- **Overlap:** Identifying common themes or agreements among participants.
- **Differences:** Highlighting significant variations in responses.
- **Themes:** Identifying recurring patterns in words (shared perspectives, and prominent conclusions derived from the overall responses).
- **Tonation:** The sentiment (positive, neutral, negative) expressed in the responses.
- **Design Implications:** Extracting actionable insights to inform the tool's development based on the responses.

4.5.2 Key Insights

The factors listed were carefully selected to ensure a thorough review of the responses. Key insights had been highlighted to allow for a more focused understanding, as not all information was essential for the project's continuation. The scoring questions were averaged to allow for simple comparisons between scenarios and the score questions. Where applicable, the most appropriate scenario was identified according to the responses to identify the most suitable scenario.

Furthermore, overlap and differences between responses were examined to find themes and not to neglect different perspectives. Identifying common themes helped to gain insight into needs and showed a clear overlap with the pre-identified needs and goals of the project. In addition, the overlapping tone of the responses was classified to quickly identify agreement or opposition to the topics. Finally, design implications were derived to ensure that the feedback is actionable and can be used in the next phase. All these steps ensured that insights could be easily interpreted.

Key insights from the analysis were identified to ensure that the testing results significantly contribute to the project, design context, and objectives. This qualitative approach provides concise and more actionable insights, with the goal of presenting the results that will most support the development of the tool. This was beneficial as the results and analysis contained a high density of information.

The following eight key insights have been identified:

1. **Overall Preference for Scenario 3 and Concept Idea: Meeting Demo.**
   Scenario 3 was the most desirable outcome in both ratings of the three scenarios and across all questions. This was due to its ability to stimulate in-depth discussions, provide insightful, tailored information, and enable effective interactions that build knowledge and trust. This aligns with the project's vision to enable relationship-building and decision-making through in-depth and engaging interactions.

2. **Scenario Synergy**
   Scenarios 1 and 2 are considered precursors to Scenarios 3, which helps spark interest and build relationships as a step toward a deeper partnership. Therefore, all participants rated scenarios 1 and 2 as important and valuable but were slightly biased towards cold call scenario 2 because of its limitations and higher rejection rate.

3. **Tailored Features across Scenarios.**
   Participants stated that all three situations (Quick Scan, Pre-populated View, and Meeting View) require enhanced and specific features to be effective. This suggests that the tool should be flexible and adaptable to suit different stages of client relationship. This emerged as participants highlighted the unique role of each scenario in the customer relationship-building process, as well as the distinctive needs and different features for engagement. The specific features of the scenarios were considered desirable.

4. **Autonomy vs Control**
   Autonomous use is generally seen as positive because it empowers customers, improves efficiency, and increases transparency. However, there are concerns. Participants indicated that consumers may use the tool to compare costs and shop around. Demo versions and limited access can help to mitigate this risk. In this way, the value of customers' planning and decision-making is maintained while risks are reduced.

5. **Flexible Live Adjustments**
   Participants in all scenarios highlighted flexibility as important, but it was especially critical in scenario 3. This is because flexibility allows customers and traders to adjust input during real-time conversations. Hereby providing relevant insights that build trust and improve customer interactions.

6. **Mobile Accessibility**
   Participants emphasized the importance of a mobile version for on-the-go use, especially for scenarios 1 and 2, to integrate into traders workflows.

7. **Tonation**
   The overall tone of the feedback was predominantly positive, reflecting strong enthusiasm for the tool's potential to address current gaps in the decision-making process for sustainable fuel adoption. They indicated confidence in the tool's value, particularly in supporting sustainability goals, enhancing customer relationships, and streamlining decision-making. This positive outlook underscores the tool's alignment with user needs and project objectives, while also providing direction for targeted refinements.

8. **Sustainability**
   The responses indicated that sustainability is often communicated in a reactive manner rather than proactive.. Participants emphasize that they now only communicate legal requirements and reduction factors when necessary for the customer, and do not use sustainability as a central narrative in customer interactions This limited approach stems from the belief that customers do not prioritize sustainability, have little knowledge of its value and find it too expensive. On top, participants emphasized difficulties in fully grasping and conveying the regulatory landscape to clients. This creates a barrier to fostering deeper conversations about sustainability's strategic value.

4.5.3 Crucial Design Features

In addition to the key insights, design-specific insights emerged from the targeted research questions, allowing clear guidelines for design features to be drawn up. The following insights into feature design can be formulated:

- **Pre-Filled Data**
  Participants felt it was important that information could be refined and modified during live consumer meetings. Participants noted that this would allow for more tailored, scenario-specific outputs, ensuring relevance and responsiveness to customer needs.
- **Adjustability of input**
  The ability to refine and adapt data during live customer conversations was seen as critical. Participants noted that this would allow for more tailored, scenario-specific outputs, ensuring relevance and responsiveness to customer needs.
- **Clear and Simplified Outputs**
  Clear visual outputs, such as CO_2 savings, cost comparisons, and compliance tracking, were highly valued. Respondents suggested that outputs should be intuitive and easy to interpret, fostering better decision-making and engagement across all scenarios.
- **Visual Comparisons and Scenario Analysis**
  Participants found features that enable comparisons across scenarios (e.g., different fuel blends or reduction goals) to be compelling and essential for showcasing value and impact.
- **Metrics**
  Insights into CO2 reduction, regulatory compliance and cost savings were identified as key metrics that needed to be clearly and appropriately integrated into the tool.

4.5.4 Pain Points

Alongside the valuable insights, the interview also revealed constructive input and points for improvements. These have been assessed and if considered important to the later design process they have been listed here as pain points:

1. Traders lack resources to communicate sustainability

Traders have a hard time communicating sustainability as they lack narratives to convey its value. Explaining regulation takes time and effort and can be confusing.

2. Sustainable options are considered costly.

It is hard to present sustainable options as viable alternatives due to the historically high prices and difficulty seeing strategic value. Hence why financial benefits are viewed skeptically, yet they may hold significant value in the future's more positive price picture.

3. Cold Calling Challenges

Due to high rejection rates and resistance regarding client input, cold calling was seen as less effective. However, it was still seen as an essential activity.

4. Data complexity

Participants expressed that if the tool requires extensive input or is too complex, it would disrupt their daily workflow as their activities take place in a fast-paced environment. Additionally, metrics should also not be too complex, as they should not be a barrier for clients and some may be less digitally literate which may impact their use and understanding of the tool.

5. Privacy Concerns

Participants were hesitant about clients being eager to share data input early as well as having insights into client usage insights. The second, especially if we communicate to them about their sensitive data, it can be off-putting.

6. Time and effort concerns

Similarly to point 4, Data Complexity, time-demanding, and high-effort interactions are impractical and disruptive to the activities.

7. Remarks regarding Scenario 3

Although scenario 3 was preferred for its ability to build trust, face-to-face meetings are not always possible. The tool should therefore be able to work during less lively online conversations. Moreover, scenarios 1 and 2 are suitable for scenario 3, without them scenario 3 will occur less frequently, which highlights their dependency. Therefore, they prefer a tool that could capture and adapt to all 3 scenarios.

8. Risks with Autonomous use.

While autonomous use of the tool is seen as useful, there is concern that customers could use the tool to compare and play against competitors and purchase elsewhere.

9. Short term and Long term Insights

Participants explained that clients value short-term financial benefits the most, especially over long-term compliance or environmental benefits. Sustainability is only important if it is required in the short term by regulations. There is little intrinsic motivation to transition. However, if long-term sustainability goals are presented cost-effectively and with strategic value, the barrier to adoption can be reduced.

4.5.5 Interview Limitations

The interview revealed useful insights, needs, and pain points from the participants. To present a balanced point of view, certain limitations must be addressed. The limitations outlined below point out areas where responses may be affected:

1. Feedback subjectivity
Some of the answers from participants contained specific personal experiences that showed fewer similarities with the other answers. This happened a few times for some participants for certain questions. However, for all questions strong similarities and trends could be found and very personal answers were evaluated for relevance.

2. Positive Bias
Because the interviewer and participants are colleagues, there may have been a tendency to provide more positive feedback. The scenarios and concept ideas may be perceived at a higher level than unrelated participants. However, the relevance and necessity of this tool is still significant. Furthermore, participants may prefer one of the three scenarios more because they have better personal experiences with it.

3. Structured Set-up
The pre-structured format of the interview may have limited the ability of participants to think beyond what was presented. This approach provided consistency,structure and validated the project goals, but it also may have reduced out-of-the-box or alternative feedback.

4. Lack of imagination.
Some participants found it a bit challenging to provide detailed feedback based on abstract features, diagrams or scenarios. That's why some answers don't capture the full potential.

5. Knowledge Levels
Some participants have more or less experience with technical tools or sustainable fuel practices. This differentiation resulted in different depth of responses, in particular regarding technical features and sustainability communication. However, the responses are evaluated among each other and adequate, generalized insights could be stated.

6. Sales Experience
There were different levels of experience with marine fuels among the participants. All participants have experience with marine fuel sales, but some are more experienced. This mainly depends on years of experience in that particular area and whether it is a daily task or not.

By generalizing the responses, the above interview limitations were partially mitigated. Individual, subjective experiences were less likely to have an impact on the final outcomes due to the generalization approach.This led to the discovery of more generic themes and insights that reinforced essential concepts and design goals. The diversity of expertise must still be considered, but this approach reduces the impact of personal biases. As a result of this a more accurate representation is provided.

4.5.6 Radar Chart Insights

Five out of six participants completed the online MS evaluation form. The average time needed for the entire process was relatively short, 12:32 minutes. This is a shorter duration than expected, which may be because the scenarios were already known, and the reading exercise was, therefore, repetitive. Participants were able to form opinions more easily and took less time to reread all the details. However, this is not a major problem, since the main features and qualities of the scenarios and concept ideas were already known. .

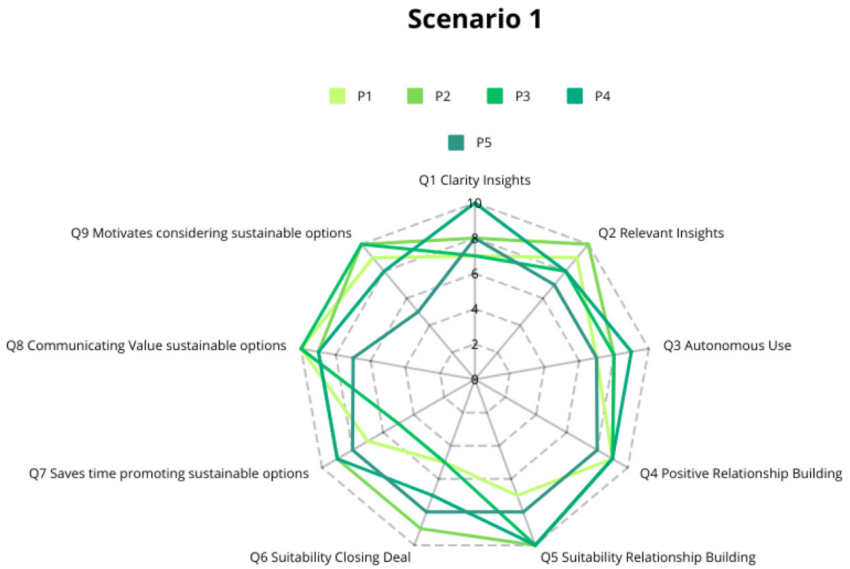
After the responses were collected, individual responses per scenario and associated concept ideas were visualized in a radar chart with individual lines representing each participant. Then, to gain a clear understanding, radar charts were created with an average response line representing all responses to get a holistic view of the results. Average scores in numbers are also evaluated alongside the charts.

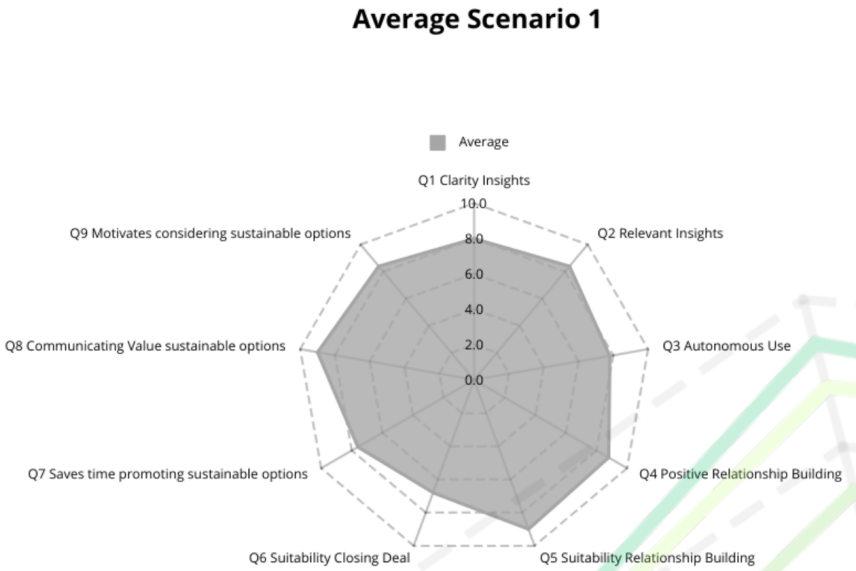
Radar Analysis Scenario 1 - Concept idea: Quick Scan

The radar chart, at the top-right, represents the individual responses and at the bottom-right reflects the average result of it. When we look at the scores, we see overall balanced results and that the tool is well rated with an average score of 8.2, indicating positive perceptions. The sum of each individual score is divided by the total number of scores to determine the average score.

Despite this, the tool scored slightly lower on its suitability for deal-making(Q6) and time-saving potential (Q7). Q1 (Clarity Insights) and Q2 (Relevant Insights) both score an average of 8, which indicates that participants find the tool's functionalities and insights clear and relevant. The tool scored a high 9 on average in the area of relationship building (Q5), reflecting its perceived effectiveness in fostering trust and good customer relationships in this scenario.

Some variation in the scores was observed for Q6 (Suitability in the deal-making process), Q7 (Time-saving potential) and Q9 (Motivation for sustainable decision-making). This variability may result from the different perceptions of the numerical magnitude by the participants or the value they attach to the evaluated factors included in the questions.





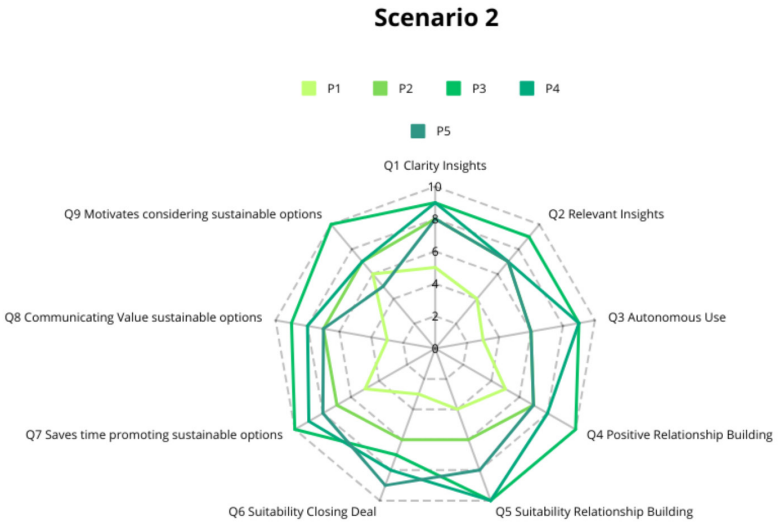
Radar Analysis Scenario 2 - Concept Idea: Prefilled Demo

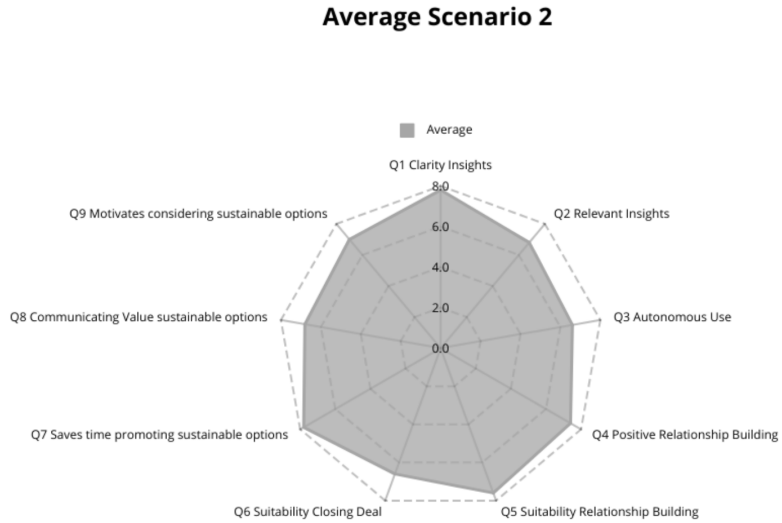
The results among the questions from the participants show slightly more variation compared to scenario 1. Remarkably, P1 also rated this tool significantly lower compared to the others.

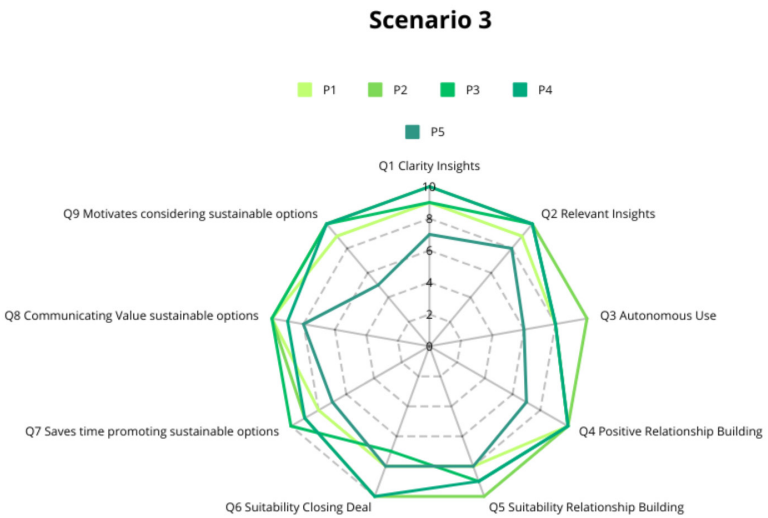
However, when excluding the deviated response, the tool overall still scores positive, particularly in terms of clarity (Q1) and the relevance of insights (Q2). This is confirmed by a positive but slightly lower average score of 7.16.

Scenario 2 scores an average that is 1.04 points lower than Scenario 1 across all criteria. This may be because the cold-calling scenario is more challenging. This also appears in the analysis of the interviews as a lower-rated scenario due to high rejection rates and less valuable interactions, which could be the reason for it scoring lower in the radar analysis as well. This could also indicate that there is room for improvement in terms of the tool's performance in fast-paced and rejection scenarios, such as cold calling.

Despite the overall lower scores, Q6 (Suitability in the deal-making process) and Q7 (Time-saving potential) show no decline in scoring. This indicates that participants perceive the tool as equally capable of capturing these criteria.



