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Environmental Assessment

Autor:

Fernández Sanz, Sofía

Responsable de Intercambio en la UVa

AVANS, Hogeschool

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TFG REALIZADO EN PROGRAMA DE INTERCAMBIO

TÍTULO:	Environmental Assessment
ALUMNO:	Sofía Fernández Sanz
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CENTRO:	School of Engineering and Information Technology 's-Hertogenbosch, the Netherlands
UNIVERSIDAD:	AVANS Hogeschool
TUTOR:	Luc Claessens

RESUMEN / ABSTRACT

El cambio climático es un problema actual mundial, es por eso que numerosas legislaciones están emergiendo, de forma que las empresas puedan tener guías y herramientas para combatirlo. Una de estas herramientas es el ACL (Análisis de ciclo de vida) mediante el cual se trata de cuantificar el impacto ambiental de un producto. En este trabajo se analizan las leyes más representativas que afectan a la empresa de alfombras de coches, BERCO Car Carpet. Además, se realiza el ACL del proceso de producción de dichas alfombras, dando especial importancia a la gestión de los residuos y su respectivo impacto. Se ha medido las emisiones de CO2 producidas al quemar las alfombras y comparado estos datos con emisiones en transporte y totales de diferentes países a lo largo de un año.

Palabras clave: medio ambiente, impacto, alfombras, residuos, legislación

Climate change is a current global problem, which is why numerous legislations are emerging, so that companies can have guidelines and tools to combat it. One of these tools is the LCA (Life Cycle Assessment) which aims to quantify the environmental impact of a product. In this work, the most representative laws that affect the car carpet company, BERCO Car Carpet, are analysed. In addition, the ACL of the production process of these carpets is carried out, giving special importance to waste management and its respective impact. The CO2 emissions produced by burning the carpets have been measured and compared with transport and total emissions in different countries over a one-year period.

Keywords: environment, impact, carpets, waste, legislation

University of Applied Sciences
School of Engineering and Information Technology
's-Hertogenbosch, the Netherlands

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Sofía Fernández, Francisco Almeida and Julian Holz

THE EUROPEAN PROJECT SEMESTER

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3. Acronyms

EPS	European Project Semester
ISO	International Organization for Standardization
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
CO2	Carbon dioxide
CH4	Methane
GWP	Global-Warming Potential
PA	Polyamide Nylon
PES	Polyether Sulfone
LDPE	Low-Density Polyethylene
EVA	Ethylene Vinyl Acetate
SFDR	Sustainable Finance Disclosure Regulation
EU	European Union
NFRD	Non-Financial Reporting Directive
CSRD	Corporate Sustainability Reporting Directive
ESG	Environmental, Social and Governance
GHG	Greenhouse Gas
COP26	Conference of the Parties number 26
HLEG	High-Level Expert Group
IPCC	Intergovernmental Panel on Climate Change
GDP	Gross Domestic Product
UNEP	United Nation Environmental Program
NGO	Non-Governmental Organization
ERMA	The European Raw Material Alliance
LED	Light-Emitting Diode
OEM	Original Equipment Manufacturer

4. Executive Summary

This report revolves around a project which was conducted by Sofía Fernández, Francisco Almeida and Julian Holz at the company BERCO Car Carpets. The project team finalized a list of three main topics together with the company coach Marijn Hermans. These topics are:

1. Researching the upcoming Dutch and European law regarding environmental legislations and giving the company advice.
2. Creating an LCA[1] (Life Cycle Analysis) for the company.
3. Analyzing the companies waste and recycling efforts to find weak aspects and giving advice.

The team has found several upcoming legislations plans of the Netherlands and the European Union that have the potential to directly affect BERCO's business. These revolve around how companies should deal with their waste, and also include action plans for the future of sustainable industry in the EU. These plans also intend to create overarching alliances of companies to further enhance the current supply chains, because the waste of one company could be a raw material of another company. In addition, the EU is planning to achieve a net-zero economy in the future through further investments and is striving towards sustainability and environmentally beneficial components. As advice, the project team suggests BERCO should work with a professional company to further analyze their overall environmental footprint. Moreover, they should continue their ambition of being as sustainable as possible. Furthermore, the company could be more interactive towards their employees about being environmentally friendly and therefore educate the staff on what can be done. Lastly, the company can also investigate different alliances and events of other big companies to perhaps join them to create vital connections in the industry. Further information of this legislation plans can be found in paragraph 9. In addition, further advice that the project team has summarized for BERCO can be found in paragraph 12.1.

In the second part of the scope, creating an LCA, the team has conducted a Life Cycle Analysis in four separate steps to end up with a concise result of the environmental footprint of the carpet production. First, the team defined the scope and the goal of the LCA by setting boundaries of what will be researched. This part can be found in paragraph 11.1.

[1] A Life Cycle Assessment (LCA) is defined as the systematic analysis of the potential environmental impacts of products or services during their entire life cycle.

Subsequently, the team started the second phase of the LCA, the LCI – Life Cycle Inventory -in which the team gathered all possible information about the production cycle, production steps, carpet compositions and more. The results of the research can be found in paragraph 11.2. After researching the basic building blocks of the LCA, the team started to analyze the collected information. This resulted in a detailed analysis of the impact that every component of the production cycle has on the environment. To be more precise, the team examined all components that make up the finished carpet and the materials that are wasted/recycled in the production steps. The result that the team came up with was a visual representation of most of the results and also a conversion of the entire carpet waste into CO2 equivalents. All results and further information on the aforementioned terms can be found in paragraph 11.3. The last part of the LCA, the interpretation phase, analyzes the impact of the results from the third step. The project team chose to convert the calculated CO2 equivalents of the carpet waste into understandable values. This includes how many kilometers could be driven by an average car to emit the same amount of CO2 as the CO2 equivalents of the carpet waste. The conversion table and further information can be found in paragraph 11.4.

The last section of the scope, the examination of the waste and recycling efforts of the company, have been partly included in paragraph 11, because the analysis and results also had an impact in the LCA. Furthermore, the team has briefly analyzed BERCO's overall energy consumption and alternate carpet compositions that are environmentally beneficial. The results of this research and the detailed explanation can be found in paragraph 12.2. The project group discovered that it would be beneficial to try to persuade the OEMs to use more sustainable carpet compositions, even though they are more expensive. Furthermore, BERCO can add a section on their website that explains all of their recycling and sustainability efforts to give customers and the community a chance to read through them.

As a sidenote, some aspects that explain certain parts of the report can be found at the end of the report in the Appendix, because the additional information does not increase the value of the information that Is stated in the report. However, if the details need to be examined on how the team came up with certain conclusions, the information can be found there.

5. Introduction

BERCO is an automotive supplier which is located in Van Leeuwenhoekweg 36, 5482 TK Schijndel, The Netherlands. The product portfolio that BERCO provides is divided into two core parts – car carpets and truck interiors. The Project-team conducts their project solely in the car carpet division of BERCO.

The variety in which BERCO can produce car carpets has attracted some of the biggest automotive corporations in the world. To name a few, BERCO supplies Mercedes-Benz, McLaren, Toyota, Volvo, and many more across the world.

All these corporations have an extensive list of requirements, different designs and different materials that BERCO must incorporate into their process. Furthermore, the company uses many different manufacturing techniques to achieve all customer requests. These techniques include Lasering, special edge finishing variations, special embroideries and even customer specific desires that can be incorporated. The BERCO facility is built up as follows:

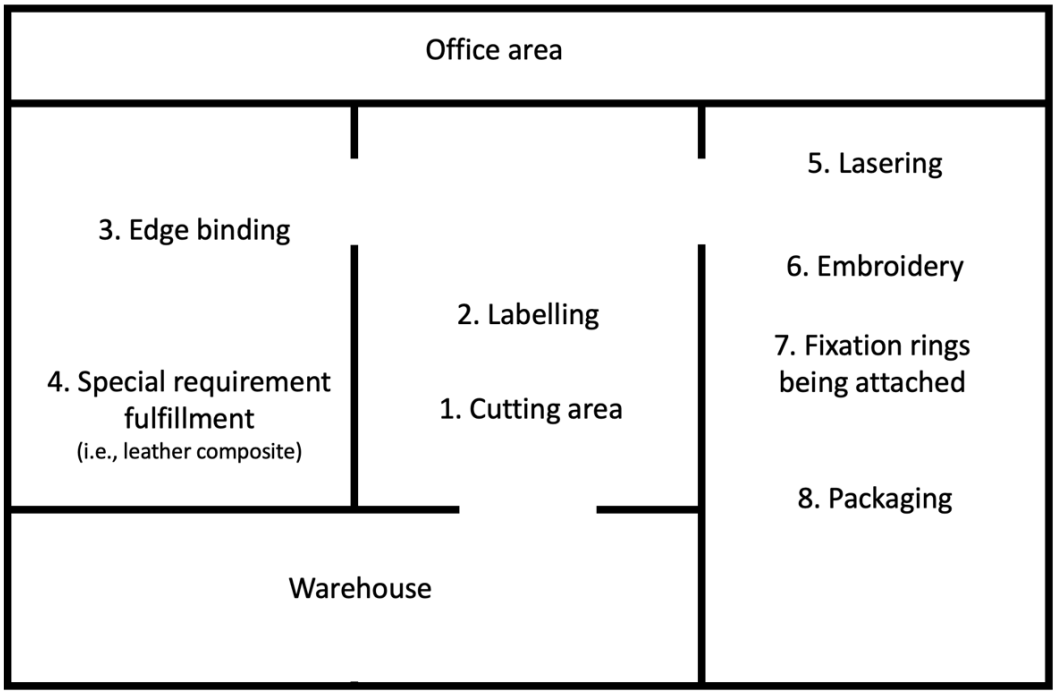


Figure 1, BERCO facility (birds eye view)

6. Description of the problem/project

BERCO is a company in a highly competitive market. This means it is very important for the company to continuously evolve to stay ahead of the competition. This philosophy is also true when it comes to environmental challenges. Therefore, BERCO is interested in knowing more about what they can change or implement to meet current and upcoming environmental regulations. Furthermore, BERCO also wants to become more efficient during production and this especially includes enhancing the current recycling and waste disposal processes. Therefore, the following set of goals have been defined in communication with the company coach, Marijn Hermans:

Figure 2, Image environmental care

1: Research future environmental regulation changes
2: Create a list of advice on how the company should/could react to these changes and further changes that could be implemented by the company to be more environmentally conscious
3: Create an LCA (Life Cycle Analysis)
4: Examine and enhance the current waste disposal and recycling processes

7. Project approach

To achieve these goals of preparing BERCO for future regulation changes and to make the company more sustainable, the Project-team has conducted research into these topics. The Project-team decided to split-up the work into two sub-topics to work more efficiently. These two topics are researching environmental regulations and lastly, researching and creating an LCA (Life-Cycle-Assessment).