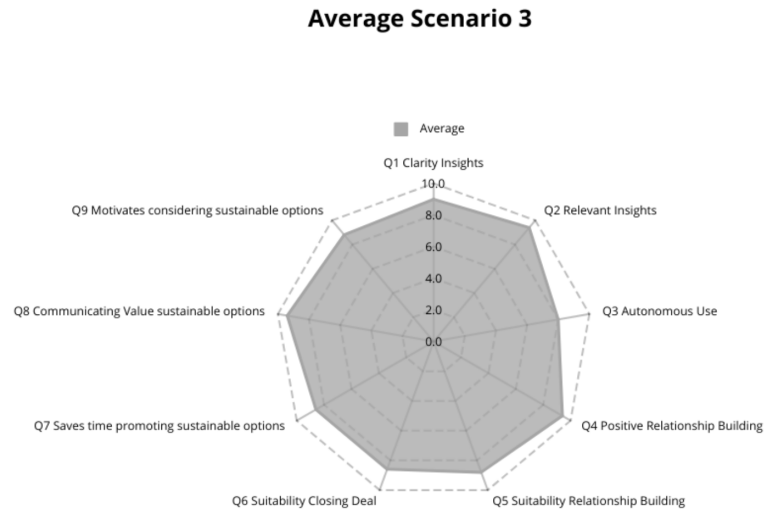




Radar Analysis Scenario 3 - Concept Idea: Meeting Demo

With an average score of 8.8, Scenario 3 and Concept Idea Meeting Demo were rated highest overall. This performs 0.6 and 1.6 points higher than situations 1 and 2, respectively. This emphasizes why scenario 3's previous findings were the most favored and successful. The overall score indicates a uniformly positive attitude, with little variation across scores. The clarity and applicability of the observations are still greatly appreciated in Q1 and Q2. This also reflects earlier interview answers to scenario 3, which were appreciated for their ability to generate insightful and constructive conversations.

Other aspects such as Q4 (Building trust and strengthening relationships), Q5 (Tailored features), and Q8 (Effectiveness in demonstrating value) also received consistent high scores. Remarkably, Q6 (suitability with closing deals) and Q7 (time savings) also received significant higher scores. This shows that the tool in this scenario lends itself better to positively influencing these aspects. This may be because there are personal and more complicated interactions where more impact can be made, as also emerged in the interview analysis.

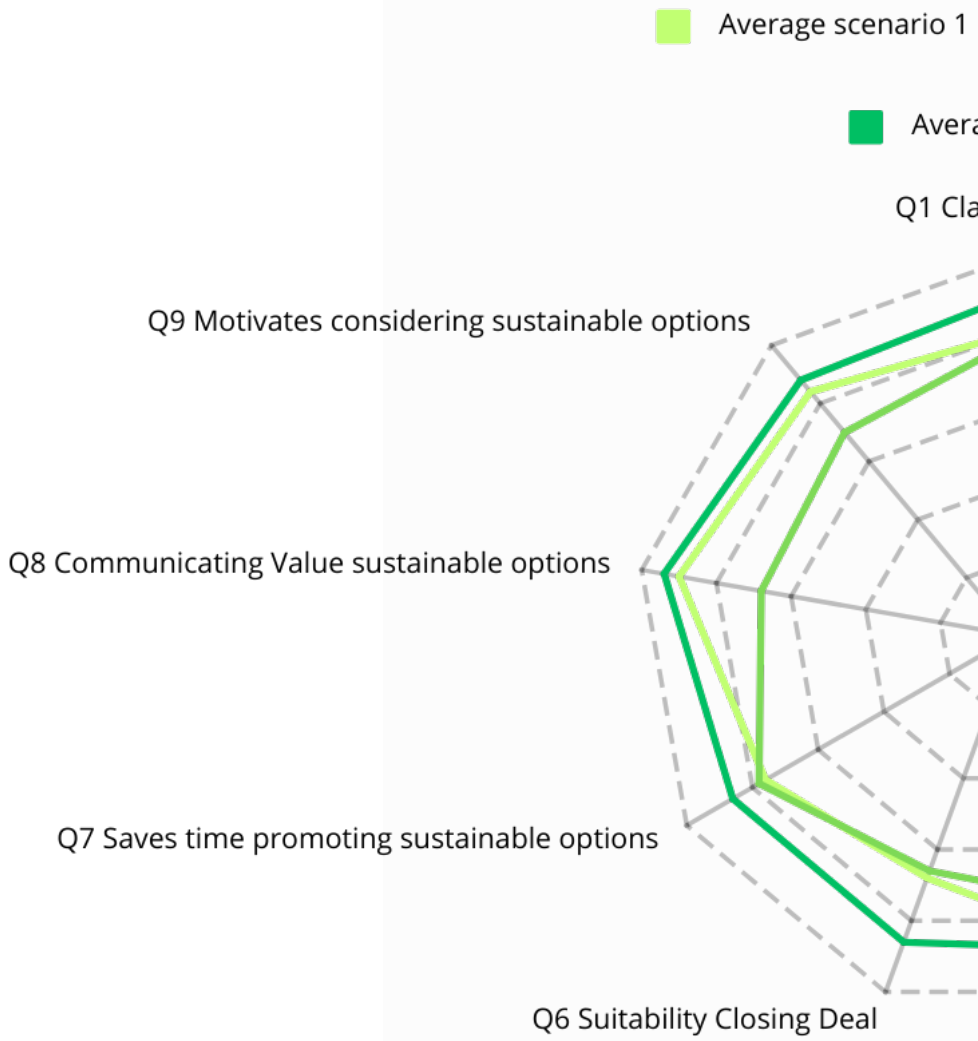


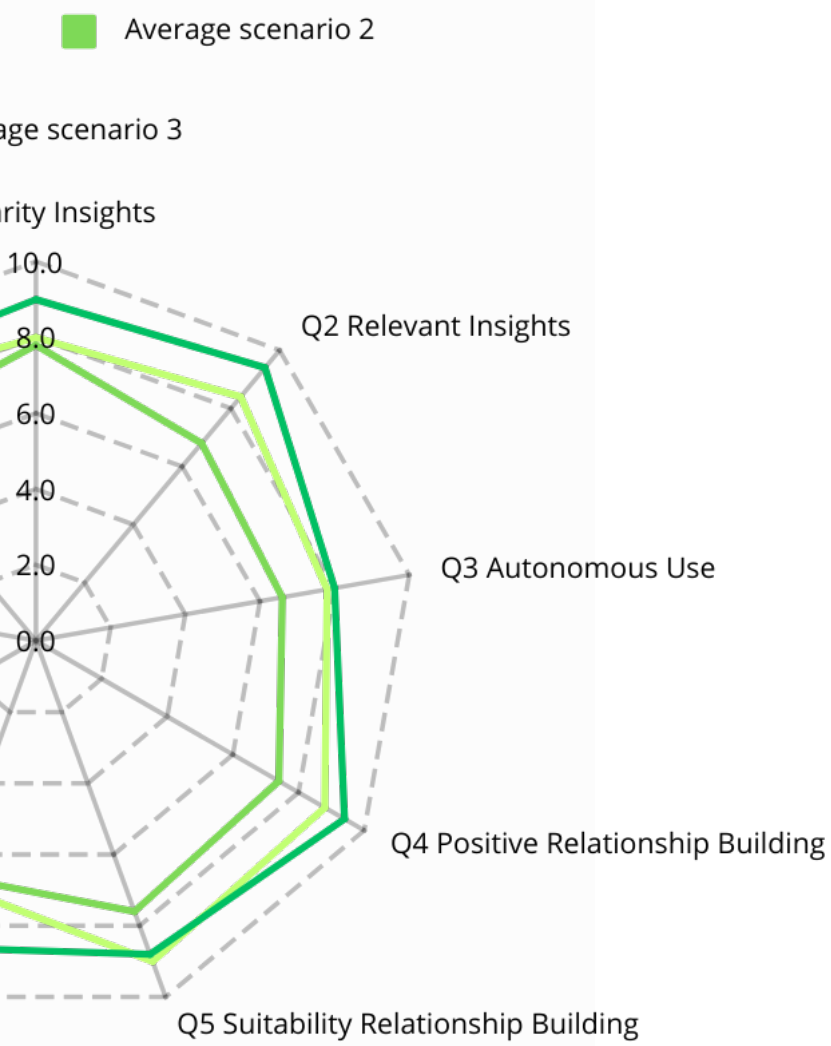
Scenario Comparisons
To visually represent the average performance of each scenario and its associated concept idea, the averaged results for each scenario's radar chart were combined into a single radar chart. This method offered a concise, comparative summary of the tool's perceived value in different scenarios. By integrating the average results into this overview, the scenarios could be easily compared with each other, and it allowed to identify similar and differing insights. This will be further elaborated in the next section.

Scenario 3 appears to be the overall winner, outperforming the other scenarios, but particularly in terms of suitability and effectiveness in closing deals. This may be because it is the most valuable scenario, as it is closest to successful deal-making. Therefore, Scenario 3 shows a higher relevance when compared to the other scenarios due to its ability to provide relevant insights and support the more complex decision-making process. Scenario 3 proved to have the greatest impact on alignment with objectives.

When comparing the scenario with each other, Scenario 1 (Quick Scan) scores only slightly below scenario 3. Although scenario 1 has the least features and is less complex, the high score indicates that participants value a comprehensive and condensed tool for earlier interactions highly. According to this result, Scenario 3's extra features and complexity are helpful, but they don't substantially outweigh Scenario 1's ease of use. This underlines the importance of clear and insightful tools in early-stage interactions.

Scenario 2 (Pre-filled Demo) scores the lowest of all scenarios, which as mentioned before can be attributed to the challenges of cold calling, a context often associated with high rejection rates and customer reluctance. Nevertheless, cold calling is an essential task and the participant pool is small, and on a global scale at slightly larger companies this could already be viewed differently.





4.5.6 User Testing Evaluation

The interview and radar chart together provide a comprehensive understanding of the tool's perceived value, the alignment with the project objectives, and additional insights and strengths and weaknesses for each scenario.

In all results, Scenario 3 is the most preferred due to its ability to foster in-depth discussions, build trust and create professional, personalized insights. This is strongly in line with the project's vision to create a relationship building tool. However, despite the preference for the meeting demo, there is also a relevant need for clear and concise tools in early customer relationships.

There is a strong synergy and appreciation between the 3 scenarios, which supports the project goal of strengthening the complete early customer relationship-building phase. In addition, aspects such as clarity and relevance of insights, as well as adaptability of input and different customer interactions were consistently rated highly. On the other hand, there is still a lot of potential for the tool to promote sustainability and position it as a more strategic driver for customers. Especially since traders are not proactive in this.

In addition to the confirming findings, pain points were also mentioned that should be taken into consideration for further design steps. The general insights strongly match the predefined vision and goals, which implies a well-executed discover and define phase. Regarding the next phase, divergent or striking insights should be investigated in a nuanced way, since the participant group is small.

4.5.7 Mixed Analysis

The impact of a tool is not only determined by the functionalities it offers, but also by how effectively the tool supports and integrates users into their daily work and (communication) processes. According to the radar chart results, the tool performs well overall (8.2 on average), especially in the areas of Relevant Insights (Q2) and Clarity of Insights (Q1). This suggests that users find the tool clear, practical and useful for structuring and conducting fruitful customer conversations.

To understand why the tool scores well and how users experience its value in practice, a mixed analysis was conducted, combining quantitative radar chart data with qualitative interview responses. This approach provides deeper insights into what drives the tool's effectiveness, how it strengthens merchant-customer relationships and which factors influence its perceived relevance. The following analysis explores these key aspects and highlights how users experience the tool, beyond the numerical ratings.

Perceived value of the tool in conversations
The high scores for Clarity of Insights (Q1) and Relevant Insights (Q2) indicate that the tool is seen as an effective way to present sustainability data in a clear, understandable and actionable way. Interviewees emphasized that it allows them to go beyond abstract statements and show customers directly the impact of their choices.

Users particularly appreciated how the tool makes complex sustainability calculations easier to communicate:

""...more professional and more convincing conversation, tangible results from showing benefits I think the result coming out of the calculation, it's definitely more convincing for them."

"Normally, they don't really understand regulation. You encountered that also. Okay, good."

"..it's going to be a huge help for customers to decide if they are using a biofuel HVO or stick to the old ones. If I were the ship owner, I would choose to have that. It's easier. Maybe I can take half of the biofuel. Half of my purchasing is going to be biofuel and half of my products still using the old ones. I can see how that's going to benefit me."

→ Insight: The tool is evaluated as a reliable and successful assest to communicate the value and impact of sustainable offerings to clients. Especially in conversations with clients that want to know the impact it has in regard to tangible financial and operational benefits but know little about the rules.

Supporting Traders as Knowledgeable Advisors
Traders stressed that the tool enhances their status as trusted advisors rather than merely sales employees, going beyond just talking about (general) numbers and surfaced insights. To be able to provide precise and data-driven insights boosts their credibility during customer interactions.

"This tool demonstrates to customers that we have in-depth knowledge and expertise. It shows we're not just providing a product but also value-added insights and calculations.."

"It doesn't change the way you talk, but it does improve the conversation. It shows you have knowledge and aren't just throwing out empty words In this industry, there are a lot of people making promises they can't keep. If you can show that your company has built an in-house tool, it demonstrates expertise."

→ Insight: The tool helps traders position themselves as experts who can provide data-driven advice. This means that clients do not solely have to rely on generic and verbally conveyed sustainability claims. This strengthens the relationship as it creates trust and shows that the tool can do more than just present data: it also helps traders improve their professional image by offering value that seems realistic and achievable for the client.

The mixed analysis confirms that the tool is seen as highly relevant and valuable in daily practice. The mixed analysis also reveals that the tool is also a powerful and valuable tool for traders. By maintaining the tool's role as clear, credible and easy to use, it can support traders in effectively engaging and convincing customers.

4.6 Develop Outcomes

This chapter adresses the conclusion from the deliver phase and reflects on the formulated questions.

The Develop phase concentrated on discovering, testing, and polishing design elements for the proposed tool. This chapter delivered the following key results:

1. Preferred Scenario and Concept idea: Scenario 3 (Meeting Demo): Appeared the most valued in the interviews and radar chart. It facilitates in-depth discussions, trust-building, and actionable, personalized insights, which all stimulate the relationship-building process. Scenarios 1 and 2 were considered valuable scenarios that build towards Scenario 3.

2. Core insights defined: Adjustability, Clarity, Sustainability/regulatory benefits.

3. Design Choices for Phase A: ensures that sustainability is introduced at the beginning of the relationship.

4. Calculation tool as MVP Providing an essential framework for input and output that can evolve into more complex tool later.

The activities addressed the prestated questions as the following:

Q4.1: How can engagement be enhanced through attractive behavioural stimuli in the deal-making and relationship-building process?
- Scenario 3 received the highest grade since it was deemed the most engaging by including personalized and dynamic insights during in-depth conversations.
- Participants highlighted the need for clear visuals and motivational triggers, such as showing regulatory benefits and benchmarking emissions.

Q4.2: How can clear and actionable insights into the CO_2 reduction potential of biofuels be effectively communicated (during the relationship-building and deal-making process)?
- Participants appreciated clear and simplified metrics such as cost savings, compliance progress, and emission reductions, which were identified as crucial outputs.
- The radar map and interviews demonstrated the significance of visual clarity and data simplicity, with several participants arguing for personalized insights that correspond with specific customer demands throughout the interviews.
Remark: Improvement can focus on proactive narrative-building around sustainability in order to transform talks from simply compliance to strategic benefit, allowing traders to sell the story. This is handy as most traders lack resources to communicate the potential benefits, regulations and implications of sustainable options. Also, the scenarios and tool stages did not go into detail on long-term strategic benefits or insights.

Q4.3: What design elements and functionalities are necessary to align with the deal-making and relationship-building processes?
Insights:
- Scenario 3's flexibility and adaptability regarding input and results were considered vital.
-Tools that provide real-time adjustments, mobile compatibility, and personalized outputs were well appreciated.
Remark: Autonomous use is deemed risky.

The insights validate the need for a flexible, scalable tool that combines clear information delivery with engaging features. Recommendations or the next phase:

- Focus on Scenario 3's strengths while retaining the foundational elements of Scenarios 1 and 2.
- Address pain points found and try to address them correctly.
- Make sure sustainability communication is possible for the traders: make it understandable and actionable for them to communicate.

5. DELIVER

In this chapter, the final concept and assets are introduced, showing how previous insights were shaped into a context-ready and strategically grounded solution.

5.1 Deliver Overview

In the Deliver phase, the previously defined objectives, findings and feedback are bundled and translated into a final end result that is presented in this chapter.

The end result consists of a conceptual calculation tool and additional assets (deliverables) that contribute to a well-functioning and strategic solution. The activities presented in Table 5.1 led to this final result.

The activities were carried out to (iteratively) develop the tool in line with the project objectives. In addition to the tool, activities were carried out to ensure that the tool can maximize its impact in daily practices. The activities contribute to the user experience of the tool, technical developments and information and communication support.

Activities							
Activities	**Chapter**	**Method Used**	**Materials**	**Executed by**	**Participants**	**Linked RQ(s)**	**Contribution to research questions**
Final Tool Development	5.3.1	Defining Core Components, Iterative prototyping, refinement cycles,	Miro, Canva, Uizard	Me	N/A	SUBQ2, SUBQ3	Creates an optimal conceptual tool that aligns with stakeholder needs and integrates objectives.
Mockups (Desktop & Mobile)	5.3.2	Creating UI/UX prototypes,	Canva, Uizard	Me	Developer	SUBQ2, SUBQ3	Creates an optimal conceptual tool that aligns with stakeholder needs and integrates objectives.
Annotations (User Flow & Understanding)	5.3.3	Mapping user decisions, understanding and intended effect of the tool	Miro, Canva	Me	N/A	SUBRQ1, SUBQ2	Helps users understand how the tool supports decision-making.
Annotations (Technical)	5.3.4	Verification of calculation models, data validation	Miro, regulatory sources, emissions database	Me	N/A	SUBQ1, SUBQ3	Ensures compliance with FuelEU regulations and accurate emission calculations.
Flowchart & User Interaction Design	5.3.5	Visualizing tool steps, mapping interactions	Miro, Canva,	Me	N/A	SUBQ2, SUBQ3	Defines logical steps in the user experience to validate and communicate the workflow.
Usage Scenarios	5.3.6	Mapping different business interactions using the tool	Miro, Canva, Midjourney, Freepik	Me	N/A	SUBQ1, SUBRQ2,	Demonstrates where and how the tool adds value in real-life business scenarios.
Mail Report	5.3.7	Visually designing the email report	Uizard, Stripo	Me	N/A	SUBQ1, SUBRQ2, SUBRQ3	Provides a template for users with structured insights in the mail, next-step guidance, and stimulates the business relationship.
Short-Term Roadmap	5.4.1	Defining key next steps, prioritization	Miro, Canva	Me	N/A	MRQ	Establishes improvements and next steps to develop and launch the final calculation tool.
Long-Term Roadmap	5.4.2	Strategic planning for future expansion	Miro, previous research, Canva	Me	N/A	MRQ	Ensures a future roadmap that remains relevant and scalable in the long term and broadens the scope.
Toolkit Development	5.5	Simplifying key insights and information, Visual design	Adobe XD, Miro, Canva	Me	N/A	SUBQ1, SUBRQ2, SUBRQ3	Provides traders and clients with an easy-to-understand reference for compliance and tool usage, to maximize the impact, understanding and support proactive communication.
Leaflet Design	5.6	Visual design	Adobe XD, Canva, Illustrator	Me	N/A	SUBQ1, SUBRQ2, SUBRQ3	Supports traders in grasping the tool(kit)'s value and being aware of the usage scenarios.

Table 5.1 Activities performed in the Develop Phase.

5.2 Deliverables

In the Deliver phase focus lies on developing a lightweight, socio-engaging tool that supports the relationship-building process by offering in-depth support (for Scenario 3) while also assisting with quick assessments required in (Scenarios 1 and 2). Thus, in this phase, an MVP calculation tool (conceptual solution) is developed as a stepping stone for scenario 3, while also being functional for usage scenarios such as scenarios 1 and 2. This concept version, focused on implementing the CORE requirements for sustainable and FuelEU fuel decision-making (defining input and output).

This proposal represents one possible approach, though it is not necessarily the only or ultimate solution. Careful consideration has been given to ensure that the proposal is as relevant and high-quality as possible, providing a solid starting point for further development.

Resulting from the findings of the previous chapters, the following components have been selected to be delivered in this phase (in addition to the calculation tool):

1. **Calculation Tool (Desktop):**
   The main deliverable, a conceptual desktop version for positioning sustainability as a strategic asset, supporting the understanding of low-carbon fuel impact in line with regulations and an effective sustainability communication resource for traders and clients. The tool should be utilized in early relationships and sales interactions and aligns with the overarching user needs for clear, quick, and adaptable insights on regulations, sustainability impact and cost savings for fuel decision-making. The calculation tool is the first step for creating scenario assessments and can later be further developed into a comprehensive digital dashboard environment.

2. **Calculation Tool (Mobile):**
   Next to the desktop version, a conceptual mobile version will be designed. This is because an important user need was that the tool should always be readily available for every opportunity and interaction (4.5.2 Key Insights, No. 6: Mobile Accessibility) waiting for a laptop to start up is not a viable option. When going to business exhibitions or gatherings, employees are on the move and often do not carry their laptops with them. Therefore, a mobile version has already been deliberately proposed at this stage. The mobile version should, of course, also be considered and designed with a focus on clarity, ease, and providing actionable insights.

3. **Email Result Report**
   After the calculation, a button can be used to save the results and have them emailed. This was a thought-out feature that was appreciated. It allows the customer to reflect on and discuss it with their team and compare scenarios. On the other hand, it helps the trader to communicate the insights through credible data and allows for conveying additional information. In short, it is a valuable asset that communicates professionalism, strengthens the relationship, and brings strategic value. It can also be utilized to strengthen the sales funnel.

4. **FuelEU Toolkit**
   Designed to improve communication and understanding by explaining the tool's impact, regulatory benefits, and sustainability opportunities. Research showed that traders struggle to communicate sustainability effectively, and clients lack understanding, both emphasizing the need for structured support. This toolkit empowers traders and clients with everything they need to know for their fuel decision-making: Regulations, Scope, Strategies, Using the Calculator and understanding The Results.

5. **Implementation Roadmap**
   Consists of a short-term roadmap (0-6 months) to create and deploy the calculator tool on the website for the company. A long-term plan for a strategic and feasible expansion is included to guarantee long-term success and response to the changing industry needs. The long-term roadmap includes a dashboard, additional regulations, and expanded functionalities to support future developments. These roadmaps have been provided to ensure that the company can implement the research and the tool successfully, meeting future and expanding needs.

6. **Usage Scenario Leaflet**
   A visual handout of the different use cases to educate users through different uses of the tool, many of which are socially oriented. This allows traders and the company to better understand how they can leverage the tool. Utilizing all scenarios is essential, as research insights highlighted that they are interconnected and build upon one another.

Delivering these informative and visual assets such as the toolkit and the leaflet, is important because it became apparent during the test phase that concepts were difficult to assess or interpret if they were not visually represented, lacked a structured framework, or were not easy to understand.

With the help of these deliverables, the following profound challenges (4.5.4 Pain points) are addressed:

- **Lack of Sustainability Resources:** Traders often do not communicate sustainability effectively yet. These deliverables provide visually compelling insights and clear information to support more proactive and informed discussions on the relevant (sustainability) topics.
- **Perception of Low-carbon Fuels as Costly:** This calculator proves the opposite, while remaining compliant and lowering emissions.
- **Rejective Interactions:** In difficult and rejecting situations, the tool can also help by providing quick and professional value, which makes a good first impression and may lower the client's barriers.
- **Complex Information:** The tool and deliverables concentrate on communicating and conveying only the most important information because complex and extensive information proved to be overwhelming. This ensures clarity, ease of use, and understanding.
- **Accessibility and Exclusivity:** While some valuable information is readily available, detailed insights are reserved for deeper engagement with business representatives, fostering meaningful interactions. This addresses the risks associated with autonomous use while still providing value to the customer and convincing them.
- **Short-term Benefits with a Long-term Vision:** The focus is on immediate advantages, as these are crucial for decision-making now, while also laying the foundation for a more sustainable long-term future.

Together, these deliverables aim to provide a comprehensive solution that is useful in the design context, fits the needs, is in line with the design directions, and addresses existing pain points.

5.3 Development Tool

5.3.1 Development Process

The development process started by reflecting on the desired inputs and outputs based on the testing results and re-analyzing the previous flow diagram (Chapter 4.3.5) of the three scenario concepts and ideas. To do this effectively, an individual ideation session was held to structure the new proposal's core components (input and output). During this session, the focus was on defining the core functionalities of the MVP conceptual calculation tool. This means that only the essential elements for fuel decision-making were considered and integrated.

In addition to the previous work, I noticed that some competitor companies have recently released FuelEU calculator tools. The tools have been collected and stored in a digital canvas in Miro, See Appendix J. Accordingly, they were used to cross-check essential input and output elements. These calculator tools do differ greatly in use cases (including advisory provided by external companies), data, and levels of complexity. Therefore, this designed tool is still specific and distinctive. However, this difference was taken into account during the comparison assessment. By executing this, it became apparent that the concepts had not yet considered the input "EU Exposure", which has an impact on the calculation (because of the FuelEU regulation rules). This also emerged in the development of the toolkit, where it also plays an important role concerning the impact of emissions regulations. This hadn't come to light earlier, as it concerns "small print"/minorities of the regulation, but this will come to light when working out the tool in greater detail.

In addition, it was investigated which formulas define the input and output process, to be able to attribute the correct unit to the presented insights and required data. This took place at the same time as the research for the Toolkit, and the same sources were consulted for this purpose (see Chapter 5.5).

As a results of this braindstorm session, the overview of the determined CORE input and output elements can be found in Appendix M.

The next step was to create and explore visual mock-ups for the potential tool. Uizard was used to design the mock-ups. It allowed for easy design and iteration, which improved and accelerated the process. Various (calculator) tools and dashboards from other designers on Dribbble were looked at to improve everything visually, aiming to create a clear and visually appealing interface. Inspiring designs were collected in a Miro canvas. While generating all the mock-ups, Osprey Energy's branding and visual identity were incorporated to create a professional, recognizable, and visually strong design that suited the intended company. Since I also handle visual work for the company, I was able to incorporate this efficiently into the deliverables.

Nevertheless, it was decided to develop a brand name for the tool, to convey a sense of autonomy. In addition, conscious attention is paid to implementing the communication message about sustainability and its value while avoiding greenwashing through incorrect claims. Different ways of visually presenting the information were considered and developed; see Appendix N for explored possibilities and mock-up iterations. After exploring different data presentation styles, the most effective version was selected, further developed, and iterated upon (see Appendix O).

Finally, I arrived at a full tool mock-up, where I did one last iteration step, see Appendix P. I held a session with a contact experienced in app and web design. Together, we gave the design a final iteration, focusing on clarity, layout, whitespace, consistency, and general feedback. In this step, the entire process of the tool is also documented in a flowchart (see Chapter 5.3.5); all steps and data were reviewed and documented one final time. This helped to ensure that nothing was missed, that the use was optimal, and that it was clearly framed. This resulted in the final version of the calculation tool.

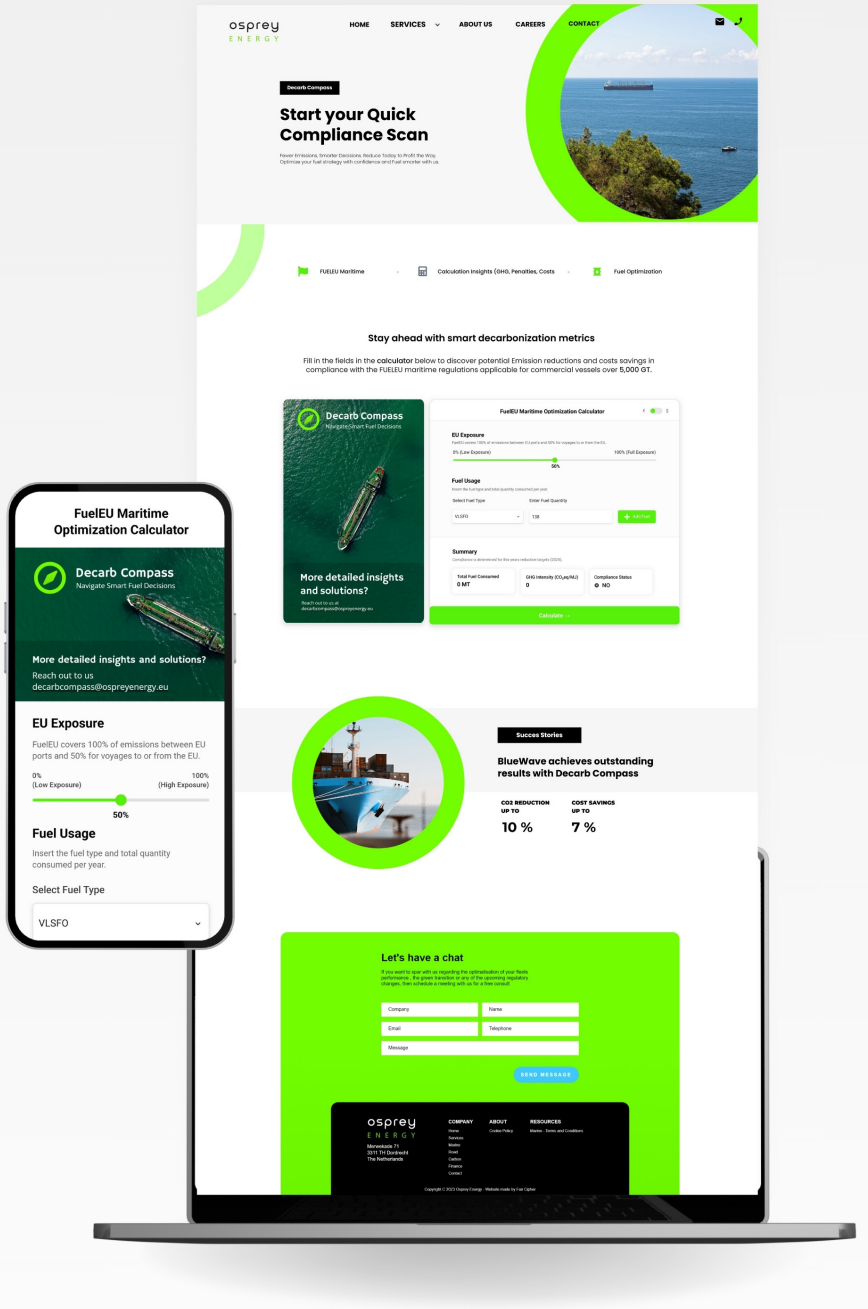
The calculator tool can also be implemented on websites. That's why I also designed a dedicated landing page where the calculator can be embedded. The landing page is designed to help users quickly understand the tool's function, with a short explanation and prompts to encourage use.

5.3.2 Final Designs

The implemented final design can be seen here (right): Here, the calculator tool is incorporated into the designed web page, as is the compatible preview presented on the mobile. Both have been designed based on the insights from this research, focusing on an intuitive and effective interface that makes it easier for shareholders to make strategic (sustainable) fuel choices.

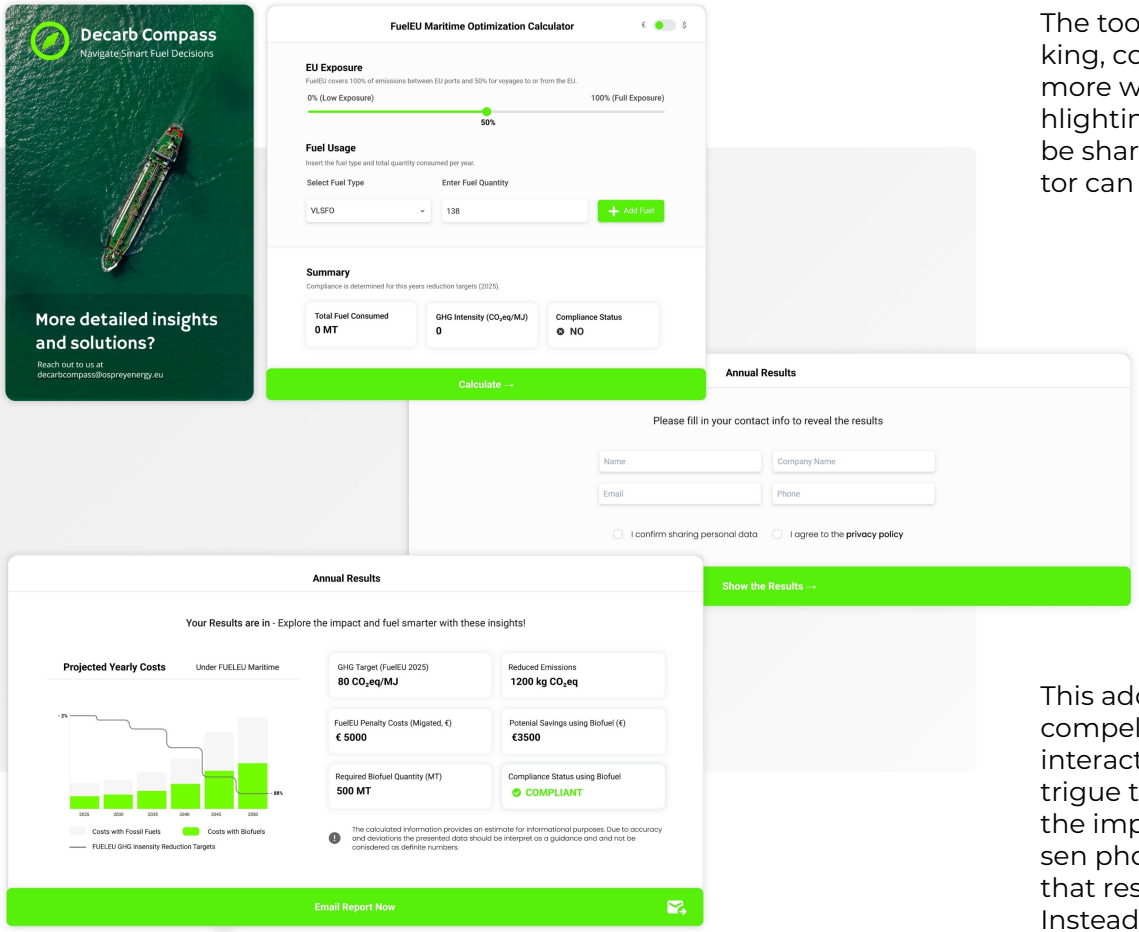
It was decided to develop a mobile and desktop version so that the tool can always be used flexibly in different usage scenarios. In addition, a web page has been developed so that the tool is easily accessible. Customers can easily get in touch with it, and it can, therefore, also be used for marketing purposes. The webpage also enables strategic storytelling through nudges and supportive messaging. For example, it was decided to emphasize a success story at the bottom, which is a social proof nudge that increases credibility and creates FOMO (fear of missing out). Because existing customers are already benefiting from it, this reduces uncertainty for new users. This is in line with the project's engagement strategies, as social nudges that are also recommended in The Little Book of Green Nudges. Also, motivational and informative texts have been added to quickly and clearly explain the impact of the tool and encourage its use.

The tool can easily be integrated into future platforms, or on other websites. Changing the greenhouse color to another brand color makes this possible, as the other design elements are minimalist and modern and do not draw too much attention. Additionally, they are designed to feel intuitive and native. This ensures that the data is easy to interpret, while key elements stand out through the use of color.



Webpage Design and Mobile Preview

DESKTOP MOCKUPS



The desktop Calculator mock-ups are shown on the left. The mobile (on the right) and desktop versions have identical functionality. They provide a clear and efficient user experience where strategic fuel scenarios can be easily explored and adjusted. The valuable insights that result from this help spark meaningful business conversations.

Visually calculated insights are easier to communicate and appear more credible, which can achieve more impact and results. In addition, they help traders quickly sketch scenarios or customers explore them independently.

The tool can be integrated into the three earlier scenarios (networking, cold calling, and business meetings), but it can be used even more widely. Additional use cases are described in Chapter 5.3.6, highlighting how the tool provides quick, valuable insights. The tool can be shared via website links, business cards, or QR codes, the calculator can be pre-filled, and insights can be saved and shared.

The tool supports all previous objectives and crucial design features such as adjustability, clarity, and relevant metrics. This is possible due to the user-friendly, clear, and natively designed interface and interactions, which take into account visual hierarchy and order.

In addition, it was decided to add a visually branded side panel: a deliberately added visual element was integrating a photo frame with a branded nudge and incentive message (as a design element) in the tool. This boosted the visual appeal by turning the tool from a static text-and-button layout into a more dynamic and attractive interface.

This addition made the tool feel more branded, intuitive, and visually compelling. Furthermore, it encouraged subtle but meaningful user interaction. The incentive text not only functioned as a nudge to intrigue the user, but also as a communication moment to emphasize the importance of further collaboration and deeper insights. The chosen photo was an image of a vessel. This creates a clear visual context that resonates with maritime professionals and fuel decision-makers. Instead of an abstract and generic calculation framework, the image immediately creates a clear context: this is about the maritime sector

and sustainable fuel management supported by the colors, logo, and text. This quickly gives the user a clear picture of the target group, the application, and the added value of the tool.

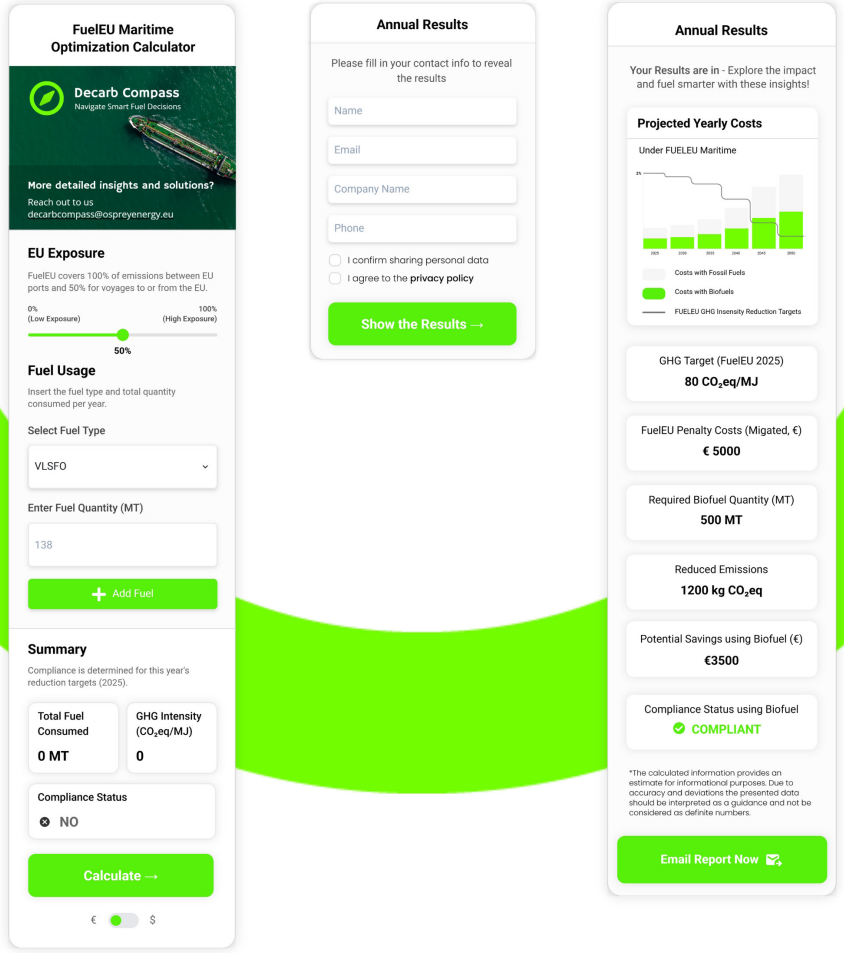
This design choice maximized the opportunity to position the tool not only as a calculator but also as a relationship-building instrument. The visual element invites contact and underlines the tool's further strategic goal and impact: not only to inform, but also to stimulate further collaboration for more in-depth insights and possibilities.