Furthermore, the team have visited the company every week to gather more information on the current processes. This enables the Project group to create a baseline of information on present practices and methodologies. It also helps to get familiar with the company and its employees, because these people are the experts. This allows the Project-team to ask specific questions and get comprehensive answers. This saves a lot of time, because the other way of retrieving the information would be to conduct in depth research.

The goal is to prepare BERCO for the future in terms of environmental regulations by creating a list of possible regulation changes that could occur in the next five years. Furthermore, the Project-team will prepare a detailed step-by-step guide on how the company could react if a certain legislation change is implemented. In addition to that, research on every production step will be conducted to find the tasks with the highest CO2 impact. Lastly, the Project-team will evaluate the current methods of waste disposal and recycling to find weaknesses and possible aspects which can be enhanced.

8. Organization / Methodology

The group was trying to organize the workload, so a Gantt Chart have been developed to give an idea of how long every step will take and to predict when the project will be completed. Besides that, the team also created meeting reports and agendas for the company meetings, to ensure that everything was reported and organized.

The methodology that the group was trying to use during the project development is the Lean methodology[2]. The final purpose was to know what were the important aspects that the company wanted out of the project, and one example of it was in the legislation document.

During the research, a huge amount of information was discovered in a variety of documents. Unfortunately, it was unclear if they had any importance for BERCO. Hence, the group asked the company coach, whenever necessary, if the information would be relevant. In some cases a positive answer was received, and in the other cases a negative answer. The group believed that in this way, the document would avoid being filled with half important information and it would steer clear of being a very long document that is very hard to read or to connect the points from the different topics.

8.1. Gantt Chart

A Gantt-chart [3]has been created to organize the tasks which must be done for the project. Furthermore, it also enables the scheduling of the tasks, and the team can assign deadlines and time frames to every task to have a structured overview over the entirety of the process. This helps the team to always oversee the project and to not forget or neglect any tasks. Figure 3 shows the Gantt Chart that has been developed, but it must be said that the finished file will also be added to the entire list of files that will be handed in at the end of the project. (Updated 04.01.2022)

[2] Lean methodology is a business approach that promotes the flow of value to customers by embracing a mindset of continuous improvement and respect for people.
[3] The Gantt chart is the most widely used chart in project management. These charts are useful in planning a project and defining the sequence of tasks that require completion. In most instances, the chart is displayed as a horizontal bar chart.

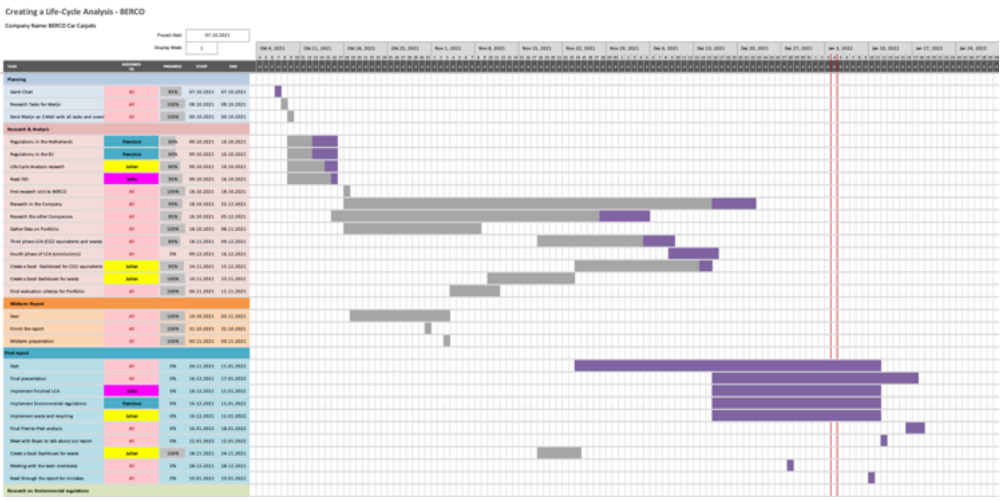


Figure 3, Gantt Chart

8.2. Meetings

Each week the team met to decide what needs to be done and how to do it, as well as to briefly review what has been done and whether any changes are needed.

On the other hand, every week an update was sent out, so that the project team can inform both Luc Claessens and Marijn Hermans about the progress and so Mr. Claessens can advise and guide us.

In addition, in the second part of the project the team went to the company to work one day per week, either for data collection or to ask/answer questions. Further information on the communication can be found in paragraph 8.4.

8.3. Non-use of a Methodology

As mentioned in paragraph 8, the project team started off the project by choosing Lean as their methodology. This methodology is focusing on making businesses and production plans more efficient by reducing waste and streamlining production processes. Since the scope of the project only includes gathering data, analyzing, finding results, and giving advice, the project found it more and more challenging to use the lean methodology. This is due to the lean methodology being better suited for entire businesses and production planning teams instead of a project team that only analyzes data and gives advice. In addition, none of the team members has previous experience with applying project management to a project in a real-life scenario.

These problems resulted in the project team steering away from using the Lean methodology and not sticking to its principles. Despite the non-use of the chosen methodology, the project did not search for a project management approach that is

better suited for the project. Instead, the team worked on the project in a way that worked out in the end, even though the approach was not pre-defined, and it did not follow a clear path of principles.

8.4. Project approach of the team

As declared in the paragraph above, the team did not use a pre-defined methodology, but the project team still worked by a set of principles that were determined in this project.

These principles are:

1. Communication is very important to understand the customer and to also inform the relevant people with the current progress and plans
2. Visiting the company once a week to gather information, ask questions and to gain further insight
3. Splitting the work into smaller parts and assign every team member with a range of parts to research and work on
4. Set deadlines for everything and use a Gantt chart to track the progress
5. Determine the strengths of every team member and assign the workloads in a way that take advantage of this strengths
6. Bring value to the customer

These principles have been used throughout the entire project. In the following part, the implementation and the principles will be explained further.

Communication: The project team was always in contact with the company coach, Marijn Hermans, and the project coach, Luc Claessens. The communication took place face-to-face at the university/company or through meetings on Teams. Furthermore, the team reported current progress and questions via E-Mail. Every week, the team either created a Résumé of their visit to the company or a weekly update of all things that have been achieved during the week to keep the coaches up to date. In addition, the mid-term and the final report have been sent to the coaches either in their final form or as drafts for review.

Presence: At first, the team did not visit BERCO often, but this has changed in the last 5 weeks of the project, because the team visited the company once a week. This is due to the project coach, Luc Claessens, telling the team show more presence. This does not only make the research easier, but most importantly, it showed the company coach that the team is motivated and working on the project.

Workload splitting: The team always split the workload into smaller sub-parts to make it easier to track progress and to divide the project into stages that can be finished one by one (can also be finished simultaneously). It was also beneficial to assign different topics to different team members, because the members can research and become experts in their small sub-part, without overloading themselves by having to research every aspect of the project.

Time management: As already mentioned, the team created a Gantt chart to track their progress and to also plan and therefore create a well-balanced and thought through schedule for the project.

Strength profile: In week three of the EPS program, the team determined their strengths and assigned certain traits to every member. This knowledge was used to assign different roles to every member, and it was also important every time the team discussed the splitting and assigning of new workload. This always ensured that the person best suited for a certain task, will be assigned with the corresponding workload.

Value: This principle was derived from the Lean methodology, since the team has always questioned every task and sub-part for its value for BERCO. Overall, the team is trying to create value for the company, and this means, the team will not work on sub-parts that it thinks are not valuable for BERCO. This means, every part that the team has worked on and that can be found in this report, adds value to BERCO in the form of knowledge, research, or advice.

8.5. Risks for not using a pre-defined methodology

The success of a project can be severely affected by the misuse or non-use of a suited project methodology. Since the project team did not use a pre-defined set of principles, there are a few risks that arose during the project. Possible risks are:

Communication: There was a possibility of misinterpreting key aspects of the project by simply misunderstanding the needs of the customer. Furthermore, the team could have steered the project in a wrong direction by researching wrong topics even though the scope has been determined correctly. By following the principle of having an active exchange about the project progress between all parties this risk can be mitigated. This also affects the inner structure of the project team, because if all team members work on separate aspects, without updating and informing the team about the progress it can lead to a segmentation of the project that can become so bad, that the individual team members lose the overview of what the other team members do. During the project, the team encountered this problem in a watered-down form, because when the work

on the final report begun, the team had to find a way to combine the three different parts of the scope into one concise final report.

Time management and workload overview: A lack of deadlines and time management can lead to huge amounts of stress and tensions inside the team. Different parts of the project can fall under the table or be neglected entirely. This means it is hugely important to always keep an overview of what must be done and setting deadlines for everything. In addition, it is also beneficial to add buffer times in the case of additional workload arising or complications during the already determined schedule. Due to the creation of a Gantt chart and also the pre-defined deadlines of the EPS project itself, the team had no problems with this described risk.

Strength profiling: It is very beneficial to know the strengths and weaknesses of each team member to efficiently split different workloads to yield the best results. If this knowledge is not obtained early in the project cycle, the workload can be split unevenly and in a manner that creates problems. For example, someone who has a lot of knowledge about Microsoft Word and how to format documents should be allocated to this task. This saves a lot of time, because the other members can focus on other aspects that suit their strengths without worrying about learning the details of the program and spending several, unnecessary, hours of their time trying to solve problems that the other team member already knows the answer to.

Creating value for the customer: Since BERCO set a scope for the project together with the project team, it is vital to stick to this scope and only add or scrap aspects in consultation with the company and the project coach. This ensures that the project team focuses their resources on the important aspects that create value for the customer.

9. Environmental legislation

9.1. Researching environmental regulations

From the Dutch government, two separate legislations are being planned to be put in practice between 2023 and 2025, related to the circulation of raw material through several selected cities, and limitations on the purchase of raw materials.
In regards to the European Union, four upcoming legislations have been found that are related to Environmental, Social and Governmental characteristics of the company and their disclosure.

Combining these regulations, it can be seen that they are mostly focused on analyzing how environmentally friendly these companies are and their commitment to the environment and transmitting this to investors. The deep reason for this, is to divert financial investments to this "environmentally friendly companies" since this aspect is becoming more and more important to financial investors.
The upcoming legislations that were found are:

- The **SFDR** which is about the company's disclosure of their ESG – Environmental, Social and Governmental – strategies and politics of the company.
- The **EU Taxonomy** that contains a classification system that allows investors and companies to indicate which investments are sustainable and which are not, and on which environmental goals they have an impact. Its goal is to have information available, so investors can make more environmentally responsible investments.
- The **NFRD** introduced a requirement for companies to report both on how sustainability issues affect their performance, position, and development (the 'outside-in' perspective), and on their impact on people and the environment (the 'inside-out' perspective). This is often known as 'double materiality'.
- The **CSRD** was adopted by the European Commission in April 2021 and is an extension of the NFRD that will apply to a significantly larger group of companies and has more extensive reporting requirements.

In addition to requiring more companies to report, there will also be additional reporting requirements under the CSRD. The format and exact criteria for reporting are still under development.

The project team also explains what these regulations are, what it implicates, when are they going to be implemented, companies that can be contacted for more information, experts contacts, visual data for more clear understanding of the content. All additional

information about this topic can be found in the attached document “Upcoming Environmental regulations”

9.2. The European Green Deal

The European Commission determined the main Environmental goals in order to transform the EU into a modern, resource-efficient, and competitive economy. These goals are:

- No net emissions of greenhouse gases by 2050, and if possible, a reduction by 55% by 2030,
- Economic growth decoupled from resource use,
- No person and no place left behind.

For this, these Environmental goals will have impact in several areas, such as:

- Climate
- Energy
- Agriculture
- Energy
- Environmental and Oceans
- Transport
- Finance and Regional Development
- Research and Innovation

9.3. The European Action Plan

Launched at March 2018, the European Commission, with the help of PRI, established ten reforms in three areas for financing sustainable growth. The plan is a response to recommendations from the High-Level Expert Group (HLEG) on Sustainable Finance.

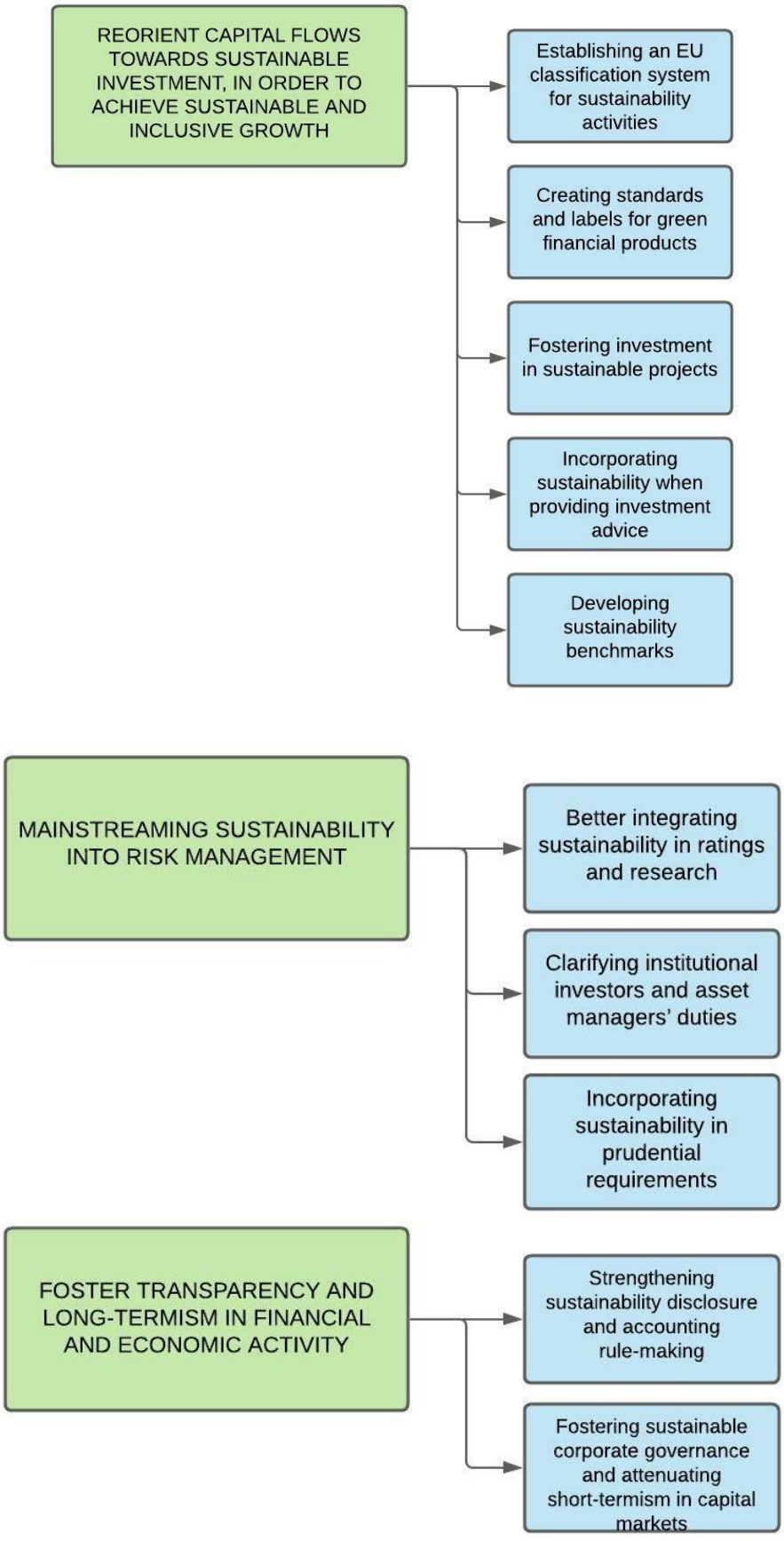


Figure 4, European Action Plan

Note: The boxes with the green background are the three areas in which the outlines are applied, and the boxes with the blue background are the reforms themselves.

In June of 2018, the European Commission Vice-President Valdis Dombrovskis introduced the first four actions proposed by the Commission. These actions are interconnected and relevant for all investors, and they will be addressed later.

9.4. COP26

The COP26 – Conference of the Parties number 26 – was a meeting between several world leaders to address environmental problems and come up with solutions. This summit took place in Glasgow, from 31 October to 13 November 2021, and it was organized by the United Kingdom and Italy. It welcomed twenty-five thousand delegates from 197 countries, including 120 heads of state.

9.4.1. Net Zero Emissions

"Net Zero Emissions" is a very important expression involving the future of the European Union vision for the future, for conveniency it is therefore necessary to explain this term. Net zero is a technical term based on the climate agreement reached at COP21 in Paris (Paris Agreement). In its latest report, the Intergovernmental Panel on Climate Change (IPCC) calls for all global GHG (Green House Gas) emissions to be reduced to net zero by 2050 – across all sectors, economic activities, and areas of life. Under the 1997 Kyoto Protocol, GHGs include:

- carbon dioxide
- methane
- nitrous oxide
- hydrofluorocarbons
- perfluorocarbons,
- Sulphur hexafluoride
- nitrogen trifluoride

Carbon dioxide currently is the most significant GHG.

9.4.2. COP26 Goals

The main goals for the COP26 summit were:

1) Mitigation, in which was achieved:

   a) Reducing emissions

b) Coal Power
c) Halting and Reversing Deforestation
d) Speeding up the switch to electrical vehicles
e) Reducing methane emissions

2) Adaptation, in which was achieved:

a) 80 countries are now covered by either Adaptation Communications or National Adaptation Plans to increase preparedness to climate risks. This is the first time an adaptation specific financing goal has ever been agreed globally.
b) A new Glasgow Dialogue on Loss and Damage funding arrangements was created.
c) The Santiago Network on Loss and Damage was brought to life through clear functions and funding.

3) Finance

a) Developed countries have made progress towards delivering the $100 billion climate finance goal and will reach it by 2023 at the latest.
b) 34 countries and five public finance institutions will stop international support for the unabated fossil fuel energy sector next year.
c) Private financial institutions and central banks are moving to realign trillions towards global net zero.