Value is already provided during the input process. It was chosen to add a summary element that plays an important role during use. Early on, valuable insights are already presented, such as whether the current scenario is compliant and the average GHG intensity of the selected fuels. This generates interest and motivates the user to complete the input process, go through the process to get the results and provide their contact details. In addition, the total entered fuel is summarized and displayed. This helps users to identify and check errors in input data quickly and minimizes incorrect input or misinterpretations.

The presented results are estimated values based on the input data. They should be interpreted as a guideline and used for initial interest to show possibilities. They are indicative, not final, and should serve as a starting point and can be discussed with a trader in more detail. Therefore, the calculation tool is functional, however, additional materials or support will be required in a future project to present the exact figures to customers.

In addition to the desktop version, a mobile version has been created. This is important for the use cases and needs of the stakeholders. Also, if the website is opened on a mobile device, the desktop design is too small. Therefore, a mobile-oriented version is necessary for usability.

For the mobile version, the structure, functionality, and order have remained the same as much as possible. Still, some adjustments have been made to make it more logical and visually better for mobile. This version was designed by stacking all elements vertically and adjusting them to fit mobile dimensions. This quickly resulted in a well-functioning mobile layout. The currency switcher was placed at the bottom because there was no more space at the top, which seemed to be a more intuitive placement. Large buttons were used to enhance usability and mobile interaction. The branded photo and accompanying text, initially a separate element, was replaced with a fixed, smaller banner inside the calculator.



MOBILE MOCKUPS

5.3.3 Annotations

The calculator helps shipping companies and traders quickly enter fuel consumption data and assess (compliant) scenarios. The annotated mock-ups in Figures 4.1 and 4.2 highlight key user decisions and moments of understanding.

The calculator is designed with a simple and structured interaction flow in mind. Users can enter and analyze data quickly and effectively. The input flow is carefully structured, using clear and familiar visual elements such as sliders, input fields, and a summary box, which all require minimal explanation.

The design is minimalistic, avoiding distraction and ensuring that the user's attention is focused on the decision moments and presented key insights. The green color highlights important (interactive) elements.

Below is an explanation that goes into more detail about what is understood and decided upon and what the intended effect on the users is during the input process.

Understand - The user gets to understand the following during **the input process:**

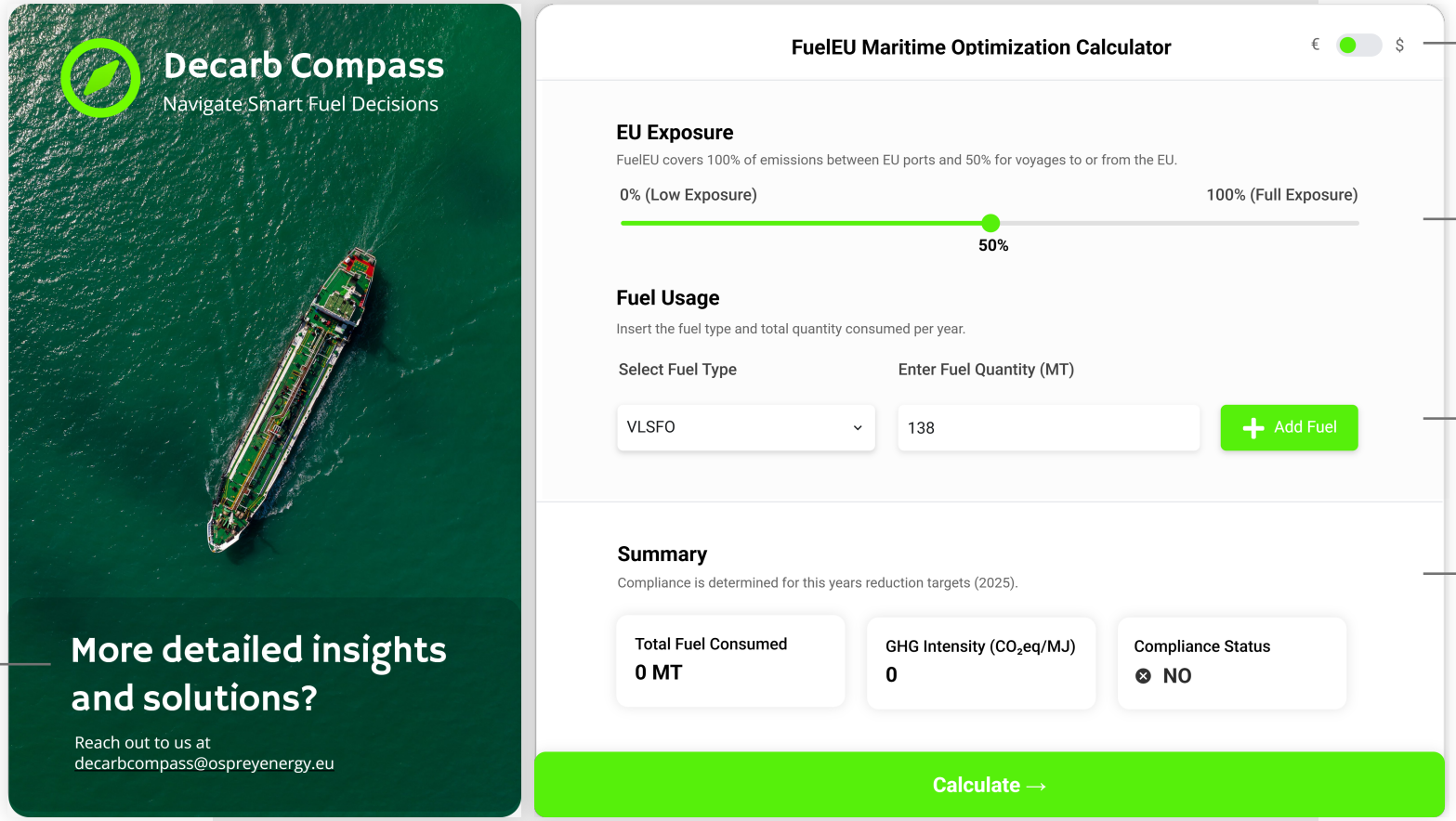
- **EU Exposure**
  They realize that a ship's specific shipping routes (inside or outside EU waters) directly impact the percentage of emissions covered by the FuelEU scheme and calculation.
- **Fuel Usage**
  The type and amount(s) of fuel(s) consumed determines the emission score (GHG Intensity).
- **Compliance Status**
  whether the entered scenario is compliant or not (applicable).
- **GHG Intensity Level**
  What the mean GHG intensity is of the fuel (mix) entered.
- **Total Fuel Consumed**
  The total amount of fuel consumed in metric tons for validation of their entered data.

Decide - The user gets to decide the following during the input process:

- **Currency**
  Users can select to switch the currency from EUR to USD (tailored for international clients)
- **EU Exposure %**
  The percentage of shipping routes under the EU regulation determines the emission calculation.
- **Fuel type and quantity**
  Users can select which fuels they want to use and in which quantities.
- **Add fuels**
  The add fuel button allows users to simulate a mix of fuels. An additional field will appear to select the fuel type and quantity. A "delete" button will also appear if the added fuel needs to be adaptively removed.

Effect - The user experiences the following intended effects:

- **Easy comprehension**
  The tool helps to better understand the implications of FuelEU regulations without (difficult) manual calculations, and data entry is easy. This bridges gaps for practical decision-making and removes complexity.
- **Motivation & Trust**
  The summary acts as a validation point, encouraging users to explore further or want to know more detailed/accurate insights and get in touch. Based on actual data and calculations, the tool communicates transparency and builds trust by demonstrating expertise.
- **Confirmation**
  After filling in the data, the summary confirms the result, which provides certainty. In addition, the tool immediately validates the compliance scenario and provides clarity regarding the regulation and the fuel scenario.
- **Curiosity**
  The tool's interactive, clear, and adaptive nature encourages users to try out different scenarios, creating a sense of discovery and encouraging them to think more strategically about fuel choices and compliance.



Effect: Simulates relationship building and nudges for communicating about deeper insights

Decide: Currency
Allows to switch between EUR and USD, which is needed for international clients.

Decide: Covered Emissions
Necessary estimate needed for annual percentage of routes in/out of the EU to reveal the amount of emissions to be covered.

Decide: Annual fuel uptake
Adaptive input field for annual fuel uptake, (multiple) type of fuel(s), and quantity to simulate the scenario.

Understand: Current compliance status (YES/NO, N.A.), mean GHG level of fuel uptake.
Instant insights on Compliance, total fuel quantity and mean GHG Intensity based on user input.

Figure 4.1 -Mock-ups of the input field of the Desktop Calculation Tool highlighted with User Experience Annotations

Below is an elaboration that goes into more detail about what is understood, decided and what the intended effect on the users is during the contact form phase.

Understand - The user gets to understand the following during the **contact form phase**

- **Results are shown after providing personal information**
  They get to understand that acquiring the results requires personal information to be entered in the form (Name, Company, Email, Phone).
- **Data privacy policy**
  The checkboxes allow the user to understand that personal data will be shared according to the linked privacy policy.

Decide - The user gets to decide the following during the **contact form phase:**

- **Providing personal details**
  The user decides whether to be willing to provide personal data and thereby obtain the results.
- **Consent**
  The user indicates to be aware of filling in personal information and agrees (or not) to the privacy terms before proceeding.

Effect - The user experiences the following intended effects:

- **Lead generation**
  By collecting personal contact information before showing the results, leads can be generated.
- **Relationship-building**
  The contact information allows traders to connect and build a relationship around tool's value.
- **Some Friction**
  Although users may be hesitant to provide personal information, this filters out users who are less interested or misuse the tool, leaving more valuable leads.

Finally, the explanation during the result phase explains what is understood and decided upon and what the intended effect on the users is.

Understand - The user gets to understand the following **during the result phase:**

- **Projected Yearly Costs**
  Let the user understand (visually) the ratio of rising costs due to emission regulation expenses when using fossil fuels alone compared to the costs when incorporating biofuels. This signifies the importance of considering biofuels
- **GHG Target**
  It lets users understand which GHG target they need to comply with this year.
- **Emission Reduction**
  Lets users understand an indication of emissions that can be saved in the compliant scenario when adopting biofuels.
- **Potential Financial Savings**
  Let users understand an estimate of potential financial savings in EUR or USD when implementing the required amount of biofuel.
- **Required Biofuel Quantity**
  Let users know how much biofuel they need to consume to meet the compliant GHG target.
- **Compliance Status**
  Confirms to users that the result scenario is compliant.

Decide - The user gets to decide the following during **the result phase:**

- **Email the report**
  The "Email Report Now" button allows users to save, share, and revisit the insights for later use by mailing them.
- **Get in contact**
  If the results lead to questions, or if the user wants more information or to plan a strategy, the user can decide to contact the company or a trader.
- **Results**
  The user interprets the insights and decides, based on the results, whether to take action directly or at a later stage.

Effect - The user experiences the following intended effects:

- **Confidence**
  Because of the easy and helpful insights, the user gains more confidence in making certain decisions and trust.
- **Motivation**
  The potential cost savings and compliance motivate the user to consider the more sustainable options.

Effect: lead generation

Leads can be generated by collecting data before showing the results. This can cause some friction; however, it filters out less serious users and disables misuse. It enables the company to engage and build relationships with users.

Understand: Results visible after sharing contact info

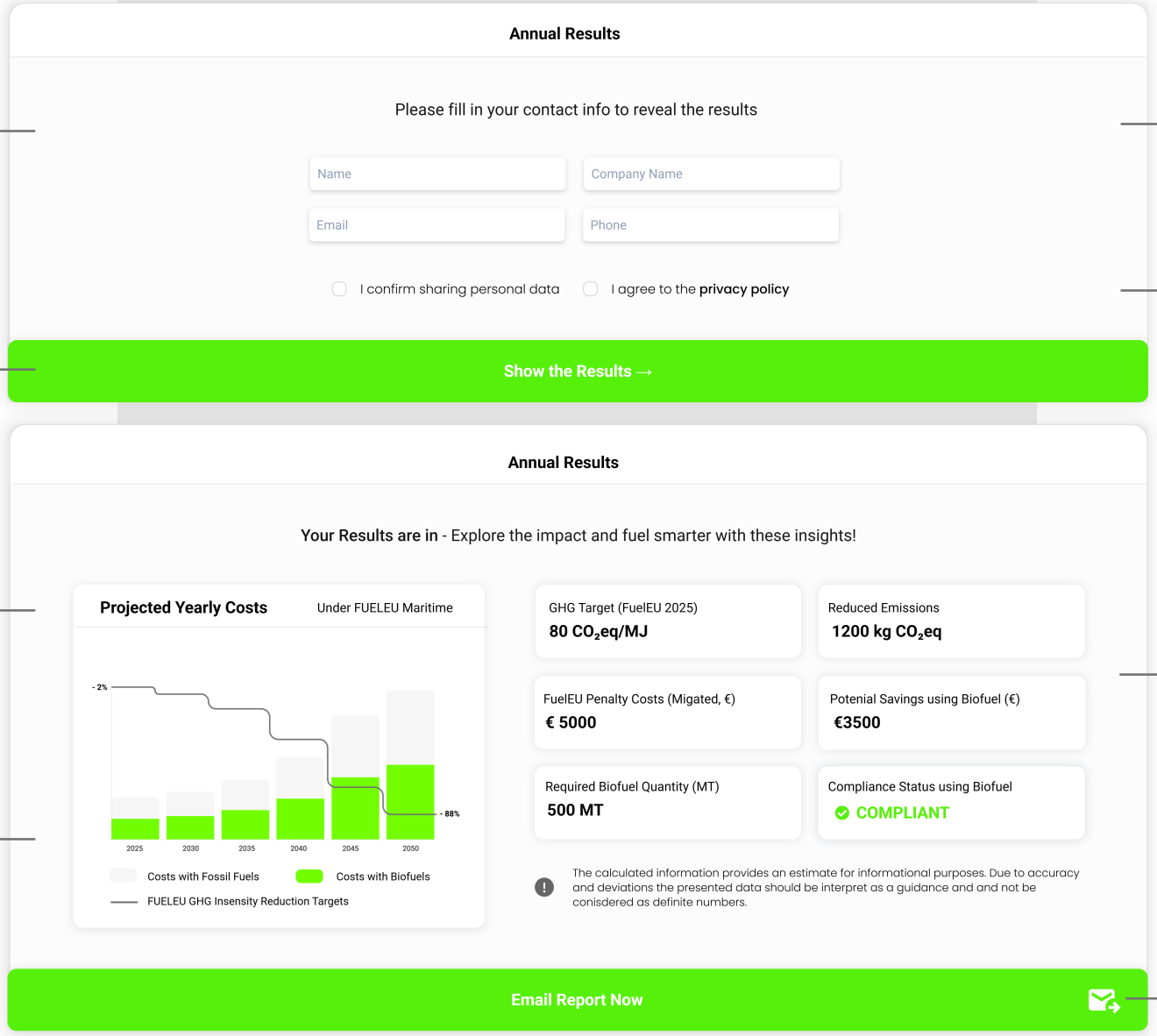
This button communicates that results will be revealed after entering personal information.

Understand: Cost Trend FuelEU

It helps users understand that conventional fuels will have rising costs compared to Biofuels and that there are huge costs to save when adopting biofuels.

Effect: Motivation

insights and visual motivation to act because a tailored scenario becomes visible in which compliance has been achieved and profitability is increased while reducing emissions.



Decide: Sharing Data

Decide whether they want to provide their information to see the results.

Decide: Confirm Boxes

Allows the user to verify whether they agree to the privacy policy and the disclosure of personal data.

Understand: Strategic Insights

Users see their GHG target for 2025, estimated emission reductions, and financial implications, including FuelEU penalties and potential savings from biofuels. The tool calculates the required biofuel quantity to meet regulations and provides an instant compliance status.

Decide: Email Report

The "Email Report Now" button allows users to decide whether to collect insights and send them to the previously provided email address.

Figure 4.2 -Mock-ups of the contact pop up form and the results section of the Desktop Calculation Tool Highlighted with User Experience Annotations

5.3.4 Technicalities

During the tool's design process, the calculation method was also considered. Formulas were searched and collected in Miro (See Appendix Q), considered, and adjusted so that they match the designed interface and that the insights could be calculated. This allows the company and the client to use the calculations for their decision-making, that the tool is feasible and can be applied in practice. Due to time constraints, the calculations could be further optimized, and more use cases could be considered. Sources used for defining the calculations include: FUELU reports from Bettersea and Schroer (2024)., and Sustainable Ships (2024). The main takeaways from the calculations and technical implementations can be seen in Figure 4.3.

In addition, research has been carried out, and the decision has been made to present an attractive use case using the tool that reduces emissions and costs. By replacing x% percentage of conventional fossil fuels with biofuel, this reduces costs and emissions. If biofuels are already being purchased, there may be another optimum. This has only currently been left aside because it complicates the calculations (due to project time constraints). This is not a problem because the focus is now mainly on the client group that is not yet adopting biofuels, which is a significant group.

Consideration was also given to which data sets should be consulted or created. The live input will be stored in a secure digital database linked to the personal information. Report mails will be saved per session as well. Fuel-specific parameters such as WtT Intensity factors will be collected from the RED II and FUELEU Maritime Annex and other relevant sources and compiled into a database that will be referred to based on the chosen input.

Additionally, a live data set with fuel prices can be considered to calculate the fuel savings; however, this can provide very fluctuating results. If desired, it is probably better to keep some control over this by means of a varying factor and let traders manually do the cost trade-off at a later stage. For now, the cost savings are expressed by means of avoided penalty costs and ETS costs.