4) Collaboration At the COP26 World Leaders Summit, over 40 countries accounting for over 70% of global GDP endorsed the Breakthrough Agenda. They are committed to:

a) Power Breakthrough: making clean power the most affordable and reliable option for all countries to meet their power needs efficiently by 2030.
b) Road Transport Breakthrough: making zero-emission vehicles the new normal - accessible, affordable, and sustainable in all regions by 2030.
c) Steel Breakthrough: making near-zero emission steel the preferred choice in global markets, with efficient use and near-zero emission steel production established and growing in every region by 2030.
d) Hydrogen Breakthrough: ensuring affordable, renewable, and low carbon hydrogen is globally available by 2030.

9.4.3. Impact of the COP26 achievements if delivered

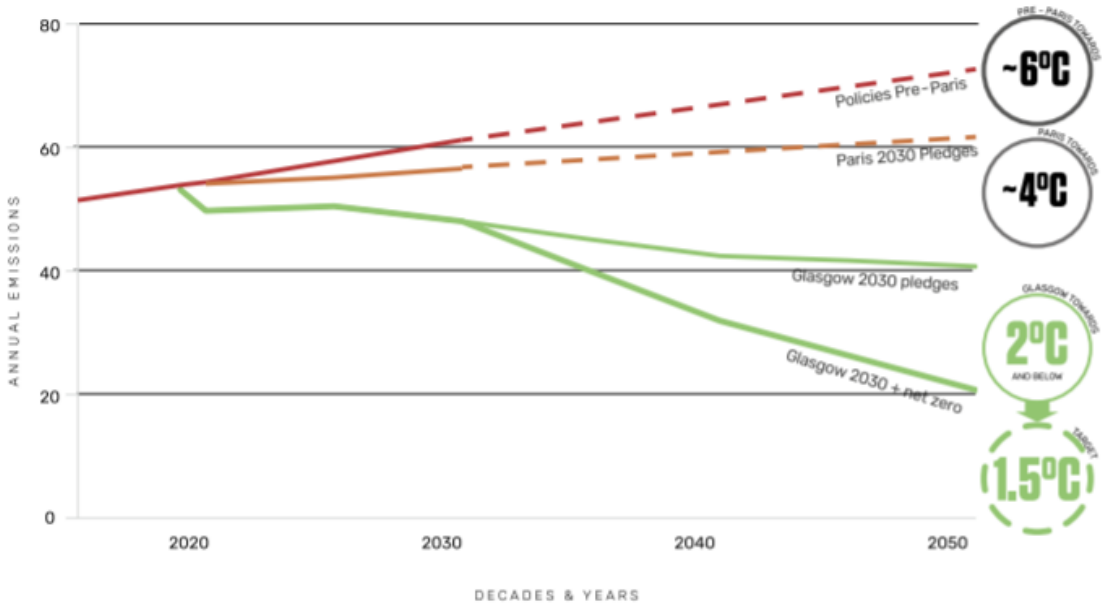


Figure 5, COP26 Achievements

Based on Rogelj et al. 2016, UNEP Emissions Gap Report 2015, 2019, 2021
COP26: THE GLASGOW CLIMATE PACT-

The main goal stated in the COP26, and also in the other climate summits, it's that the world needs to achieve the net-zero emissions.

For this, the European Union requests the European companies to have a net-zero emissions plan prepared. This involves a plan to make a company CO2 emission neutral, with the amount of the chemical that is set free and plans for achieving that reduction.

9.5. The European Raw Materials Alliance

The European Raw Materials Alliance [4]aims to build resilience and strategic autonomy for Europe's rare earth and magnet value chains. It will identify barriers, opportunities, and investment possibilities in the raw materials value chain, while also addressing sustainability and social impact.

[4] To join the Alliance, it is requested to the entity to sign the following declaration:
https://erma.eu/about-us/join-erma/
It requests some company information, and some contacts.

One of the Alliances objectives is to implement a Circular Economy [5]of complex products; therefore, the group believes this would be a possible way to find solutions for the disposal of waste produced by the company.

Furthermore, the Alliance also aims the creation of environmentally sustainable and socially equitable innovations and infrastructure; support Europe's raw materials industry capability, to extract, design, manufacture and recycle materials and promoting innovation, strategic investment, and industrial production across specific value chains.

The alliance is open to all relevant stakeholders, including industrial actors along the value chain, EU countries and regions, trade unions, civil society, research and technology organizations, investors, and NGOs.

[5] A circular economy is an economic system aimed at eliminating waste and the continual use of resources.

10. LCA Research

LCA stands for “Life-Cycle-Assessment” and it is a way of determining the environmental impacts of product systems. The objects studied in LCA are often physical products and the term “product system” signals that a life cycle perspective is taken, i.e., that all the processes required to deliver the function of the product are considered. To explain a Life-Cycle in further detail, it is possible to use nature as an example. If we look at a butterfly, his life starts off in an egg which bursts open to reveal a caterpillar. This caterpillar turns into a pupa from which the butterfly emerges that will eventually lay eggs before dying to repeat the process. This same methodology can be used in the industrial world, with the harvest of resources, production, product use and management of the waste.

The main goal of LCA is to provide a broad look on the entire process with all environmental impacts and risks. For example, changing fossil fuels with biofuels seems to be more environmentally friendly at first glance, but it can also have a larger impact elsewhere. It is possible that the energy that is used and needed in the creation of biofuel and the use of land for growing the necessary resources has a worse impact than using fossil fuels in the first place. The LCA takes many aspects into account like freshwater use during production, usage of toxic chemicals, climate change and more, this provides the required range of different environmental issues to make comprehensive analyses and comparisons, which other assessment tools do not offer. LCA results are clear and there is no room for interpretation. The quantitative nature of LCA means that it can be used to compare environmental impacts of different processes and product systems. This can, for example, be used to judge which products or systems are better for the environment or to point to the processes that contribute the most to the overall impact and therefore should receive attention.

10.1. Researching the relevant ISO[6] standards

Figure 6, ISO Logo

The project focused on ISO 14000, which corresponds to environmental management standards. Specifically, the team has studied ISO 14040 and ISO 14044 which correspond to LCA, and on the other hand ISO 14064 and ISO 14067 which correspond to greenhouse gases.

[6] ISO standards are an international working tool that allows us to work and develop the industry in a cooperative and orderly manner.

10.1.1. ISO 14040 - ISO 14044

These standards specify how to perform the LCA.
The LCA is split in 4 phases:

1. **Goal and scope definition phase**: This section defines the objective of the analysis as well as the limits of the system, what is to be included, what is not to be included and why.
2. **Inventory analysis phase (LCI) (input/output):** In this phase the inputs and outputs of both energy and matter in the manufacturing process will be analyzed.

   How to create the LCI

   1. Research of data. Input-Output.
   2. Data validation: Mass and energy balances verify conservation laws.
   3. System limit setting. Exclusion and inclusion of stages, inputs and outputs.
   4. Assignment
      i. Subdivide processes into others to avoid overlapping.
      ii. Physical relationships between products.
      iii. Indicate relationships between products and wastes
      iv. Allocation for reuse and recycling:
         1. Inputs and outputs shared by more than one product.
         2. Change of physical properties and economic value.
         3. Enter number of subsequent uses.
3. **Impact assessment phase (LCIA):** The environmental impact of this process will be analyzed.
4. **Interpretation phase:** In this last phase, everything previously studied will be analyzed.

10.1.2. ISO 14064 – ISO 14067

These standards provide requirements and guidelines for the reporting and quantification of greenhouse gases.
The process can be divided into 3 phases:

- Documenting: collecting and saving information.
- Explain: Describe how the approaches are used and why they were chosen.
- Justify: why alternative approaches were not chosen.

11. LCA

First, the research was started to gather information and to become familiar with what a LCA is and how to use it. Two books have been used to further deepen the team's knowledge on the topic and these books are:

- "LCA Compendium – The Complete World of Life Cycle Assessment"; written by Walter Klöpffer and Mary Ann Curan (Springer Verlag)
- "Life Cycle Assessment - Theory and Practice"; written by Michael Z. Hauschild, Ralph K. Rosenbaum and Stig Irving Olsen (Springer Verlag)

In addition, ISO standards were studied to perform the LCA correctly.

- ISO 14040:2006 Environmental management — Life cycle assessment — Principles and framework.
- ISO 14044:2006 Environmental management — Life cycle assessment — Requirements and guidelines.
- ISO 14067:2018 Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification.
- ISO 14064-1:2018 Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.

After the investigation the team started with the LCA.

11.1. Goal and scope definition phase

The first phase, goal and scope definition phase, can be seen in section 6. In addition, the team has defined the limits of the system by following the ISO 14040 standard. The LCA is preformed from the time the materials enter in the warehouse until they leave it.

- **Raw material procurement**: the impact prior to the arrival of the materials at the warehouse will not be taken into account.
- **Inputs/outputs in the main sequence**: all the impacts of the production process will be considered and if not, the reason why will be detailed.
- **Distribution/transport**: the impact of transportation before arriving and when leaving with the carpets already manufactured will not be considered
- **Production and use of fuels, electricity, and heat**: Their consumption will be analyzed but not their environmental impact. The option of analyzing the impact of each of the machines has been considered in order to classify the steps.

However, as the team does not have the necessary technology to carry out such measurements, this calculation will not be carried out.

- **Use and maintenance of products**: Will not be considered. We are only looking at the impact of production.
- **Disposal of process and product residues**: Will be considered. The team will mainly focus on the environmental impact of the waste generated in the manufacturing process.
- **Recovery of used products**: To be considered. Reuse processes are already implemented.
- **Recovery of secondary materials**: BERCO does not generate any second materials.
- **Production, maintenance and dismantling of equipment**: Will not be considered. The project group is only looking at the impact of production.
- **Lighting and heating**: Will not be considered. The team is only looking at the impact of production.

11.2. Inventory analysis phase (LCI) (input/output)

The team started to gather data at BERCO's production facility in Schijndel. The team walked through the entire production process and took notes at every separate task. The notes which have been taken include a description of the task that has been examined, the materials which go into the task, the end-product of every job and the waste that is produced at every step.

This Data was then visualized in a flowchart diagram. The visualization can be seen down below in Figure 7.

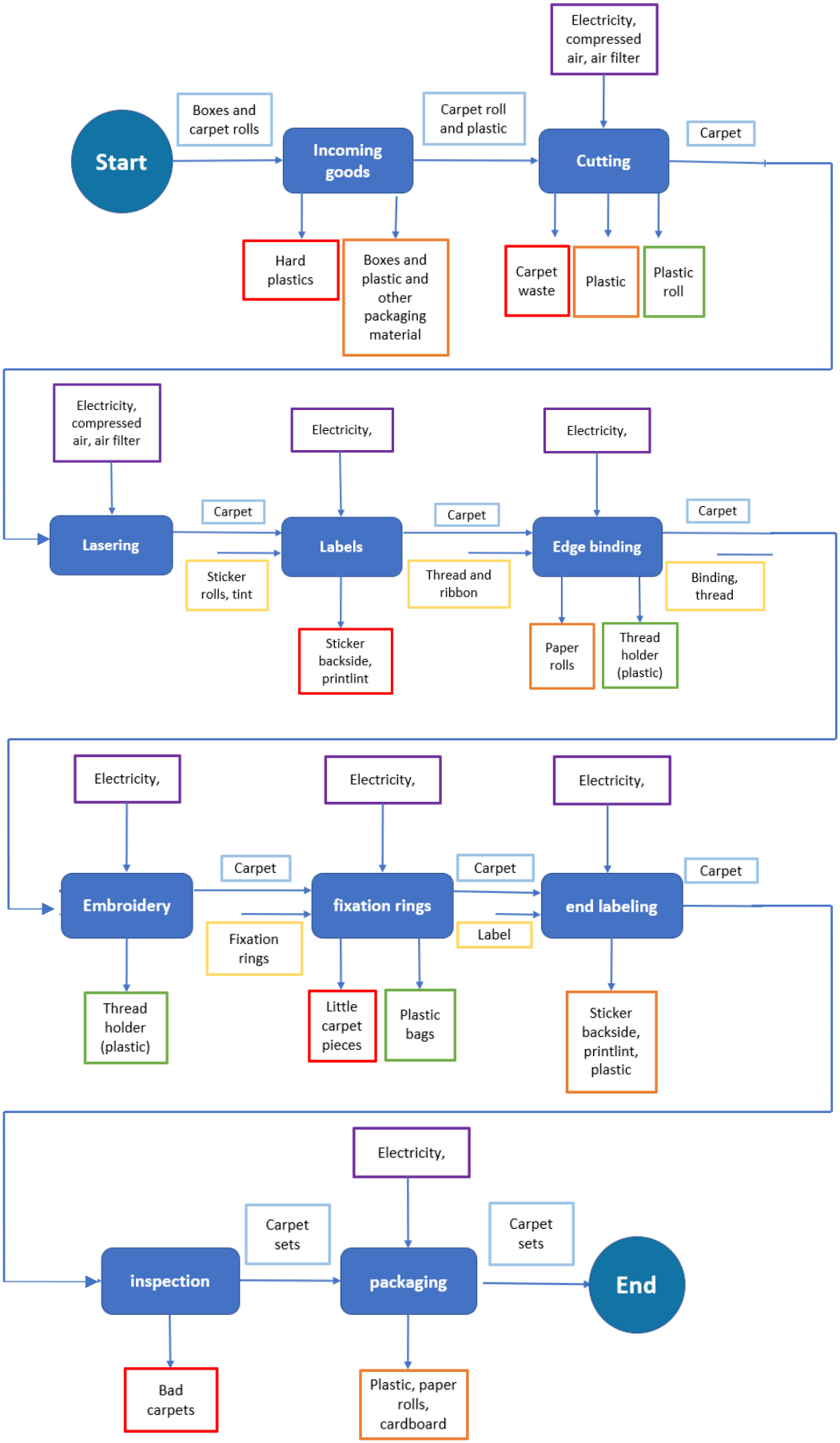
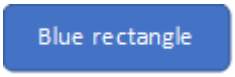


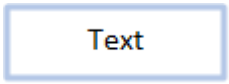
Figure 7, LCI Flow-Chart

This Flow-Chart can be explained as follows:

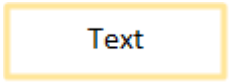
- Blue Rectangles: Determine separate tasks in the production



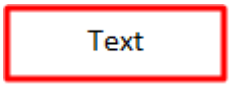
- Light-blue text: End-product from last production step



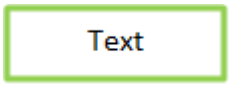
- Yellow text box: Additional input materials for next production task



- Red text box: Waste



- Green text box: Reusable components



- Orange text box: Recyclable components

- Purple text box: Input mediums

In the diagram we can see both the inputs and outputs of materials, as well as the inputs of energy. It should be noted that, due to lack of time and information, in what follows of the LCA the focus is on the environmental impact of material waste, but the energy used to produce or the impact of at the end of life of the product sold will not be considered. However, in terms of energy, it can be said that the energy outputs are in the form of mechanical and heat energy, with the movement and heat needed for

cutting and gluing among other processes, as well as in the form of losses, as heat, mechanical and light.

Analyzing each of the steps in the process, it can be seen that the cutting phase is the most worrying part of the process. At this stage the team has gathered all the information about reusable, recyclable, and waste outputs. Furthermore, it can be estimated that the machinery used here is the most energy intensive.

In any case, as specified above, the study will focus on the impact of waste, which is why an interpretation of the data provided by the company has been carried out.

11.2.1. Waste overview and Dashboard

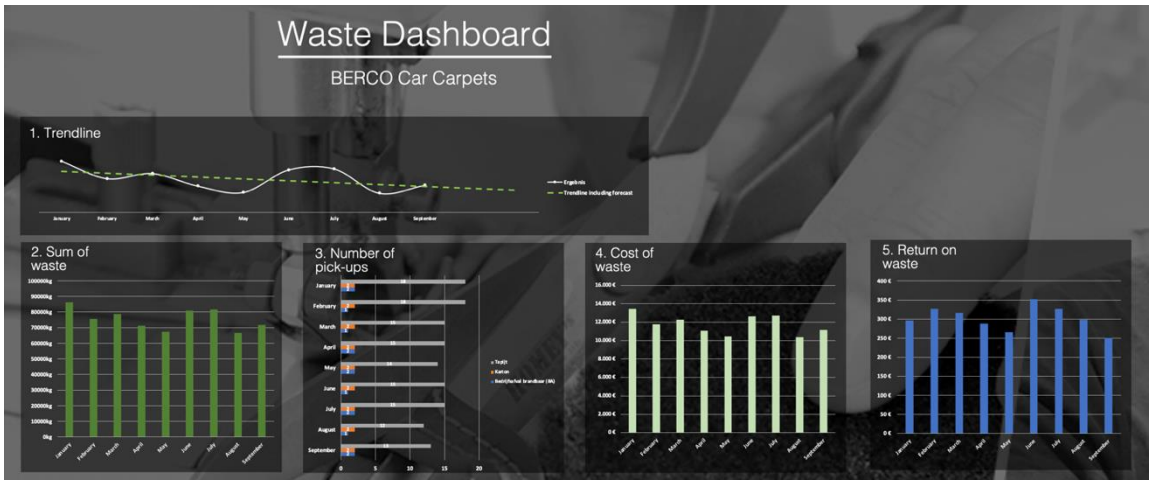


Figure 8, Waste Dashboard

Furthermore, the team has conducted research into BERCO's waste disposal and recycling efforts. Therefore, an Excel file was created to visualize and evaluate the data that we received. As seen in Figure 8, five different graphs were created to get an overview of the current situation at BERCO. First, the group plotted a graph with a trendline of the total amount of waste per month (first graph at the top). We can clearly see that the amount of waste has been steadily declining over the year. This decline can most likely be explained by the ongoing COVID-19 pandemic and the current micro-chip shortage that heavily affects the worldwide automotive sector. As an automotive supplier, the output of car carpets is logically correlated to the number of cars that are being produced worldwide. If we take look at Figure 9, a sharp decline in the vehicle production since the start of the pandemic in 2019 can be seen. This means the decline of waste that has been sent to the waste firm "Van Kaathoven" by BERCO in 2021 is not representative for the overall waste and recycling efforts of BERCO.