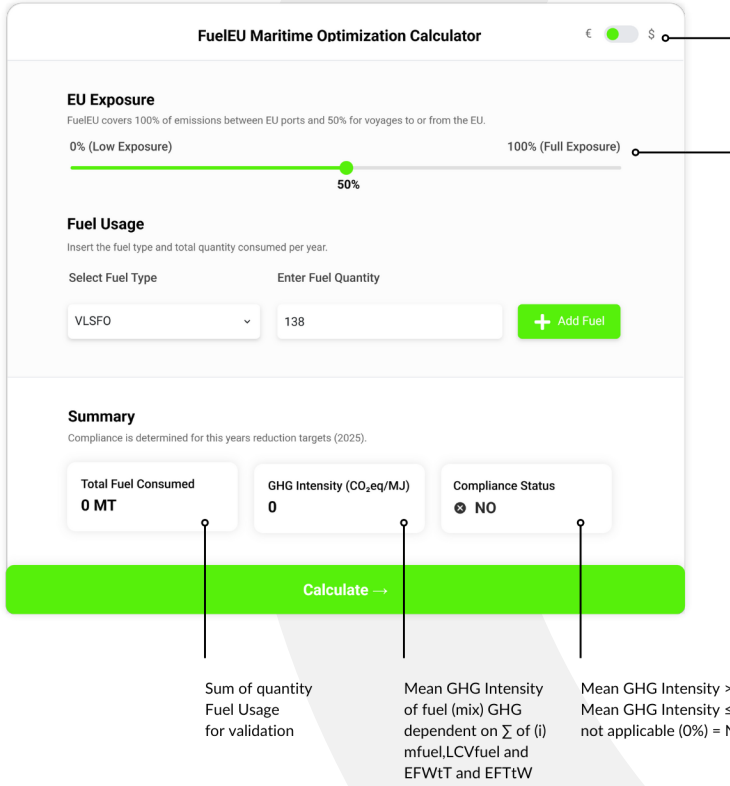


Figure 4.3 -Mock-ups of the input form and annual results section

Connected to live usd and
eur ECB Exchange Rate

% off fuel that is FuelEUcompliant.
Used as quantity (factor) for the calculation

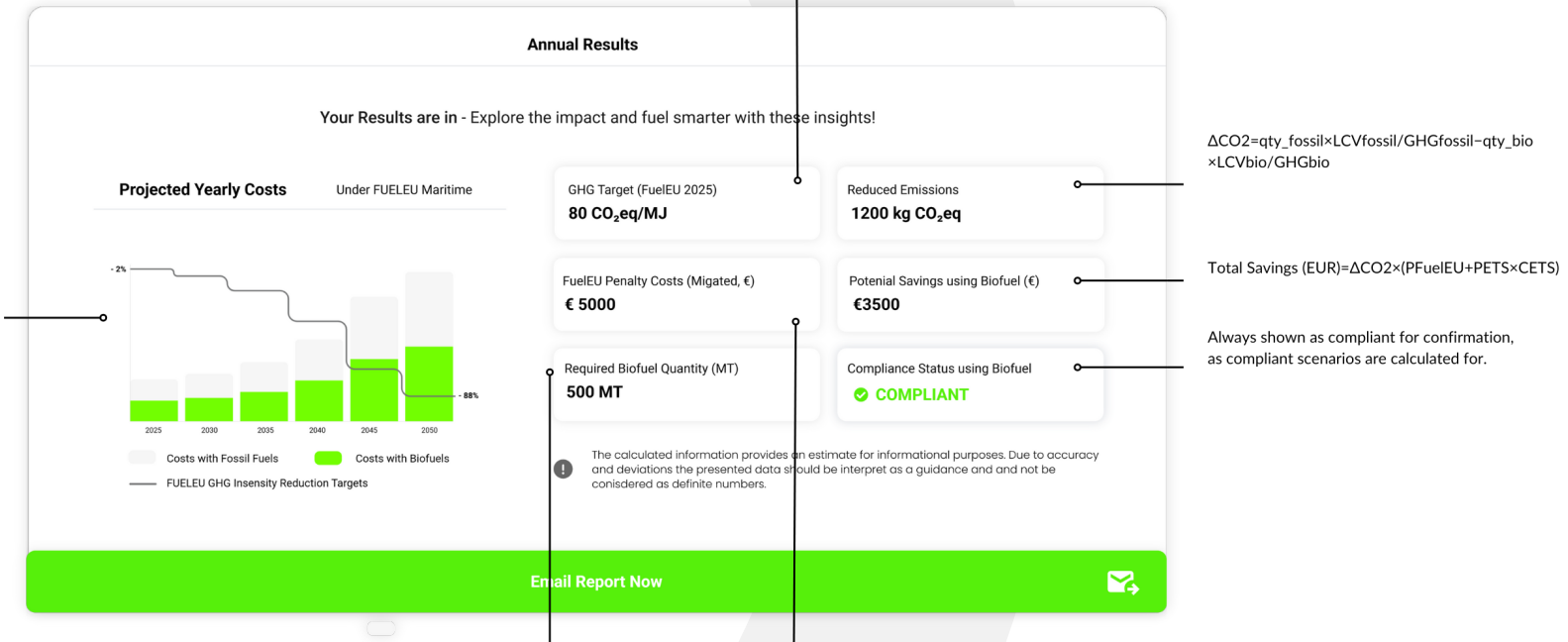
GHG target Intensity of
that year: (-) 2% less
then baseline for 2025

ΔCO2=qty_fossil×LCVfossil/GHGfossil−qty_bio
×LCVbio/GHGbio

Total Savings (EUR)=ΔCO2×(PFuelEU+PETS×CETS)

Always shown as compliant for confirmation,
as compliant scenarios are calculated for.

Fixed
visual



- GHG Intensity target = Not compliant
- GHG Intensity Target = Compliant
N.A.

% of total fuel consumed
that is cost effective

Penatly = Compliance balance *€2400/
MeanGHGintensityFuel * 41000

with annotated technical details.

5.3.5 Flowchart

The right flowchart shows the user process with steps containing user and system actions, required data, metrics, and units. The workflow is shown step by step from top to bottom. The flowchart was made during the development of the final tool in Canva.

This was a good exercise to check and validate the tool's functioning. Each phase and the data were well analyzed for a streamlined and logical experience. In addition, it can communicate the tool's functioning well to stakeholders or involved parties that are interested in or want to understand the detailed operation and structure of the tool.

The tool is mainly designed to guide users at strategic moments in their fuel decision-making. Within the workflow, there are key decision points where the user makes choices that strongly influence the tool's results.

Decision point 1: Input phase
Here, the user determines what percentage of trips fall within the EU. This influences the summary and results mainly in order of magnitude, together with the fuel quantity. The choice of fuel type determines the value of the greenhouse gas intensity. If the greenhouse gas intensity increases or decreases, this will affect the compliance status and the results to be achieved. The EU Exposure and Fuel Types are values that can be optimized for a favorable balance. Based on the input, immediate feedback is given on the Compliance Status, which makes it easy and quick to see whether action needs to be taken this year to avoid penalties. The compliance status is the key insight of this phase because it is decisive and has the greatest informative value.

Decision point 2: Contact Form
Here, the user decides whether it is worth filling in personal data. Questions like these can be considered before proceeding: Is it valuable enough? Is the company and the tool trustworthy? Is it relevant to me? Do I want to be approached? A professional and clear appearance was deliberately chosen, and insights were provided in advance (the summary) to reduce the questions and increase the chance of proceeding. If the user continues, this is a starting point for the company and the trader to establish and start the relationship. The insights provide reference points and highlight where value can be delivered.

Decision point 3: Results Phase
Here, all valuable insights are presented. The most important message is that significant cost benefits and emissions can be reduced while complying with regulations. In addition, it is worth it in the long run because the cost savings become even more significant due to the reduction of the compliant greenhouse gas intensity over the years, resulting in increased costs when using fossil fuels. The user decides whether the insights have convinced or informed enough and are relevant. He can determine if the perceived value is large enough and if the input is to his liking so that the results can be sent as an email report. This report can stimulate and support further decision-making, both within the clients organization and with traders. The client will contact the company to discuss possibilities if the perceived value and interest are large enough.

Feedback Loops
In addition to the decision points, two feedback loops can be identified. Users can adjust the input data and reflect on it based on the insights in the summary. Additionally, they have a second opportunity to refine their input later in the process. After reviewing the results, they can scroll up to make adjustments and press the 'calculate' button again.

WORK FLOW STEPS

⬇ USER PROCESS

START

User enters the webpage

/ INPUT

User enters Input

- Fleet/vessel EU exposure [%, Decide esimate]
- Fuel Type [Choose from list]
  - Add more [Click button]
- Quanitity [MT, Type annual qty]

System Shows summary of input

- Total Fuel quantity based on input [MT]
- GHG Intensity [Co2eq/MJ, mean from input]
- Compliance Status [Yes/NO/N,A., based on Mean GHG intensity input fuels and EU Exposure]

→ *Decisional nudge for users, instant validation on current scenario for compliance, builds trust, users are more likely to enter personal data afterwards.*

User clicks "Calculate" button

System Pop Up - Hidden results elements

User enters details and approves terms

- User enters details [name, company, email, phone]
- Approves terms and sharing information

→ *For company to follow up and have the data to build advising relationship*

User clicks "Show Results" button

/ OUTPUT

System Pop Up - show results

System Shows Optimal Annual Complaince Results

- Projected yearly costs prognose [Fossil vs Biofuels, GHG reduction line over time]
- This years GHG target [Co2eq/MJ]
- Migated FUELEU Penanalty [€]
- Required Biofuel quantity [MT, for compliant scenario]
- Reduced Emissions [kg co2eq]
- Potential Savings [€]
- Compliance status new scenario [Yes, No]

→ *Visual conveys easily the most important messages: GHG reductions are significant and utlizing biofuels is cost and ompliance beneficial + also conveys long term value. Data coverts compliance from obligation to opportunity. Supports fuel decision making*

FINISH

User clicks "Email Report" button

- Receives input and results in mail
- Additional information is shared

→ *Allows for internal discussions and re-engagements + Boosts credibility*

5.3.6 Usage Scenarios

The previous chapter focused on three scenarios: Cold Calling, Networking, and Business Meetings, which have the most significant impact on the relationship-building process. Here, potential customers and traders may, for the first time, discuss sustainable and compliant fuel options. The tool has been developed and researched according to the earlier concept ideas to deliver direct value when starting conversations and stimulating and supporting the decision-making processes that take place.

However, to fully leverage the tool's value from a business perspective, further (social) usage scenarios were explored where the tool can deliver value. In addition to these three most common moments, other social contexts influence the decision-making process. This broad research results in the additional usage scenarios shown in Figure 4.4.

These usage scenarios contribute to a sustainable commitment to the (broad) adoption of more sustainable and compliant fuel options. The company should map this out so that long-term and (large-scale) effective change and adoption of the tool can be guaranteed.

The tool's use in each usage scenario and the associated impact and value are now briefly explained per usage scenario.

1. Individual Client Use
The tool is used independently by a client (fleet manager, sustainability officer, etc.). The client knows the tool through an (online) campaign or other means. The client enters the data on the website to evaluate the current strategy and emission reduction. The client can simulate and evaluate scenarios independently. This lowers the threshold for entering into a conversation with the trader or the fuel company because the client already has an idea of the satisfactory possibilities. The client can thus enter into a strategic conversation prepared. The trader can then offer the client additional value and help with the implementation and follow-up.

2. Email Report
Traders can successively send a report to (potential) customers following a call or demo. The trader enters the customer data into the tool and sends the tailored report. The report is sent with an explanation, additional value and call to actions. The client can share the report internally with other (key) decision-makers. Therefore, the customer has valuable reference work with concrete figures and advice. This increases follow-up conversations and strengthens the relationship between companies and individuals. It also lowers the threshold for discussing biofuels and calculating and implementing choices. The Report is also sent after completing the calculation by independent usage, offering the same impact and value.

3. (Online) Meeting Demo's
A trader presents the tool and insights during an (online) meeting with a (potential) customer. During the meeting, several scenarios are discussed and adjusted based on customer feedback and trader suggestions. The customer immediately sees the impact on emissions and costs. This makes the results tangible and concrete, which is convincing and offers certainty and clarity to the customer. Traders can fulfill their expertise and advisory role well without much effort and calculations with the help of the tool. It also enables traders to position sustainable options better and to communicate actively about them in the early relationship and deal-makling phases.

QUICK FUEL SCAN ON THE PHONE

4. Business Gatherings
Traders use the tool during networking events or informal meetings. They can easily and quickly start an interesting conversation topic with customers who are interested or unclear about issues such as emission reduction, FuelEU Maritime, or cost savings. The tool can easily and quickly be shared through a business card or QR code on the phone, which is a good PR asset and generates interest. If there is a strong interest in the tool, it can even be filled in together. It is a short and fast process, which leaves a strong first impression on the customer.

5. Cold Calling
Traders can use the tool when cold calling potential clients. They can mention the tool, use it and read some insights to convince a client and give personal value in the form of concrete figures. This can increase chances because clients receive immediate impact instead of just verbal promises. Clients can even receive a tailored email report afterwards. This is a good strategy to get customers to provide their contact information, and it also gives the opportunity to schedule a follow-up call or follow up on the insights.

6. Social Media
The tool can be used as a marketing tool via LinkedIn, Facebook, and Google, as well as at industry events. The company can promote posts about the use and link directly to the tool, where they can directly target the intended customers who can immediately try out the tool with a low threshold. Or the company can use the tool at events to

demonstrate its use and generate interest. Quick calculations can be done together or autonomously. This increases the reach, visibility, and adoption of the strategy. It also attracts customers who are considering or not yet actively involved in sustainable fuel solutions. Or it attracts customers who are already doing this but want to consider and compare options.

7. Trainee Workshops

The tool can be used in internal training sessions with traders or in customer workshops on emission reduction. Trainers can then help explain the tool's regulation, strategy, and use. This will increase awareness and knowledge and help people better understand how to use the tool and evaluate different scenarios in an easy and accessible way. This has educational value, helps to build knowledge, and prepares traders to support customers. It also increases the impact on customers. In this way, the sustainable fuel options and the tool have a greater chance of becoming a strategic topic of discussion.

Therefore, the above usage scenarios are valuable in social and organizational contexts. They stimulate (autonomous) engagement, knowledge sharing, and (long-term) stakeholder decision-making. The tool is, therefore, designed to offer value in (early) customer interactions but is also a means to stimulate behavioral change in broader implementations. The greatest impact will still be achieved with cold calling, meeting Demos, and business gatherings because here, active action is taken to start conversations with customers and to convince and support them in the process (with the help of the tool). It is important that traders see the tool as a sales tool but also as a strategic instrument.

Figure 4.4 - Overview of Usage Scenario's surrounding the Final Tool

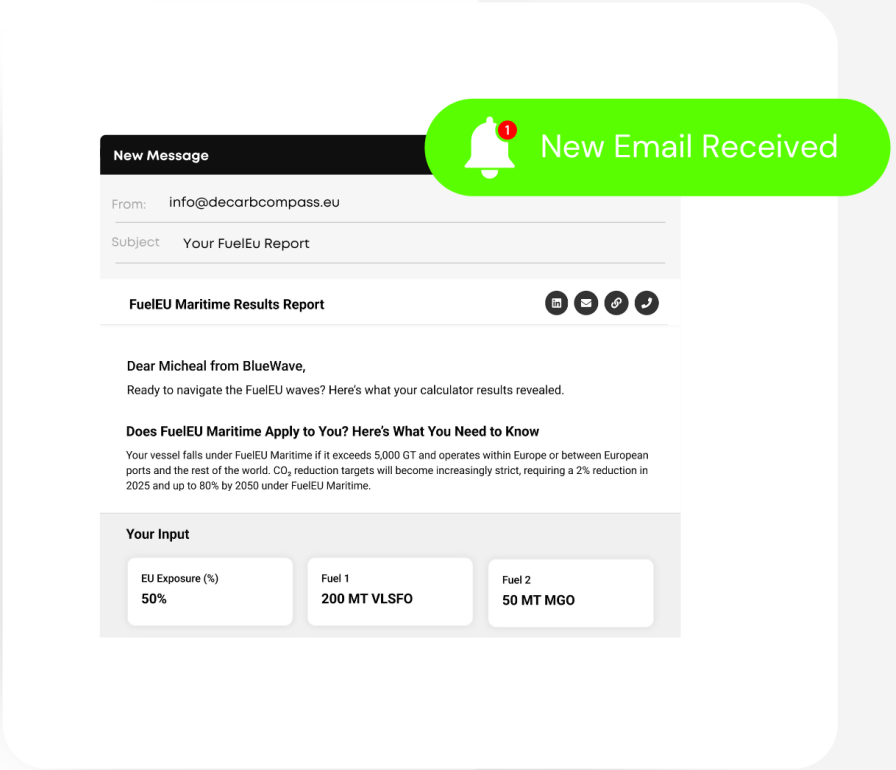
5.3.7 Mail Report

The Email Report is sent when the user clicks on the “Email Report Now” button when the results section appears. It is an important part of biofuel adoption and stimulates behavioral change. The report offers a visually appealing and clear summary of the calculations and scenario entered into the tool. The report is an important value-supporting asset. Customers can then easily review the results or discuss and share them (internally).

The design of the mail was made in UIzard, where I copied some elements, like the banner and the footer, in the company’s style. All insights from the tool (and new elements) are placed in the same visual style to ensure consistency, simplifying the process by increasing intuition, recognition, and confidence and limiting confusion.

In addition to the insights provided, the email report also highlights new aspects. It provides additional information about the usefulness of changing fuel strategy and provides insight into other compliance strategies (such as using pooling, banking or borrowing mechanisms or using Biofuels to reduce the intensity).

The email report is informative, strategically valuable, and engagingly written. Accessible and captivating copywriting has been used to make it fun, engaging, and easy to absorb the information. Encouraging and proactive texts were also added to encourage action, and call-to-action buttons were implemented, such as “Schedule a Strategy Meeting with a Trader,” as a nudge method to stimulate contact, build relationships, and consider adoption.



FuelEU Maritime Results Report

Dear Micheal from BlueWave,

Ready to navigate the FuelEU waves? Here's what your calculator results revealed.

Does FuelEU Maritime Apply to You? Here's What You Need to Know

Your vessel falls under FuelEU Maritime if it exceeds 5,000 GT and operates within Europe or between European ports and the rest of the world. CO_2 reduction targets will become increasingly strict, requiring a 2% reduction in 2025 and up to 80% by 2050 under FuelEU Maritime.

Your Input

EU Exposure (%)	Fuel 1	Fuel 2
50%	200 MT VLSFO	50 MT MGO

Total Fuel Consumed	GHG Intensity (CO_2eq/MJ)	Compliance Status
250 MT	0	NO

Your Results

GHG Target (FuelEU 2025)	Reduced Emissions	FuelEU Penalty Costs (Migated, €)
80 CO_2eq/MJ	1200 kg CO_2eq	€ 5000

Potenial Savings using Biofuel (€)	Required Biofuel Quantity (MT)	Compliance Status using Biofuel
€3500	500 MT	COMPLIANT

The calculated information provides an estimate for informational purposes. Due to accuracy and deviations the presented data should be interpret as a guidance and and not be conisdered as definite numbers.

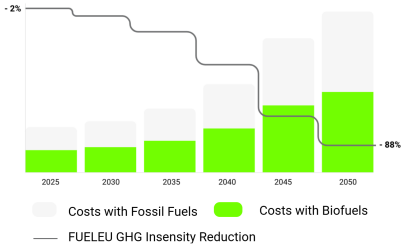
What Does This Mean for Your Fuel Strategy?

With FuelEU Maritime, shipowners must take proactive steps to avoid penalties and implement cost-effective compliance strategies. The Image below presents the ratio of rising costs due to emission regulation expenses. when using fossil fuels alone compared to the costs when incorporating biofuels.

The calculated information provides an estimate for informational purposes. Due to accuracy and deviations the presented data should be interpret as a guidance and and not be conisdered as definite numbers.

What Does This Mean for Your Fuel Strategy?

With FuelEU Maritime, shipowners must take proactive steps to avoid penalties and implement cost-effective compliance strategies. The Image below presents the ratio of rising costs due to emission regulation expenses. when using fossil fuels alone compared to the costs when incorporating biofuels.



Potential Compliance Strategies:

- Switching to biofuels such as HVO or FAME to lower fuel CO_2 intensity and achieve cost savings.
- Fleet pooling: Achieving compliance at the fleet level by balancing emissions across multiple vessels.
- Banking and borrowing: Storing excess CO_2 reductions for future use or compensating for shortfalls through emission trading within FuelEU Maritime.

These calculations provide an estimate and should be used as a guideline. Would you like strategic advice on how to make the best use of these insights?

Schedule a Strategy Meeting with a Trader

Our traders can help you optimize your fuel strategy and explore the most cost-effective pathways to compliance.
Schedule a strategic consultation via [insert scheduling link]
Or contact us at [email address]

Best regards,
[Your Name]
[Company Name]
[Contact Details]

Merwekade 71,
3311 TH Dordrecht,
The Netherlands
office@ospreyenergy.eu

Insights Powered by osprey ENERGY

5.4 Roadmaps

In addition to the tool itself, a short-term and long-term roadmap has been developed. This ensures that the tool and further extensions can be successfully implemented and that (further) strategic support can be offered to stakeholders in the long term.

5.4.1 Short-term Roadmap

The short-term roadmap, presented on the right, focuses on validating, optimizing, integrating, and launching the Calculation tool. Its steps have an intended implementation time of 6 months. Following this roadmap reduces the risk of errors and increases impact and efficiency. The short-term roadmap was developed by logically thinking about the next steps and mapping them out.

The roadmap contains phases with feedback loops focusing on validation and optimization. This reduces the chance of errors and ensures that the tool is usable and practical for stakeholders. These iterative processes are necessary because otherwise important improvement points can be missed, and the impact is not maximized.

In addition to following the steps, it is also essential that the stakeholders give effective feedback, and multiple experts will need to be involved. A designer will have to work on visual and functional optimizations. A developer should further build and optimize the tool. Traders and customers play an essential role in providing feedback, and there will have to be active collaboration between these parties, perhaps through a project manager. When executing the plan, it may become apparent that adjustments or new optimization steps are needed to ensure a well-fitting end product.