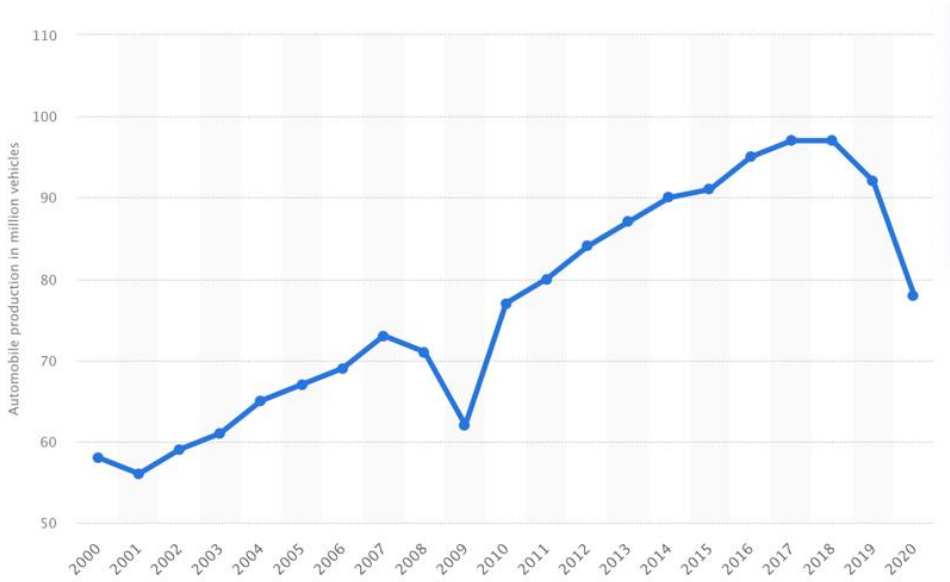


Figure 9, Automobile Production

If we examine the next graph of Figure 8 (bottom left, "2. Sum of waste") we see the same data plotted in a different kind of graph. It shows the total amount of waste in kilogram per month until September of 2021. Furthermore, the graph "3. Number of pick-ups" shows the number of waste pick-ups per month. It is further separated into the three different types of waste that Van Kaathoven handles for BERCO. These three types are Carpet waste, cardboard, and burnable industrial waste. it can clearly be seen that carpet waste is responsible for most of the waste at BERCO and the amount of waste pick-ups are significantly higher.

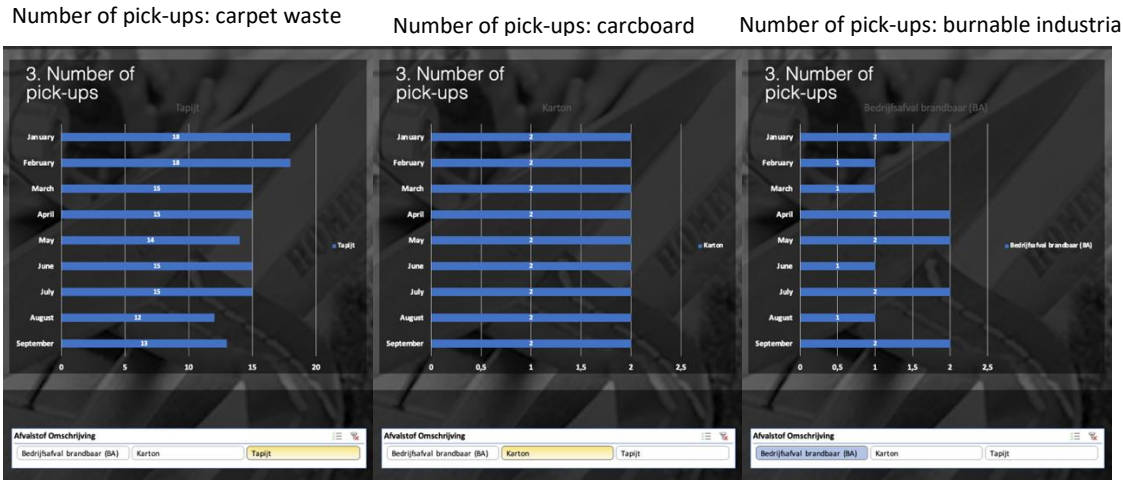


Figure 10, Number of pick-ups

If we now filter number of pick-ups by the type of waste, we can see the described decline in the number of carpet waste pick-ups due to the decline of produced cars over the year 2021. Nonetheless, the amount of cardboard waste pick-ups and burnable industrial waste pick-ups has stayed constant over the year. This result shows, that

BERCO could investigate why the overall production of carpets has declined, while the amount of the other two waste types has stayed constant.

The graph "4. Cost of waste" is directly correlated to the graph "2. Sum of waste" because Van Kaathoven does not offer a quantity discount. Therefore, the costs will always stay directly linked to the amount of waste that is sent to the recycling company.

The last graph "5. Return on waste" plots the amount of money that BERCO receives from Van Kaathoven for their cardboard waste. BERCO does not receive any money for the other waste types because carpet waste and burnable industrial waste is non-recyclable. In contrast to that, cardboard waste can be recycled and sold again. Hence, BERCO is receiving a payment for giving Van Kaathoven their cardboard waste. We can see a direct correlation between the sum of cardboard waste and the sum of return on waste every month.

11.3. Impact assessment phase

Once the inputs and outputs of the whole process are known, the impact of these will be analyzed by dividing them into three sections.

11.3.1. Reusable components impact

Some materials such as carpet and thread holders, made by plastic, are sent back to the company of origin, that way they can be used as many times as their life let them. These types of materials obviously have an environmental impact as their reuse involves energy and electricity consume, as well as end of life which can be either in the form of recycling or waste. However, these are the materials with the lowest impact as they eliminate the need to extract new raw materials.

11.3.2. Recyclable components impact

Nowadays one of the main methods to avoid extracting new materials and reduce the carbon footprint is recycling. In this case, as we can see in the flowchart, figure 7, recyclable waste is paper, cardboard, plastic, and print lint.

In order to study the impact of this type of material, the study[7] carried out by the company Cbalance Solutions (Vivek Gilani) was used. This document compares the CO2 emissions emitted when producing different virgin or recycled materials.

[7] Carbon Savings Achieved by Recycling - Carbon Saving achieved by Recycling (cbalance.in)

a. Paper and cardboard

The following table shows the Kg of CO2 emitted per Kg of material produced, both virgin and recycled. On the other hand, in Table 2, fourth column, Land filling emission, this refers to the equivalent of CO2 emitted in the form of methane, CH4, which is produced when degradable-organic-carbon containing materials, such as paper, are landfilled.

Table 1, Recycled ang virgin paper equivalent

Type	Virgin Paper : Life cycle emission (kgCO2e/kg)	Recycled Paper : Life cycle emission (kgCO2e/kg) (100% recycled)
Paper sheets	2.58	1.62
Newspaper Inserts	3.30	1.77
Newsprint	3.15	1.55
Cardboard	2.62	2.67
Magazines	2.86	1.49

If we look at Table 1, we can see a big difference between virgin paper and recycled paper, but the opposite is true for cardboard, which emits more with recycling. In spite of this, as already said, it is necessary to take into account the landfill emissions as we can see in Table 2, so we can see that emissions are reduced for both paper and cardboard.

Table 2, Paper Emission Achieved

	Life Cycle emission: Virgin Material (kgCO2e/kg) (A)	Life Cycle emission: Recycled Material (kgCO2e/kg) (B)	Land filling emission (kgCO2e/kg) (C)	Emission Achieved (kgCO2e/kg) (A-B+C)
Paper sheets & Newspaper Inserts	2.61	1.63	1.725	2.70
Newsprint	3.15	1.55	1. 725	3.32
Cardboard & Magazines	2.72	2.20	1. 725	2.24

Due to the low emission difference of cardboard and the high cost of recycling, cardboard, as in our case, is often considered waste and is not recycled.

b. Plastic

In this case, as with paper, the table shows the Kg of CO2 emitted when producing different types of virgin or recycled plastics. In addition, as it is not an organic and degradable material, it does not produce waste emissions.

Table 3, Recycled and virgin plastic equivalent

	Life Cycle emission: Virgin Material (kgCO2e/kg) (A)	Life Cycle emission: Recycled Material (kgCO2e/kg) (B)	Land filling emission (kgCO2e/kg) (C)	Emission Achieved (kgCO2e/kg) (A-B+C)
High Value Plastic	4.30	3.57	0	0.73
PET Bottles	6.94	4.21	0	2.73
Low Value Plastic	5.09	3.50	0	1.59

We can see that the difference in hard plastics is much smaller than in soft plastics. In most cases, for the same reasoning as cardboard, hard plastics are considered waste and are not recycled.

11.3.3. Waste impact

These materials are the most worrying. Their composition and format make them very difficult to recycle or reuse. Other reasons may be that the cost of carrying out these operations is very high.

In this case the main products that are considered waste and which overlaps the rest of the residual materials as we can see in the waste dashboard, are the carpet remnants that are obtained from cutting from the roll, from the fixing of fasteners and from defective carpets. For this reason, the group will focus on their impact.

Each carpet has a different composition made up of different types of cohesive plastic textiles, so there is no way to recycle them. At least not right now.
At BERCO, this type of waste is sent to the company Van Kaathoven for disposal. What they do there is either use it as raw material for cementation or burn it as fuel to produce energy in the form of heat.

Nowadays burning the carpets is the most common process which has a big environmental impact in the form of CO2. To quantify how big this impact is, CO2 equivalents have been calculated for the most used carpets in the company. This can be seen in the following section.

a. CO2 Equivalents

Before starting with this section, it must be stated that the results obtained are an estimation. To arrive at them, it has been necessary to make several approximations due to lack of information, time, and knowledge.

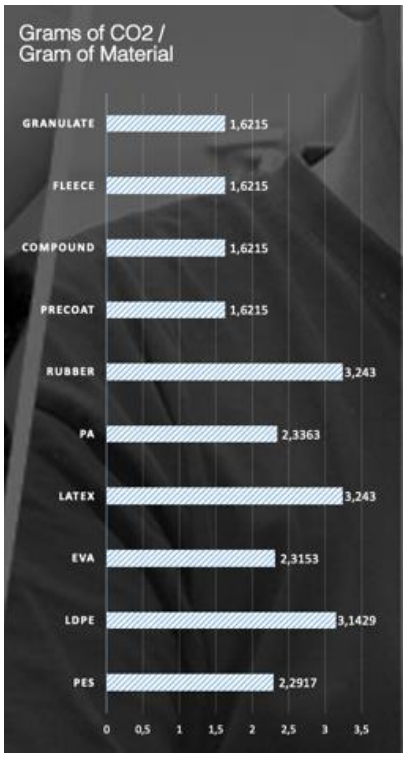


Figure 11, CO2 Equivalents

A carbon dioxide equivalent or CO2 equivalent, is a metric measure used to compare the emissions from various greenhouse gases or materials based on their global-warming potential (GWP[8]), by converting amounts of other gases/materials to the equivalent amount of carbon dioxide with the same global warming potential.