The final result is the foundation and starting point for the long-term strategy. This serves as a basis on which further expansions and plans can be implemented. This aligns with the previously mentioned insights that a broader infrastructure must be created that can grow with future developments (dashboard/online environment with further functions).

SHORT-TE

ROADMA

Building the T

ERM

P

Tool

1. Testing & Validation

User testing

With traders and clients to assess usability and evaluate scenarios

Test calculations

Test and validate with traders on accuracy of the calculations

Collect

Address and identify errors, uncertainties, and inconsistencies.

2. UI and Interaction Optimization

Multiple New UI's

Design and test multiple UI variants to determine the best layout for Desktop and Mobile

Interaction Flow

Test and optimize interaction flow among the new UIs

Usability iteration

Perform final usability test

3. Final Tool Development

Final Design

Design and finalize the final user interface and interaction. Optimize data, input and output fields. Mobile and Desktop version and update Email Report.

4. Technical Requirements

Coded Version

Build the final tool for web and mobile in code.

Integration

Link the databases for calculations. Manage storage, access and security.

5. Launch

Final Test

Conduct final user testing to find bugs and impelemnt final refinements

Launch

Finalize the tool, prepare the training and announce on Social Media and mail to clients.

LONG-TERM ROADMAP

Strategic Expansion

1. Regulatory Expansion

Research

Research and integrate other EU policys that effect the maritime industry

Updates

Have a dedicated employee and update policy in place for regulatory changes-updates.

Fuel Strategies

Develop new fuel strategies based on the other policies or updates and integrate these.

2. Interactive Dashboard

Deeper insights

Provide more extensive insights that allow long term desicion making and more complex fuel strategies and track uptake.

Scenarios

Enable multi fuel and year scenario planning to allow for long term planning

Overview

Create an overview with straight forward data, quick acces and progress stimulation.

3. Utilizing AI

Recommendations

Utilize AI to help users and traders find the best fuel strategy instantly and provide recommendations.

Smart Alerts

Let clients and traders be automatically alerted about regulatory changes and market shifts for opportunities.

4. New Feature

Socio-Qu

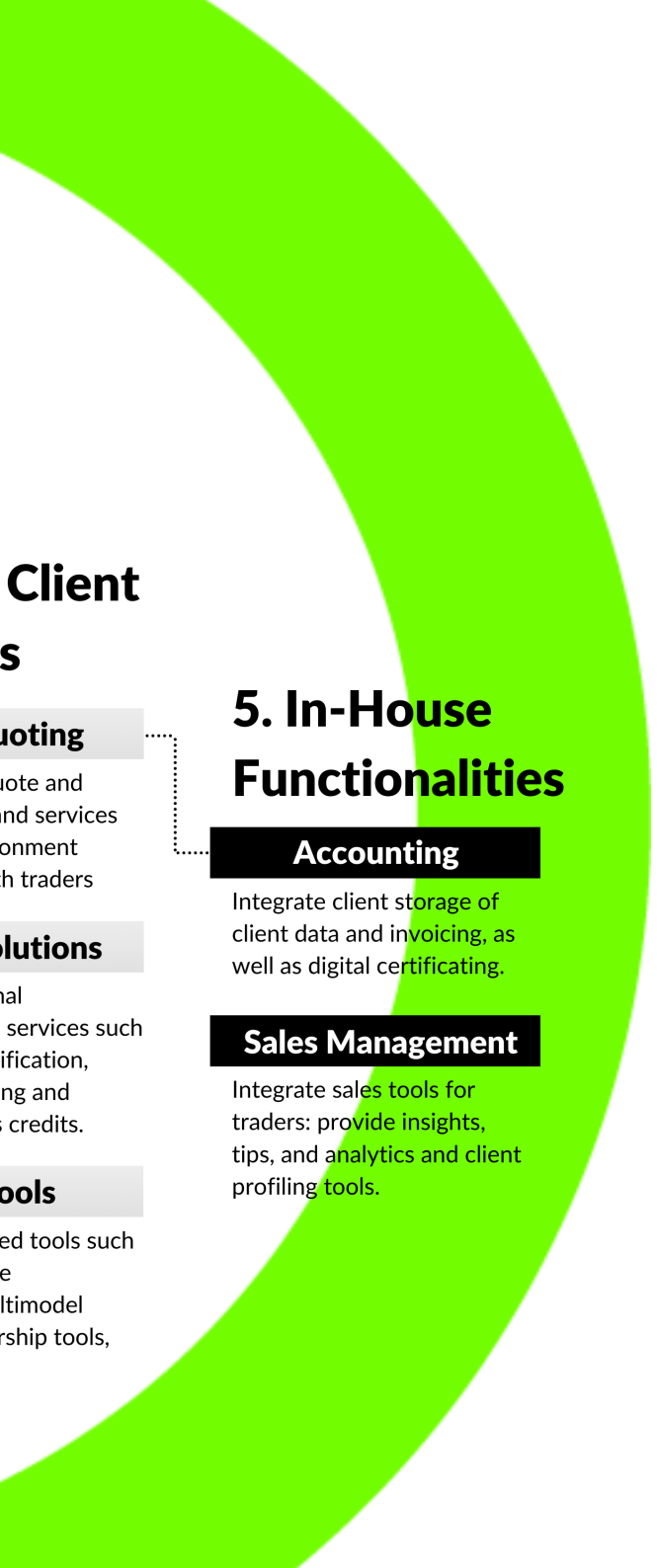
Allow user to qu
book products a
within the envir
and connect wit

Decarb So

Provide addition
decarbonisation
as emission cert
carbon accounti
emission offsets

New T

Additional need
as dynamic rout
calculations, mu
services, partne
and reporting.



5.4.2 Long-term Roadmap

The long-term roadmap ensures the tool's further development is sustainable and future-proof. This is mainly based on (strategic) needs and side/new developments. In addition, the work from the previous chapters, where the scope was broader, was taken into account. Recommendations have already emerged between the lines here.

This way, a broader comprehensive solution (environment) can eventually be tailored to further regulations and (emerging) market movements. In addition to expanding the scope, it is also important to consider adjustments to the currently implemented regulations and calculations because this allows for updates or adjustments to be made.

In addition, this roadmap provides in-depth functionalities that could improve strategic and decision-making effectiveness. It also recommends leveraging AI to respond better and faster, such as providing AI-driven recommendations or smart alerts to traders and customers However, some functionalities also enhance the interaction between the parties and increase involvement.

Also, a multidisciplinary team should work on this digital solution for development and maintenance, which would be an iterative and step-by-step process. This development will take longer and will be rolled out in phases over 1–3 years, depending on the progress.

Ultimately, this ecosystem will help accelerate the adoption of sustainable fuels and provide better strategic visibility in line with the regulations that are being implemented.

5.5 Toolkit

The Toolkit has been developed as a resource to support traders and clients in understanding and communicating the impact of the FuelEU regulation on sustainability, the tool, and strategic fuel choices.

The toolkit was developed by thoroughly analyzing various sources, mainly reports and publications on regulations. The most relevant and crucial information was selected and translated into an accessible and usable toolkit. The toolkit is designed in Adobe XD in the targeted company's corporate identity style.

The information gathered was converted into clear, concise, and engaging texts that were easy to understand. This is useful because there are often many complex or industry-specific sources that take time and effort to understand. A logical, constructive sequence has been chosen, and visual elements have been added that stand out and communicate important information quickly and easily.

The toolkit helps the reader quickly understand the basic principles and impact of the regulations and provides insight into the possibilities for complying with them. In addition, it explains how to use the tool so that users can make optimal use of it and its functionalities. Traders can use the toolkit to learn everything they need to know when communicating with the customer. However, they can also share the toolkit with the customer so that they can gain good insight on their own.

The toolkit helps remove barriers and uncertainties and lowers the threshold for adoption. As a result, sustainable fuel choices are easier to implement and communicate.

TOOLKIT HIGHLIGHTS

- For Internal and External use
- FuelEU Simplified
- Engaging Format
- Practical Explanations
- How to use the Tool
- How to utilize the Insights
- Fuel Strategies
- Matching Corporate Identity

**The following sources were consulted for the development of the toolkit and calculations:*

Bettersea and Schroer (2024). - ClassNK and KYOKAI (2023) - Doedee (2024) - Korean Register (n.d). - Sustainable Ships (2024).

DECARB COMPASS

osprey ENERGY

FUELEU MARITIME TOOLKIT

#smarter paths to sustainable energy

Stay ahead in the fuel trade with these essential FuelEU Maritime regulation insights. This toolkit equips you with everything you need to navigate FuelEU Maritime compliance and optimize your fuel strategy.

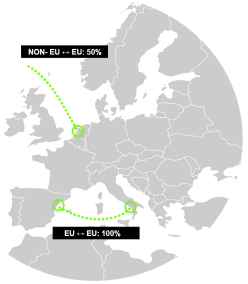
FuelEU at a Glance

- **GHG Intensity:** GHG emissions per energy unit [9CO2eq/MJ] annual average well-to-wake is **limited** per ship.
- Applicable to all ships above **5000 GT** voyaging a**t EU/EEA ports**, regardless of their flag.
- Phased **reduction of GHG intensity** set for fuel used on board to stimulate the demand of sustainable fuels.
- Ships monitor, report and verify their fuel and emission consumptions for EU-voyages since 2018 (**EU-MVR**).
- Fishing, naval, Warships and wooden ships are **exempted.**
- **Shore Power:** Mandatory use of shore power in ports starts in 2030.

Voyage Scope

- Intra-EU Voyages **(EU ↔ EU): 100%** of burnt fuel is counted for compliance.
- Extra-EU Voyages **(EU ↔ Non-EU): 50%** of burnt fuel is counted for compliance.
- Outermost Regions Voyage **(EU or Non-EU ↔ Outermost Regions*): 50%** of burnt fuel is counted for compliance.

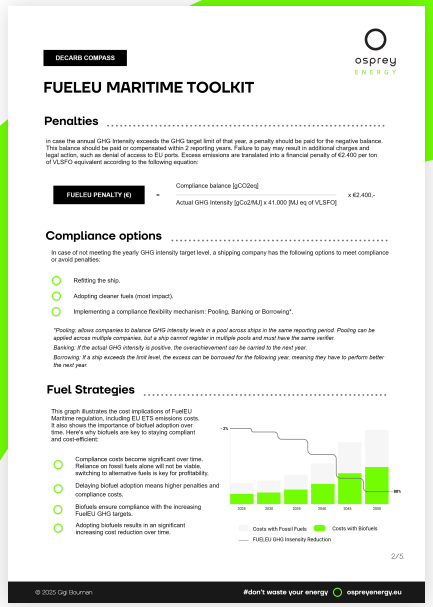
**Outermost regions: Azores, Madeira (Portugal), French Guiana, Guadeloupe, Martinique, Mayotte, Reunion Island and Saint-Martin (France) and The Canary Islands (Spain).*



GHG Targets

To decarbonize the maritime industry, the GHG intensity limit is strengthened every five years, from 2% in 2025 to 80% in 2050, see the Table below. A verifier calculates the yearly average GHG intensity of energy used on board (per fleet). The fuels used on board impact the GHG intensity level as each fuel has a distinct Well-to-Tank (WtT) and Tank-to-Wake (TtW) emissions factors. The WtT and TtW factors combined result in the GHG intensity of the fuel covering the Greenhouse gasses: Carbon dioxide, Methane and Nitrous oxide. In case of fossil fuels the factors can be found in Annex II of the FuelEU Maritime regulation.For biofuels, the factors from the Renewable Energy Directive (RED) should be used.

YEAR	2020	2025	2030	2035	2040	2045	2050
REDUCTION	-	-2%	-6%	-14,5%	-31%	-62%	-80%
GHG TARGET	91.16	89.34	85.69	77.94	62.90	34.64	18.23


DECARB COMPASS

osprey ENERGY

FUELEU MARITIME TOOLKIT

Penalties

In case the annual GHG intensity exceeds the GHG target limit of that year, a penalty should be paid for the negative balance. This balance should be paid or compensated within 2 reporting years. Failure to pay may result in additional charges and legal action, such as denial of access to EU ports. Excess emissions are translated into a financial penalty of €2.400 per ton of VLSFO equivalent according to the following equation:

FUELEU PENALTY (€) = Compliance balance [gCO2eq] / Actual GHG Intensity [gCo2/MJ] x 41.000 [MJ eq of VLSFO] x €2.400,-

Compliance options

In case of not meeting the yearly GHG intensity target level, a shipping company has the following options to meet compliance or avoid penalties:

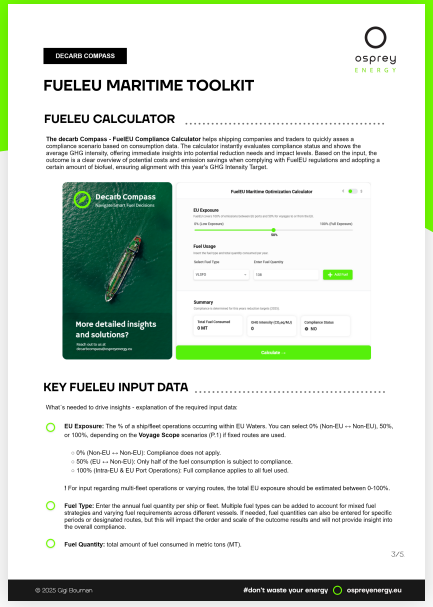
- Refitting the ship.
- Adopting cleaner fuels (most impact).
- Implementing a compliance flexibility mechanism: Pooling, Banking or Borrowing*.

**Pooling: allows companies to balance GHG intensity levels in a pool across ships in the same reporting period. Pooling can be applied across multiple companies, but a ship cannot register in multiple pools and must have the same verifier.*
Banking: If the actual GHG intensity is positive, the overachievement can be carried to the next year.
Borrowing: If a ship exceeds the limit level, the excess can be borrowed for the following year, meaning they have to perform better the next year.

Fuel Strategies

This graph illustrates the cost implications of FuelEU Maritime regulation, including EU ETS emissions costs. It also shows the importance of biofuel adoption over time. Here's why biofuels are key to staying compliant and cost-efficient:

- Compliance costs become significant over time. Reliance on fossil fuels alone will not be viable, switching to alternative fuels is key for profitability.
- Delaying biofuel adoption means higher penalties and compliance costs.
- Biofuels ensure compliance with the increasing FuelEU GHG targets.
- Adopting biofuels results in an significant increasing cost reduction over time.


DECARB COMPASS

osprey ENERGY

FUELEU MARITIME TOOLKIT

FUELEU CALCULATOR

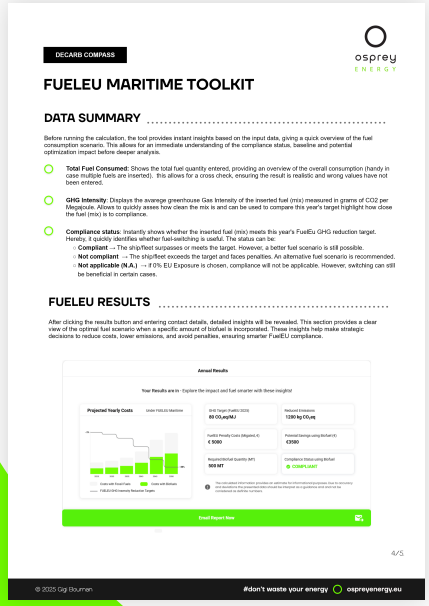
The decarb Compass - FuelEU Compliance Calculator helps shipping companies and traders to quickly assess a compliance scenario based on consumption data. The calculator instantly evaluates compliance status and shows the average GHG intensity, offering immediate insights into potential reduction needs and impact levels. Based on the input, the outcome is a clear overview of potential costs and emission savings when complying with FuelEU regulations and adopting a certain amount of biofuel, ensuring alignment with this year's GHG Intensity Target.

KEY FUELEU INPUT DATA

What's needed to drive insights - explanation of the required input data:

- **EU Exposure:** The % of a ship/fleet operations occurring within EU Waters. You can select 0% (Non-EU ↔ Non-EU), 50%, or 100%, depending on the **Voyage Scope** scenarios (P.1) if fixed routes are used.
  - 0% (Non-EU ↔ Non-EU): Compliance does not apply.
  - 50% (EU ↔ Non-EU): Only half of the fuel consumption is subject to compliance.
  - 100% (Intra-EU & EU Port Operations): Full compliance applies to all fuel used.

  ! For input regarding multi-fleet operations or varying routes, the total EU exposure should be estimated between 0-100%.
- **Fuel Type:** Enter the annual fuel quantity per ship or fleet. Multiple fuel types can be added to account for mixed fuel strategies and varying fuel requirements across different vessels. If needed, fuel quantities can also be entered for specific periods or designated routes, but this will impact the order and scale of the outcome results and will not provide insight into the overall compliance.
- **Fuel Quantity:** total amount of fuel consumed in metric tons (MT).


DECARB COMPASS

osprey ENERGY

FUELEU MARITIME TOOLKIT

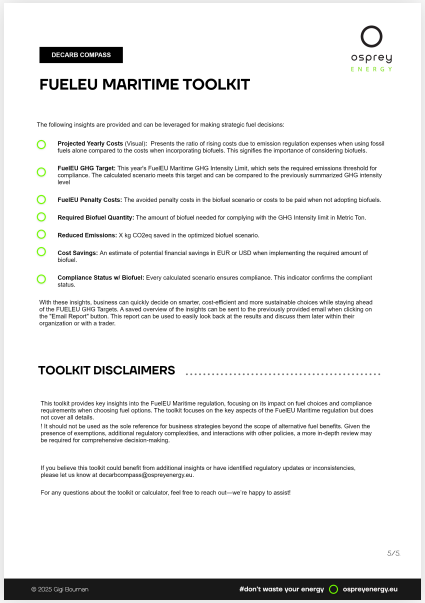
DATA SUMMARY

Before running the calculation, the tool provides instant insights based on the input data, giving a quick overview of the fuel consumption scenario. This allows for an immediate understanding of the compliance status, baseline and potential optimization impact before deeper analysis.

- **Total Fuel Consumed:** Shows the total fuel quantity entered, providing an overview of the overall consumption (handy in case multiple fuels are inserted). this allows for a cross check, ensuring the result is realistic and wrong values have not been entered.
- **GHG Intensity:** Displays the average greenhouse Gas Intensity of the inserted fuel (mix) measured in grams of CO2 per Megajoule. Allows to quickly assess how clean the mix is and can be used to compare this year's target highlight how close the fuel (mix) is to compliance.
- **Compliance status:** Instantly shows whether the inserted fuel (mix) meets this year's FuelEu GHG reduction target. Hereby, it quickly identifies whether fuel-switching is useful. The status can be:
  - **Compliant** → The ship/fleet surpasses or meets the target. However, a better fuel scenario is still possible.
  - **Not compliant** → The ship/fleet exceeds the target and faces penalties. An alternative fuel scenario is recommended.
  - **Not applicable (N.A.)** → If 0% EU Exposure is chosen, compliance will not be applicable. However, switching can still be beneficial in certain cases.

FUELEU RESULTS

After clicking the results button and entering contact details, detailed insights will be revealed. This section provides a clear view of the optimal fuel scenario when a specific amount of biofuel is incorporated. These insights help make strategic decisions to reduce costs, lower emissions, and avoid penalties, ensuring smarter FuelEU compliance.


DECARB COMPASS

osprey ENERGY

FUELEU MARITIME TOOLKIT

The following insights are provided and can be leveraged for making strategic fuel decisions:

- **Projected Yearly Costs** (Visual): Presents the ratio of rising costs due to emission regulation expenses when using fossil fuels alone compared to the costs when incorporating biofuels. This signifies the importance of considering biofuels.
- **FuelEU GHG Target:** This year's FuelEU Maritime GHG Intensity Limit, which sets the required emissions threshold for compliance. The calculated scenario meets this target and can be compared to the previously summarized GHG intensity level
- **FuelEU Penalty Costs:** The avoided penalty costs in the biofuel scenario or costs to be paid when not adopting biofuels.
- **Required Biofuel Quantity:** The amount of biofuel needed for complying with the GHG Intensity limit in Metric Ton.
- **Reduced Emissions:** X kg CO2eq saved in the optimized biofuel scenario.
- **Cost Savings:** An estimate of potential financial savings in EUR or USD when implementing the required amount of biofuel.
- **Compliance Status w/ Biofuel:** Every calculated scenario ensures compliance. This indicator confirms the compliant status.

With these insights, business can quickly decide on smarter, cost-efficient and more sustainable choices while staying ahead of the FUELEU GHG Targets. A saved overview of the insights can be sent to the previously provided email when clicking on the "Email Report" button. This report can be used to easily look back at the results and discuss them later within their organization or with a trader.

TOOLKIT DISCLAIMERS

This toolkit provides key insights into the FuelEU Maritime regulation, focusing on its impact on fuel choices and compliance requirements when choosing fuel options. The toolkit focuses on the key aspects of the FuelEU Maritime regulation but does not cover all details.

! It should not be used as the sole reference for business strategies beyond the scope of alternative fuel benefits. Given the presence of exemptions, additional regulatory complexities, and interactions with other policies, a more in-depth review may be required for comprehensive decision-making.

If you believe this toolkit could benefit from additional insights or have identified regulatory updates or inconsistencies, please let us know at decarbcompass@ospreyenergy.eu.

For any questions about the toolkit or calculator, feel free to reach out—we're happy to assist!

5.6 Leaflet

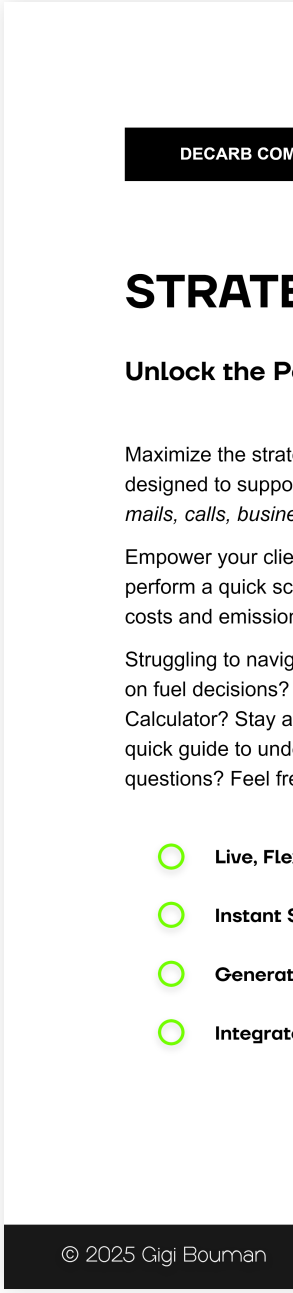
The right-hand leaflet was developed as an essential in-house communication tool to inform traders about the Calculation Tool's strategic and social applications. It was created using the intended company's corporate identity in Adobe XD.

The leaflet focused on demonstrating the broad applicability and possibilities of the tool, both online and offline. The explanation is clear and engaging, helping traders easily see the tool's potential. The calculation tool can serve as a conversation starter and create value for the customer and trader regarding fuel optimization, emission reduction, and compliance.

The leaflet also explains the purpose of the Toolkit and how it can be used: to inform traders and customers and to help them get the most out of the tool. Besides, the leaflet effectively communicates the key points of the calculator: tailored adaptive scenario calculations, instant insights (financial, compliance, and sustainability), Email Reports, and integration into workflows (usage scenarios). This ensures that traders are quickly aware of the key strategic applications. Knowing this, they can better communicate these attractive key points to the client.

The choice was made to visualize the use cases because this allows traders to easily see where the tool can be used. This is more memorable than text alone and can inspire traders to use it because they now have a visual association with the usage scenarios.

In short, the leaflet is an asset for the company that strengthens traders' understanding of the tool. This ensures that they can better understand the tool's application and impact and integrate it into customer conversations, increasing the tool's awareness, impact, and adoption. Additionally, it contributes to proactive communication from traders in customer conversations and to active participation in the transition and adoption.



IPASS

EGIC APPLICATIONS

otential of the Calculator in Your Workflow

egic impact with the **FUELEU calculator** -
rt every interaction from online and offline, such as:
ess meetings + leverage it as a conversation starter.

nts with instant insights, tailored reports and
enario analysis to make the right decisions, reduce
ns, and comply with **FUELEU Maritme**.

gate the decarbonization landscape and its impact
Wondering how to make the most of the FUELEU
head with the **FUELEU Toolkit:** your essential
erstand all that is needed. Got clients with
ee to share the Toolkit with them!

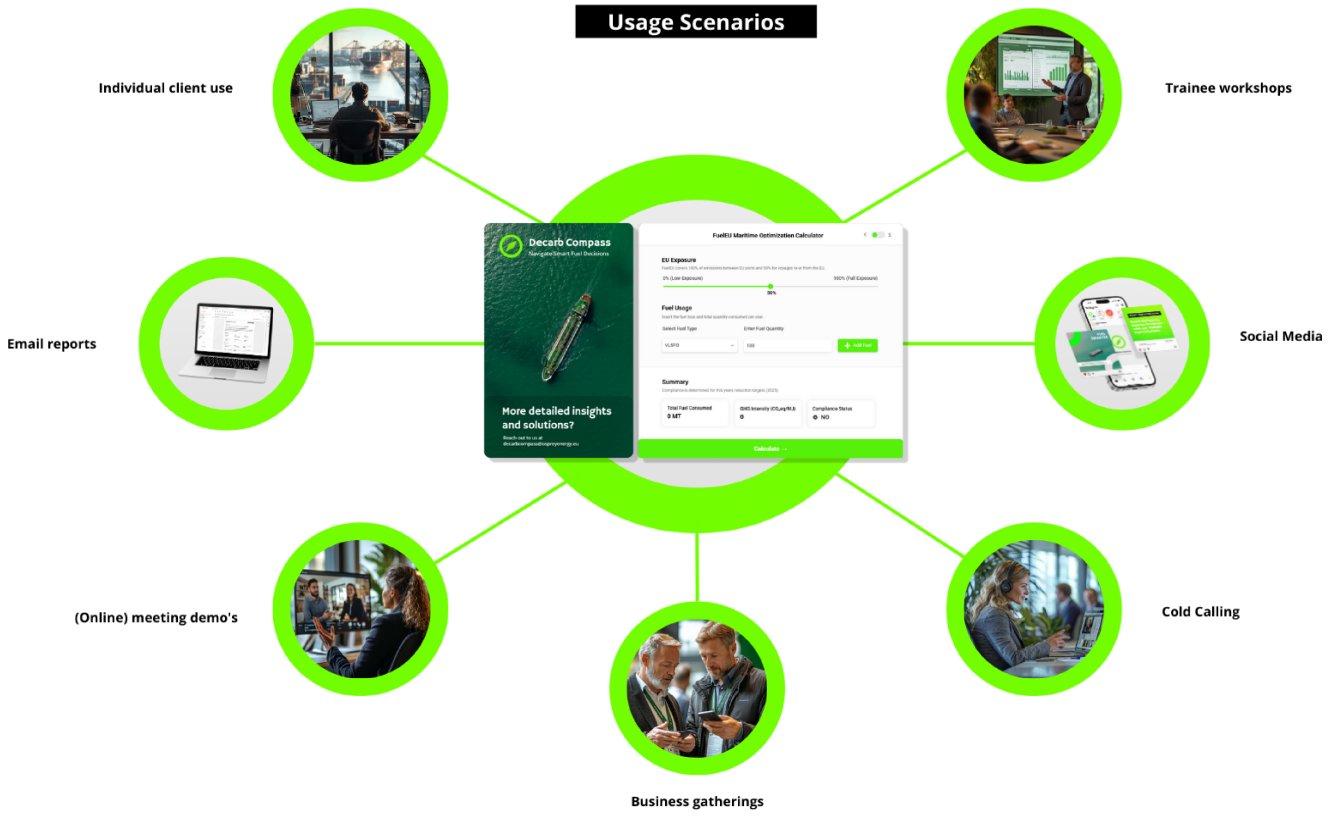
xible and Tailored Calculations

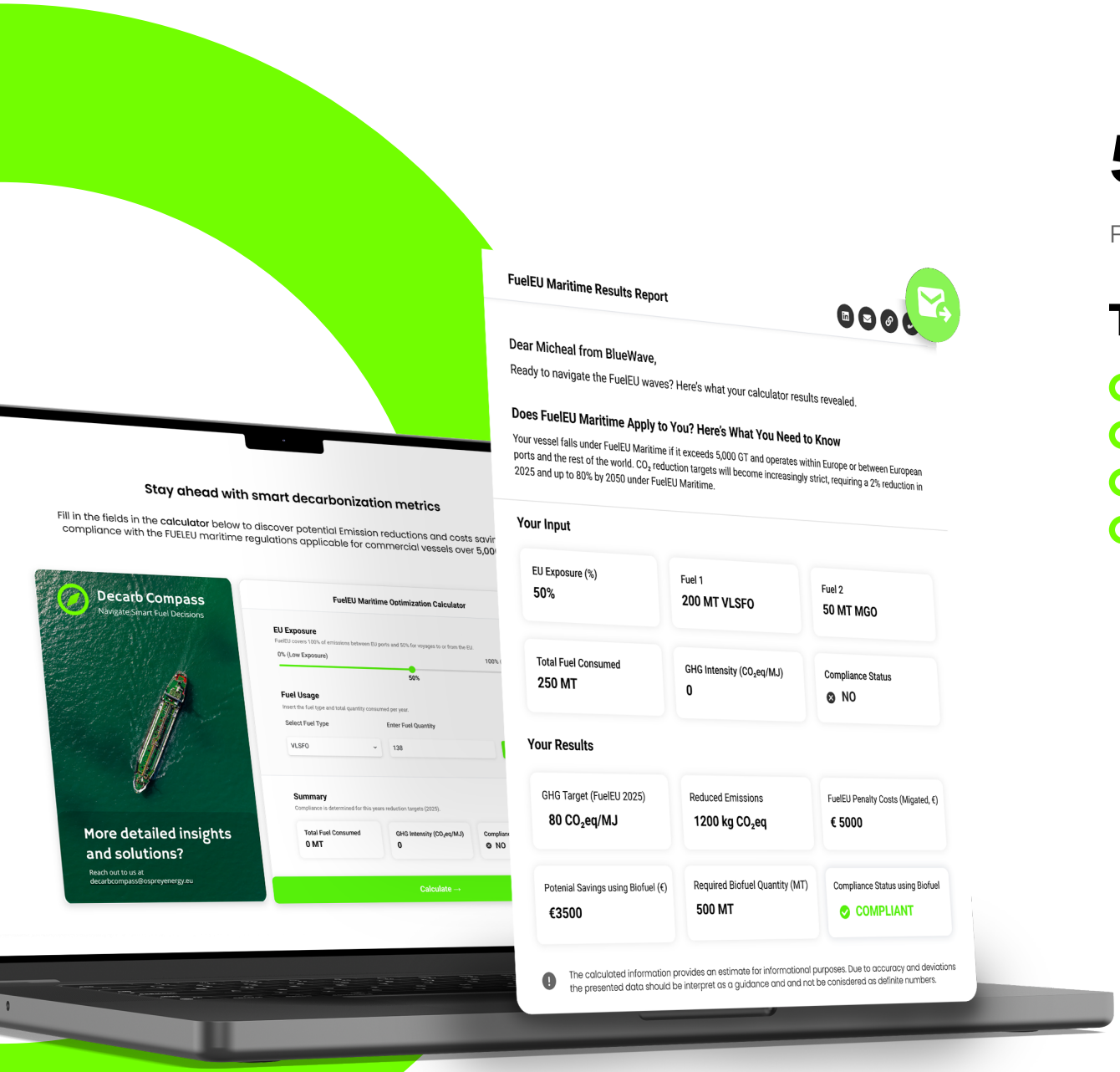
Sustainability, Compliance and Financial Insights

e Reports, Share Insights and Unlock Opportunities

e it in your workflow, Fuel Smarter Conversations

osprey ENERGY





5.5 Showcase

Fewer Emissions, Smarter Decisions.

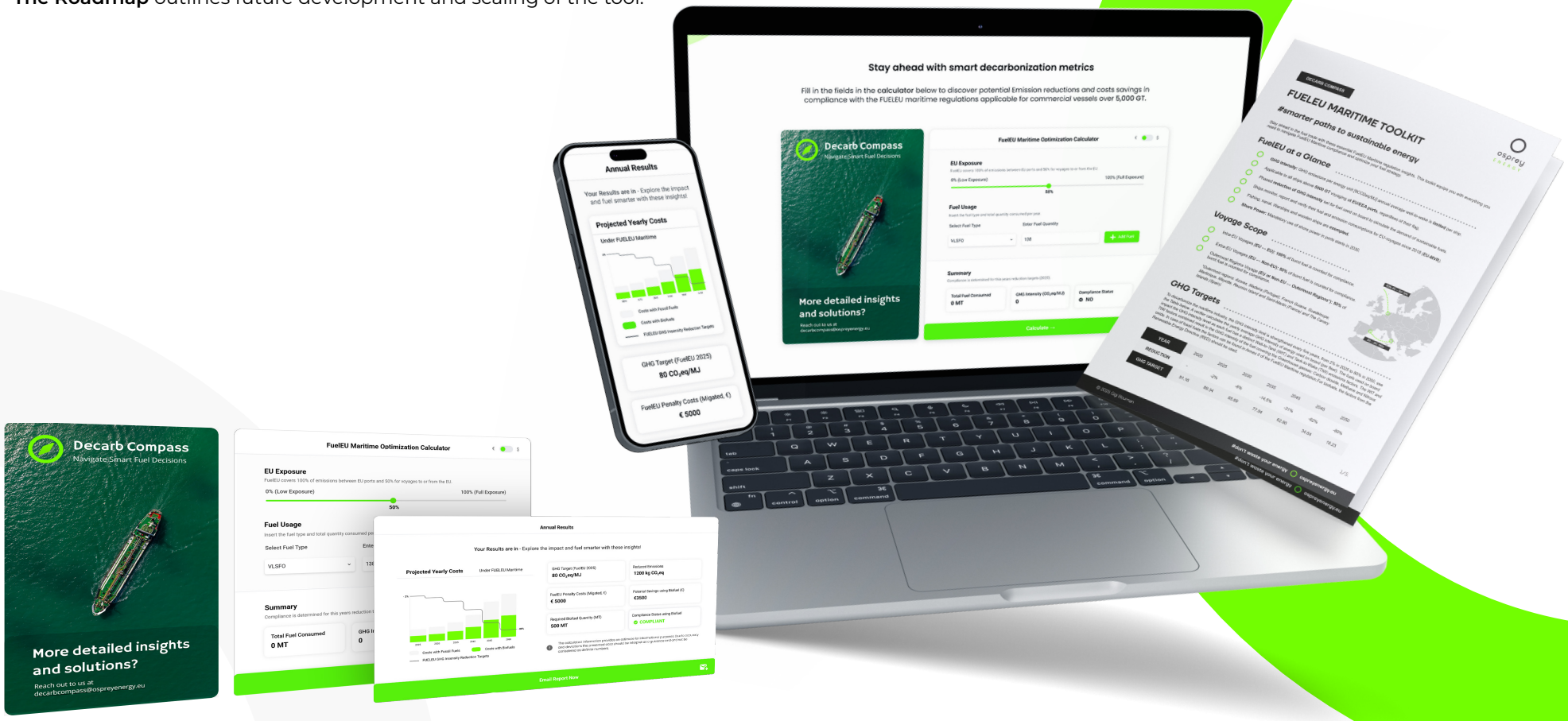
The Tool

- **Instant insight** - CO_2 reduction, cost savings and FuelEU compliance
- **Informed Support** – Summary & Results overview with clear KPIs
- **Adapt & Save** – Adjust inputs and email your results for later use
- **Multi-Scenario** - Mobile & desktop access for various use cases

TRY THE TOOL
SCAN THE QR-CODE

Supporting Materials

- **The Leaflet** visualizes key usage scenarios and clarifies the tool's value for traders.
- **The Toolkit** provides FuelEU and tool guidance for both clients and traders.
- **The Email Report** makes results easy to share, review, and follow up
- **The Roadmap** outlines future development and scaling of the tool.



5.6 Conclusion and Reflection

The deliver phase marks the end of the tool development process and further supporting material. The outcome of this phase consists of essential and valuable deliverables that are presented, collectively forming a comprehensive solution and strategy to effectively drive the transition and adoption of sustainable fuel choices by the key stakeholders (traders and shipping companies).

Multiple iteration rounds have shaped the tool, and various technical, effective, and user-friendly considerations have been applied. The result is a good conceptual starting point that gives a head start for the further development and optimization of the final tool.

In addition to the tool itself, there has been a strong focus on encouraging user support and adoption through a toolkit and leaflet. These assets help traders and clients navigate domains such as FuelEU Maritime regulations, strategic fuel choices, the calculator, usage scenarios, and insights. The usage scenarios and email report strengthen the tool by positioning it in different (business) interactions, increasing its potential impact. Finally, the short- and long-term roadmap ensures that the options for correct implementation and further development are present and future-proof.

The deliverables together form a solid foundation, where implementation is not only about a well-developed tool but also about the way in which the tool is presented, explained, and integrated into the daily practice of clients and traders. This stems from the need for seamless integration into the relationship-building process and, ultimately, the deal-making process between the customer and merchants. In addition, the tool should be clear and easy to understand and not require too much effort. Integrating the deliverables at many interaction moments also works as a nudging and iterative strategy to drive and maximize sustainable impact and actively engage the decision-makers.

Linking back to the objectives, the deliverables align well with the design vision and goals. Clearly simulated data and insights are presented through intuitive and attractive design and copywriting, and a straightforward and fast process is achieved. Motivational and engaging assets are designed to stimulate (autonomy) involvement, minimize effort, and effectively communicate benefits. This aims to outweigh the decisional balance (SUBRQ1) positively. The tool can be used in natural business interactions between traders and clients, where it supports and provides value and strengthens relationships. Its use in these scenarios is also communicated to encourage adoption.

However, it was decided to focus on developing an MVP tool with core functionalities. This resulted in several aspects of the objectives that could have been further elaborated. Nudge strategies and behavioural incentives were used and mentioned, but the level of impact of this integration will have to be tested and possibly improved. On top of that, more additional elements could have been integrated, such as gamification, personalized interactions, or reminders and recommendations. This can be added in a later process if it works as a stimulus and there is a need for it.

6. PROJECT WRAP UP

In this chapter, the final conclusion is drawn, and the limitations and recommendations are discussed.

6.1 Conclusion

The maritime industry is under increasing pressure due to emerging regulations requiring shipping companies to reduce CO2 emissions. Although mainly the large shipping companies and larger fuel suppliers are green frontrunners, the fuel purchasing process is still traditional and depends on social interactions. Furthermore, significant efforts have been made to develop climate-neutral solutions in the maritime industry in the near future, but the potential of low-carbon transition fuels, which can already make a difference, is underutilized.

Within this project, the focus has been placed on two stakeholders: Trading companies, with an emphasis on traders, and shipping companies, with vessel operational managers (or other fuel decision-makers). The final result that has been delivered is ultimately designed to help traders promote sustainable fuel options to shipping companies in line with emerging regulations. This is because traders act as intermediaries and are positioned to accelerate the transition and stimulate the decision-making of the shipping companies.