Using the combustion reactions generated by burning the carpets and the compositions provided by the carpet supplier Condor Cartex (see Appendix B), CO2 equivalents have been calculated for each of the components of the 5 most used carpet types. These calculations can be found in Appendix A.

Figure 11 shows the equivalents of each of the material components that make up the carpet.

In the following graphs, figure 12 and figure 13, the contribution of each of the materials in each type can be seen. The Y-axis is related to the carpet composition in percent, 0% meaning nothing and 100% meaning the entire carpet and every color is referring to a different material in the carpet composition including the relative weight per square meter. The X-axis shows the five different carpet types.

In figure 12, the percentage of the different materials in each model can be seen, while in figure 13 we can see the percentage contribution of each material in the form of CO2 equivalent. If we look at model TN0202200, for example, we can see that the blue color corresponding to Latex has increased in size, it has a greater contribution than PES. Therefore, it can be seen in each of the models which are the materials with the greatest and least impact.

The Excel file “Carpet composition and CO2 equivalents” contains all relevant calculations and details regarding this graph and its contents and below there is a summary of the compositions.

[8] The Global Warming Potential (GWP) was developed to allow comparisons of the global warming impacts of different gases. Specifically, it is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO2).

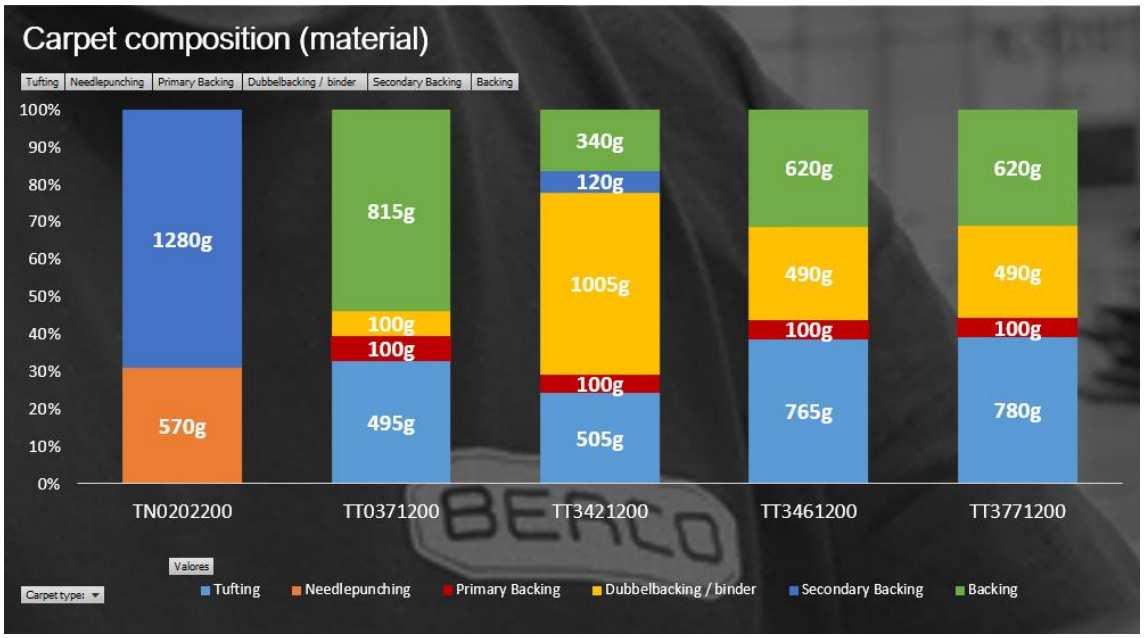


Figure 12, Carpet composition (material)

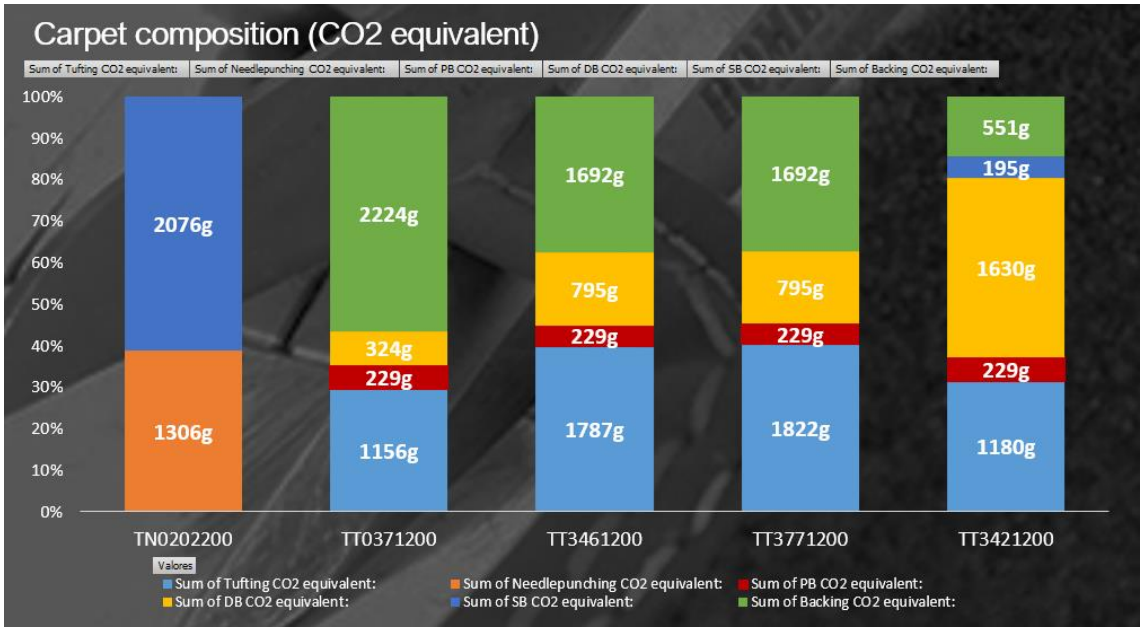


Figure 13, Carpet composition (CO2 Equivalent)

Blue: Secondary Backing (Latex)

Orange: Needlepunching (PES)

Green: Backing (LDPE + EVA + Tuftbacking)

Yellow: Dubbelbacking (Latex)

Red: Primary backing (PES)

Light blue: Tufting (PA)

Once the team gathered the information on the carpet composition, a summary table has been made in which the five most used carpets can be clarified and classified by their environmental impact.

Table 4, Summary environmental impact of different carpets

Grams of CO2 per gram of carpet weight

Carpet type:	CO2 equivalent per m²:	Total weight Carpet:	Impact (g of CO2 / g)
TN0202200	3382 g/m²	1850 g/m²	1,83
TT0371200	3934 g/m²	1510 g/m²	2,61
TT3461200	4503 g/m²	1975 g/m²	2,28
TT3771200	4538 g/m²	1990 g/m²	2,28
TT3421200	3784 g/m²	2070 g/m²	1,83

Explanation:

What is CO2 equivalent: This represents the amount of CO2 that would be released if the material would be burned. For example, the carpet TN0202200 emits 4,297kg of CO2 per square meter if it would be burned.

Total weight: This is the net weight of the carpet per square meter.

Gram of CO2 per gram of weight: This number shows how many grams of CO2 per gram of carpet weight would be released when burning the carpet

Impact: Green means, the carpet has a low carbon footprint and red means the carpet has a high carbon footprint in comparison to the others.

At first, this data gives us a great overview of the relative environmental impact of these carpets, but it does not show the total impact that these results have. Hence, the team calculated the total CO2 equivalent of the entire production year. The project team also converted the unit to tons because at this scale it is easier to work with.

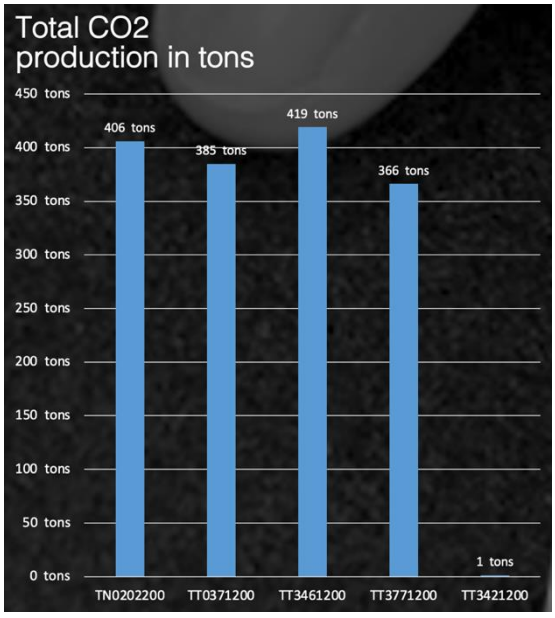


Figure 14, Total CO2 production in tons

Figure 14 shows these calculations and their results. The Y-axis represents the number of tons, and the X-axis shows the five carpet types that have been examined. The carpet type TT3421200 (right side) only has an impact of one ton, this is due to a relatively low quantity that has been produced of this type.

The team calculated these results by multiplying the amount of CO2 equivalent of the carpet type (see Table 4) and the quantity of m^2 of carpet that have been produced of this type over the entire year.

The data that has been gathered is an estimation of the emissions that would occur if all carpet types, both the carpet sold to consumers and the residual carpet, was burnt. Knowing that the four most used carpets correspond to approximately 15% of the production and using their impact as an assumption and approximation for the rest of the types, we arrive at the figure of 10507 tons of CO2 emitted annually. This is a representative estimate as we do not know the end of life of the carpets sold. For this reason, the study focused on the impact of the carpet waste that BERCO emits annually.