In addition, the research phase showed that it is key that a solution is embedded in current workflows, interaction, and communication processes between stakeholders. Moreover, by obtaining attractive and clear insights and strategic help, shipping companies can consider adopting biofuels. This has the advantage that they do not just receive empty words but directly see value insight, which strengthens relationships and collaboration, which is necessary for a sustainable shift. In addition, SME shipping companies are not yet well-informed about the consequences and possibilities surrounding new regulations and fuel options.

To make the above possible, it was decided to develop a digital tool that can help with this transition, in line with the formedMRQ - *How can a fuel-trading company use a simulation dashboard to communicate sustainability effortsmore seamlessly to shipping companies, with the goal of achieving greater emission reductions?*

The project was developed according to the Double Diamond Design Process, but feedback from stakeholders and coaches led to iterations that provided additional direction and ensured that it met needs. Also, during the project, important design choices were made because the context of the project was broad and complex. For example, it was decided to go from a simulation dashboard to an MVP calculation tool to guarantee impact and feasibility within the project and to be able to address the most critical needs. The project also started from the perspective of looking at the entire deal-making process but ultimately zoomed in on the initial phase: establishing a business relationship.

In Chapter 2, research was done on the needs of the stakeholders, the context, behavioral models, and alternative tools. This was translated in Chapter 3 into a clear scope, vision, goals, and requirements for the project. In Chapter 4, envisioned scenarios were designed, and 3 different concept ideas emerged. These concepts and scenarios were validated by qualitative and quantitative research with traders. The participants assessed that the concept ideas, which were a bit more abstract at the time, met all design goals and aligned with the vision. They found all three scenes relevant and interconnected. They strongly advocated for a solution that can be used in all scenarios and is adaptive and felt that the tool could help them stimulate (sustainable) decision-making and improve communication, mainly because it helps them to respond proactively about sustainability and regulations, which they are not doing (enough) at the moment. These insights resulted in confirmations, direction, and refinements for the final results delivered in Chapter 5.

The final tool, presented in Chapter 5, is a strategic (concept) asset that aligns with the project objectives and insights gained. In addition to the calculation tool, a broad set of supporting resources has been developed, consisting of a toolkit, leaflets, roadmaps, and an email report. Together, these instruments ensure that not only the right information and insights can be presented, but that they can also be effectively used and deployed. This has resulted in a stronger sustainability strategy for stimulating fuel emission reductions in the maritime industry. This choice was mainly made based on the broader approach at the beginning, where the entire acquisition & deal process was examined, and it emerged in Chapter 4 that traders and (also shipping companies) have difficulty understanding, grasping, and communicating all the many and complex information in the fast-paced working environments. Furthermore, it made it clear that

the effectiveness and impact of the
tool depend not only on the tool itself but also on how well the broader context, such as regulations, usage, and application frameworks, is understood. Without this understanding, there is no optimal application and communication.

Due to this integrated approach, the final result fits well with the research questions and the design vision and goals. The design goals that resulted from the vision are integrated into the final deliverables as follows:

Goal 1. Provide Clear and Accessible Data Insights
The calculation tool and the presented input and insights are visually attractive, simple, and intuitively designed. The presented data will have to be validated again in a further project. Still, it has been continued in line with the presented and validated data provided in the development phase. The mail report offers a clear, storable overview in the same style and elements. In addition, the toolkit is an accessible and easy-to-read manual that further simplifies the tool and implications and makes them understandable for people who have no experience with the subjects. In addition, the leaflet communicates core messages in a simple and concise manner. The assets thus contribute to removing any difficulty or inconvenience to ensure accessibility, clarity, and understanding of the insights.

Goal 2. Integrate Attractive Behaviour Stimuli to Engage Stakeholders
This is integrated mainly via the calculation tool because it quickly shows the possible impact in an optimal biofuel scenario. Hereby, emission reductions and cost savings are presented, as well as confirmation that there is compliance. These three things were seen as valuable motivational insights in the test phase and are therefore incorporated into the CORE calculator tool. In addition, it was communicated what kind of savings can be obtained in the future to make the importance of adoption clear and attractive. In addition to the attractive insights, several nudge strategies have been applied to the deliverables, and copywriting has been used to motivate action.

Goal 3. Ensure Positive Communication Between Parties
The tool supports and enables data-driven communication between stakeholders. In addition, the tool can adaptively simulate scenarios, which offers positive value in orientation discussions. The tool provides significant value, builds trust and confidence, and comes across as professional. This has a positive effect on the relationship and communication between stakeholders. Traders indicated that this tool will also contribute positively during the test activity. The email report ensures that the results can be discussed internally and externally afterward. The other assets also contribute to more effective communication, which is beneficial.

Goal 4. Support Informed Decision-Making for Sustainable Fuel Choices
Because time is of the essence in the fast-paced sales environment, the tool quickly reduces barriers by presenting useful and valuable data. It functions as a decision support system to quickly and easily assess sustainable and compliant choices, thereby preparing stakeholders to take action. Users can quickly see what the impact is of their fuel input and how their uptake can be strategically improved by (further) integrating sustainable fuels. It is applicable in different types of social use cases, where it can be used by traders to quickly receive valuable data and use it as attractive selling points in a sales conversation, or to let clients see the benefits themselves at their convenience. The other deliverables support stakeholders in navigating and providing an approach to enable informed fuel decision-making.

Goal 5. Ensure Seamless Integration Into the Relationship-Building Process
The tool is designed to be deployed and usable in existing work processes and use cases, for example, during cold calls, negotiation meetings, and networking events. It supports the natural decision-making processes and does not disrupt them because it is an easy and fast process. In addition, the regulations (unconsciously) impact the fuel order process, and the tool ensures that sustainability and sustainable options become a seamless part of the interaction moments. The additional assets support this at other touchpoints so that there is streamlined information and engagement.

In short, the end deliverables close knowledge gaps through clear and accessible insights, make sustainable choices attractive and improve sustainable and strategic communication seamlessly during the relationship-building process. Ultimately, this results in a

growing and possibly accelerated acceptance and implementation of low-carbon fuels through a tool that effectively supports stakeholders.

Referring back to the research questions, these can be touched upon as follows:

SUBRQ1: How can stakeholders' confidence and decisional balance be stimulated to support the adoption of low-carbon fuels?

The tool and accompanying assets reduce uncertainty, provide confidence in the feasibility of sustainable fuel choices, and support the positive assessment of the decision balance. This is mainly because the tool provides insight into benefits (emissions and costs) that are automatically in line with regulations. This ties in with SUBRQ1 and the underlying behavioral model (COM-B) because knowledge and trust are essential for behavioral change.

SUBRQ2: How can the dashboard align with stakeholders' deal-making and relationship-building processes to enhance communication?

The dashboard is primarily designed to be effective in the relationship-building process, as the tool does not yet provide deep insights for facilitating and closing (complex) deals. This is because, within the feasibility of this project, the focus was on the most critical and impactful phases and the development of an MVP tool. However, it can help when closing a deal, and further development will be needed. The tool is a strategic resource that can quickly and effectively visually communicate data-driven visual benefits, and it also offers and stimulates communication touchpoints with traders and clients. Besides, the tool has been developed for both mobile and desktop because this was a requirement to be effective and valuable in the deal and relationship processes.

SUBRQ3: What dashboard features and insights are required to foster engagement and simplify sustainable decision-making?

Adaptable fuel scenarios, compliance checks, and (beneficial) price and emissions insights have been implemented into the tool as requirements for effective engagement and easier decision-making. In addition, the toolkit and leaflet reduce adoption and usage barriers so that the tool can be used more effectively and easily. In addition, an email report template has been designed that allows for (later) decision-making, as insights are often not immediately understood, or choices need to be thought through and discussed.

Looking back at the list of requirements, it was drawn up just like the main research question, with the intended goal of developing a complete (concept) dashboard. This final design solution was scaled down to a calculation tool, so the list of requirements was reflected in a broader sense. Most requirements are within or in line with the delivered results. Some requirements were not fully implemented due to the adjustment of the intended goal (from dashboard to calculation tool).

Because the dashboard has been reduced to a calculation tool, mainly affecting the relationship-building phase, this change affects some of the established functionalities and requirements. This is also the case with requirement 1.2, where a reduction target is automatically set, which is achieved in the result section. However, the current tool does not allow for tracking the targets over time. This would be possible in a future dashboard. Requirements 2.4 and 2.6 are also less applicable for the same reason. The following can be noted about requirement 1.3: Data visualization is included in the result section of the tool and assets. However, most data is visualized in text (KPIs). All technical, environmental, operational, behavioral, and communication requirements are implemented in the final result. Only certain functional and experience requirements need to be adjusted.

6.2 Limitations & recommendations

Although the project has been carefully executed and is valuable to the context and stakeholders, some limitations should be addressed, and from which recommendations follow.

Foremost, looking back at the testing phase, research was only conducted with traders, which makes sense since the tool was primarily developed for traders. On the other hand, shipping companies are also strongly involved in using the tool, and they are the ones who have to be open to the insights and willingly adjust their choices. This important stakeholder was not optimally included in the testing and validation process, and this could have yielded other valuable needs or insights. This stems from the fact that involving this stakeholder was not feasible then. Moving forward, it is vital to further test and optimize the tool with traders and also include the shipping companies. Subsequently, testing and optimizing the interaction between the stakeholders using the tool and the resulting effects is also crucial.

Furthermore, the calculation tool provided for this project cannot be implemented directly; it is still conceptual. It must be tested regarding all objectives to determine whether this translation process meets all needs, as well as any adjustments resulting from the test and analysis of the 3 envisioned concept ideas. Going from 3 intangible concept ideas to this almost presentable result is also a big step that may lead to a different assessment of the outcome (during a user test).

In addition, the scope is narrowed for feasibility, but there is still a need to expand on various aspects for completeness and real-life application. For example, it was decided to only look at FuelEU maritime, but there are other regulations (EU ETS, IMO) that have implications for the maritime industry. Further research into the role and integration of regulation will be necessary for industry relevance. On top of that, there is still a need for support and functionalities broader than just the relationship-building process and the start of the deal-making process, such as considering relationship maintenance and in-house or external business needs. However, developing a complete dashboard environment is also strategically valuable. This is also addressed in the short-term and long-term roadmap.

The roadmaps contain valuable short—and long-term recommendations that also broaden the scope and can be consulted for the next steps in the project's development.

The following must also be noted about the regulations: legislation is not fixed and can change over time. Updates will, therefore, always have to be noticed and implemented in the tool and in case new regulations emerge.

Additionally, the presented results of the tool can sometimes be too positive (or negative). Fuel prices and infrastructure changes are dynamic and sometimes very volatile due to political or economic events. As a result, using biofuels can sometimes be more expensive than fossil fuels. This has not been taken into account in the project, as a fuel trading company has enough knowledge about this matter and can respond to this correctly in client conversations. However, they must consider how this should be translated into the final tool and calculations.

6.3 Personal reflection

Looking back at what I have delivered, I believe I have delivered a feasible and desirable study and result. The underlying need for the tool was proven during the testing phase, which is the overall main goal of this project. Other deliverables are nice to have and can be validated at a later stage.

Thereupon, I do envision how the overall end result can truly provide value for traders within the company, giving them the necessary resources and understanding to effectively engage in conversations about sustainability and regulations with customers. This really enables a shift because currently, these topics are being addressed reactively and not proactively by some within the company.

Since I saw that some competitors were also starting to offer such solutions and tools during the last two months of the thesis, there is definitely market pressure and a need for it. In order to be viable in the long term, the process really needs to be easy, effective, and impactful and also differentiate from competitors. This has been intended and attempted to be implemented as much as possible in the concept tool.

I originally started this project because of the experience I gained in the (maritime) fuel industry and my interest in sustainability. I like to delve into important matters because of my curious nature, which is how I came into contact with the FuelEU regulations. Likewise, I also wanted to work on something valuable and applicable for the sector and could make a difference towards more sustainable practices. During the project, I learned more about the challenges of sustainable fuel adoption, regulations, research into social collaboration between stakeholders, and the use of behavioral models.

At times, I found the project execution a bit difficult because the domains and activities were not the most common ones for me, as I have more experience in traditional product or product service design projects. However, the coaches guided me well with the right comments and tips. During the process, I became more confident in my skills, executed, and learned many new things.

The large domain of the project made it difficult for me at times, forcing me to narrow the scope or take a step back. I often wanted to keep going forward. I tend to see this as progress and, therefore, end up with a more linear process. However, the process was not linear, and adjustments were needed along the way. This sometimes felt like a setback, but I came to the realization that these iterations were necessary and actually led to better depth and fitting results.

On a last note, I look forward to further applying the acquired knowledge and contributing to innovative and sustainable solutions in the (near) future.

REFERENCES

On the next page you will find the list of references consulted for the thesis.

The following list reflects the (academic) references consulted in the thesis.

Bettersea, & Schroer, M. (2024). Monday Newsletter Booklet: FuelEU Marirtime Compliance Insights. Retrieved February 24, 2025, from https://www.bettersea.tech/_files/ugd/269648_261514e77a69463586cb03ba4991fa5c.pdf

Chatzopoulou, E. (2018, September 13). Where do you start when designing for behaviour change? Medium. https://uxdesign.cc/how-do-you-design-for-behaviour-change-790b9abefa08

ClassNK, & KYOKAI, N. K. (2023). FAQs on the FuelEU Maritime (1st Edition) (1st ed.). https://www.classnk.or.jp/hp/pdf/authentication/eumrv/fueleumaritime_faq_e.pdf

Design Council. (n.d.). The Double Diamond - Design Council. https://www.designcouncil.org.uk/our-resources/the-double-diamond/

Doedee, V. (2024, September 18). FuelEU Maritime — Sustainable Ships. Sustainable Ships. Retrieved January 6, 2025, from https://www.sustainable-ships.org/rules-regulations/fueleu

Draffin, N. (2011). Commercial practice in bunkering (First Edition). https://www.petrospot.com/books/product/commercial-practice-in-bunkering

European Commission. (n.d.-a). Decarbonising maritime transport – FuelEU Maritime. Mobility and Transport. Retrieved June 8, 2024, from https://transport.ec.europa.eu/transport-modes/maritime/decarbonising-maritime-transport-fueleu-maritime_en

European Commission. (n.d.-b). Reducing emissions from the shipping sector. Climate Action European Commission. Retrieved June 13, 2024, from https://climate.ec.europa.eu/eu-action/transport/reducing-emissions-shipping-sector_en

European Council of the European Union. (2023, July 25). FuelEU maritime initiative: Council adopts new law to decarbonise the maritime sector. Consilium. Retrieved July 3, 2024, from https://www.consilium.europa.eu/en/press/press-releases/2023/07/25/fueleu-maritime-initiative-council-adopts-new-law-to-decarbonise-the-maritime-sector/

Friman, M., Huck, J., & Olsson, L. (2017). Transtheoretical Model of Change during Travel Behavior Interventions: An Integrative Review. International Journal of Environmental Research and Public Health, 14(6), 581. https://doi.org/10.3390/ijerph14060581

Hausmann, L., Wolff, C., Liu, S., Mohr, D., & Weber, B. (2022, July 28). Driving decarbonization: Accelerating zero-emission freight transport. McKinsey & Company. https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/driving-decarbonization-accelerating-zero-emission-freight-transport

Heller, L. J., Skinner, C. S., Tomiyama, A. J., Epel, E. S., Hall, P. A., Allan, J., LaCaille, L., Randall, A. K., Bodenmann, G., Li-Tsang, C. W. P., Sinclair, K., Creek, J., Baumann, L. C., Karel, A., Andersson, G., Hanewinkel, R., Morgenstern, M., Puska, P., Bucks, R. S., . . . Denollet, J. (2012). Transtheoretical Model of Behavior Change. In Springer eBooks (pp. 1997–2000). https://doi.org/10.1007/978-1-4419-1005-9_70

IMO. (2021, July 15). Cutting GHG emissions from shipping - 10 years of mandatory rules. Retrieved June 21, 2024, from https://www.imo.org/en/MediaCentre/PressBriefings/pages/DecadeOfGHGAction.aspx

ISCC. (n.d.). Sustainable Marine Fuels – ISCC System. Retrieved July 13, 2024, from https://www.iscc-system.org/markets/sustainable-transport-fuels/sustainable-marine-fuels/

Jameson, P., Egloff, C., Sanders, U., Krogsgaard, M., Burke, D., Tan, M., Hegnsholt, E., & Nyheim, E. (2021, September 24). Global Shipping's Net-Zero Transformation Challenge. Boston Consulting

Group. Retrieved July 16, 2024, from https://www.bcg.com/publications/2021/global-zero-carbon-shipping-transformation-challenge

Korean Register. (n.d.). FuelEU Maritime GUidelines. In Korean Register. Retrieved February 24, 2025, from https://www.krs.co.kr/TECHNICAL_FILE/KR%20FuelEU%20Maritime%20Guidelines_Rev.2.pdf

Maersk for Zero Carbon Shipping, Global Maritime Forum, Global Centre for Maritime Decarbonisation, & McKinsey & Company. (2023). The shipping industry's fuel choices on the path to net zero. Retrieved July 24, 2024, from https://safety4sea.com/wp-content/uploads/2023/04/GMF-the-shipping-industrys-fuel-choices-on-the-path-to-net-zero-2023_04.pdf

Osprey Energy. (2024, August 6). Osprey Energy on LinkedIn: #sustainability #greenenergy #iscc #biofuel #renewables. LinkedIn. https://www.linkedin.com/posts/osprey-energy_sustainability-greenenergy-iscc-activity-7226503215251369985-fLjr/?utm_source=share&utm_medium=member_desktop

Price waterhouse Coopers. (2024, May 15). Consumers willing to pay 9.7% sustainability premium, even as cost-of-living and inflationary concerns weigh: PwC 2024 Voice of the Consumer Survey. PwC. Retrieved August 13, 2024, from https://www.pwc.com/gx/en/news-room/press-releases/2024/pwc-2024-voice-of-consumer-survey.html

Qlik. (n.d.). What is a Key Performance Indicator (KPI)? Guide & Examples. Retrieved December 9, 2024, from https://www.qlik.com/us/kpi

Sustainable Ships. (2024). FuelEU Maritime Guide: Guide on the calculation and impact of FuelEU Maritime on your ship. In Sustainable Ships. Retrieved February 24, 2025, from https://www.sustainable-ships.org/s/FuelEU-Guide.pdf

Transport & Environments. (2023). Modelling The Impact Of FuelEU Maritime On EUShipping.: Current EU shipping policies leave Europe dependent on fossil fuels beyond 2050. In Transport & Environment. European Federation for Transport an dEnvironment AISBL. Retrieved August 6, 2024, from https://www.transportenvironment.org/uploads/files/FuelEU-Maritime-Impact-Assessment.pdf

Turtle Design. (2023). Fashion App Experience Map (by Turtle. Design) | Figma. Figma. Retrieved November 15, 2024, from https://www.figma.com/community/file/1225500193035347266/fashion-app-experience-map-by-turtle-design

United Nations Environment Programme, Grid-Arendal, & Team, B. I. (2020). The Little Book of Green Nudges: 40 Nudges to Spark Sustainable Behaviour on Campus (No. 978-82-7701-198–1). United Nations Environment Programme and GRIDArendal. Retrieved July 3, 2024, from https://stg-wedocs.unep.org/handle/20.500.11822/33578?show=full

World Economic Forum. (2023, September 14). How the shipping industry is targeting zero emissions. Retrieved July 17, 2024, from https://www.weforum.org/stories/2023/09/the-shipping-industry-is-targeting-zero-emissions-heres-how-it-could-do-it/

Zak, J. (n.d.). Experience Map Template | Miro. https://miro.com/. Retrieved December 6, 2024, from https://miro.com/templates/experience-map-josh-zak/

Zero Carbon Shipping & Maersk. (2022). Maritime Decarbonization Strategy 2022. In Zero Carbon Shipping. Retrieved August 6, 2024, from https://cms.zerocarbonshipping.com/media/uploads/publications/Maritime-Decarbonization-Strategy-2022.pdf