In the year 2020, 792,18 tons of carpet was disposed.

Table 5 shows the four most used carpets by BERCO, and they make up approximately 15% of the total production. Since we now know the quantity of carpet waste and how much CO2 equivalent each carpet has, we can calculate its impact. The team will analyze and talk about the results in the following paragraph 11.4.

Table 5, Total emissions CO2

Total waste	792 tons			
Carpet type	**% of total**	**g of CO2/g**	**Wasted carpet (total waste * % of total)**	**tons of CO2 (wasted carpet * g of CO2/g)**
TN0202200	4,62%	1,83g	37 tons	67 tons
TT0371200	3,76%	2,61g	30 tons	78 tons
TT3461200	3,58%	2,28g	28 tons	65 tons
TT3771200	3,11%	2,28g	25 tons	56 tons
Rest	84,93%	2,17g	673 tons	1.460 tons
Total	100,00%	-	792 tons	1.726 tons

11.4. Interpretation phase

In the last phase of the LCA, the interpretation phase, we will analyze the results of our research and assess the impact that these results have. The team chose to include the general results of CO2 emissions in the Impact assessment phase (paragraph 11.3) as well as the recyclable and reusable materials impact. Therefore, paragraph 11.4.1 will contain a conversion of the CO2 emission results to make them easier to understand. Furthermore, the team will also include an analysis of the results in advice for the company BERCO.

11.4.1. Conversion of the CO2 results

Everybody understands the general idea of what impact CO2 has. In simple terms, it leads to a continuous increase in global temperature which ultimately steers towards severe climate change and related natural disasters. In Figure 14, the four most produced carpets of 2020 represented a total of between 366 tons and 419 tons of CO2 equivalents. It can be agreed upon, that the amount of CO2 is high, but how much is it actually? Despite the knowledge, that 400 tons of CO2 is a lot, it is difficult to put this number into perspective. Hence, The project team created a few conversions in Table 6 to make the amount of CO2 more relatable.

Table 6, Representative emission values

Spalte1	Car	Train	Airplane
Average grams of CO2 per km:	150 g/km	32 g/km	380 g/km
CO2 equivalent of waste per year from BERCO:	1.725.531.496 g	1.725.531.496 g	1.725.531.496 g
This is the total distance you could travel to emit the same amount of CO2 as the equivalent carpet waste:	11.503.543 km	53.922.859 km	4.540.872 km
You could travel to the moon and back (384400km) this many times:	almost 15 times	almost 70 times	almost 6 times
You could travel around the earth at the equator (40075km) this many times:	almost 287 times	almost 1346 times	almost 113 times
The average distance a german drives by car in one year is 11733 km, this means it takes this many germans to equal the amount of CO2 pollution:	980 germans	-	-
The CO2 pollution (CO2 equivalents) of BERCO's carpet waste is equal to the CO2 emission of this many US households (ø7,5 tons):	230 households	-	-

In this table it can be clearly seen that the CO2 equivalents of the carpet waste amount to many comparable pollutions. For example, the amount of CO2 equivalents of BERCO's carpet waste is comparable to 11,5 million kilometers driven by an average road car. This amount is comparable to a theoretical roundtrip of the earth at the equator, 287 times!

This conversion makes the pollution understandable for everyone, but it is now important to compare the emissions to the entirety of The Netherlands to make it more representative.

Table 7, Comparation to total Netherlands and USA emissions

Comparison to Total Netherlands and USA	
Per capita CO2 emissions (Netherlands):	8,06 tons
Population Netherlands (2020):	17.134.000
BERCOs CO2 equivalent of total carpet waste:	1.726 tons
Total CO2 emissions of The Netherlands (2020)*:	138.100.040 tons
Total CO2 emissions of The USA (2020)*:	5.011.686.600 tons
This it the total impact of BERCOs carpet waste compared to the total Durtch CO2 emissions in 2020:	0,0012%
Impact of all passenger cars emissions in the Netherlands*:	12,94%
This it the total impact of BERCOs carpet waste compared to the total US CO2 emissions in 2020:	0,000034%

* estimation

By calculating the total CO2 emissions of The Netherlands, it is possible to estimate the impact of BERCO on the total.

In Table 7 the team compared BERCO's emissions with different values. For example, the number of the CO2 equivalents of BERCO's carpet waste amount to approximately 0,0012% of the entire Dutch CO2 emissions in 2020. This is 1000x less than the entire amount of pollution that is produced by all passenger cars.

The result is that BERCO does a good job already, since the impact of their carpet waste is comparably

small. This becomes even more apparent if BERCO's CO2 equivalent carpet waste is compared to the entire CO2 emissions of the US. The impact that BERCO makes is drastically smaller again and it now only amounts to approximately 0,000034% of the US total.

11.4.2. Reusable and recyclable materials

As could be seen in the previous phase, the environmental impact of recycled materials is much less than waste, and even less with reused materials. BERCO already has certain reuse methods in place, such as in the case of carpet rolls. In addition, most of its materials are recycled, with the exception of those whose recycling has a very high economic cost, such as hard plastics, and those whose recycling industry does not yet exist, as has already been seen with carpet.

As a result, the environmental impact of the entire production process is significantly reduced.

12. Conclusions

12.1. Environmental legislation advice

12.1.1. BERCO net-zero emissions

Although there's no legislation requesting companies not emitting Greenhouse Gases, the European Commission has as one of its missions to turn Europe into the first continent with net-zero emission by 2050.

The group is certain that turning BERCO into a Zero emission entity would benefit the company. Besides showing that the company is environmentally friendly and responsible, it would turn the company into an attractive partner for car and truck constructors, since nowadays, these entities need to show careness for the environment.

The team suggests BERCO to use our study about the CO2 emissions from each carpet, and continue it, in a way this goal can be achieved. The study could also be used to further convince OEMs to change to more sustainable carpet compositions.
It is obvious that a study like this is complicated to develop. Hence, the project group searched for some companies BERCO could contact for help.

12.1.1.1. Greenfeet

Greenfeets mission is: "help reduce the world's carbon footprint by providing an easy to use and accessible solution for companies of all sizes to quickly and painlessly manage and ultimately reduce their emissions in line with international agreements and targets".

The company is specialized in Software Development in the areas of monitoring, managing, and analyzing data, User Experience and User Interface Design, Data Security, and Climate Science.

Here are some company plans [9]and their fees:

[9] Website: https://greenfeet.com/carbon-calculator-for-business/?utm_source=google&utm_medium=Business-Calculator-Europe&utm_campaign=business_calculator_europe&gclid=Cj0KCQiAzMGNBhCyARIsANpUkzONNcSFaeP4BPknZy-mywd1JRGawIJs_FR3sH4i9g9YJjmnlGGI3cMaAoqFEALw_wcB
Contact: support@greenfeet.com

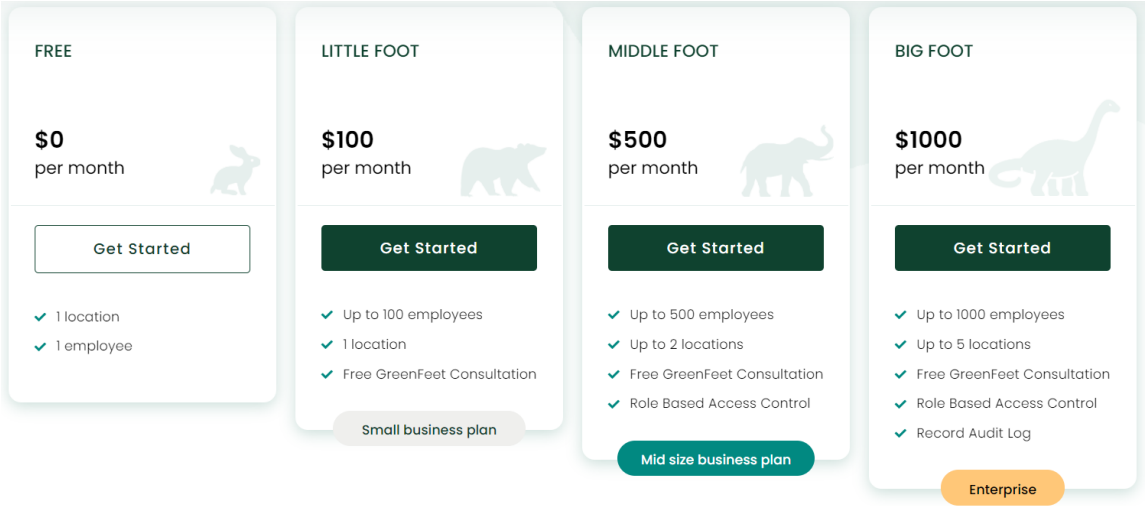


Figure 15, Greenfeer plans and fees

12.1.1.2. Normative

Normative measures the company's emissions and identifies hotspots. The carbon specialists use this intelligence to create a tailored reduction plan – and a climate investment strategy for what you can't reduce. Given so, the company offers a full carbon footprint, a Hotspot Analysis, and a Carbon Expert Help.

Normative's carbon accounting engine works essentially by 3 steps, which are:

1. Import data for future analysis
2. Calculate Carbon emissions
3. Get directions/advice in the form of an emission analysis report.

Below are the company plans[10]. Unfortunately, Normative does not disclose their fees.

10

Website:https://normative.io/?gclid=Cj0KCQiAzMGNBhCyARIsANpUkzPG0iAFIMyrqctqlPUFeBlJ-TNfhP9Lr_qIeYcDGxAsZXpWTjv5hMcaApRREALw_wcB
Contact: info@normative.io

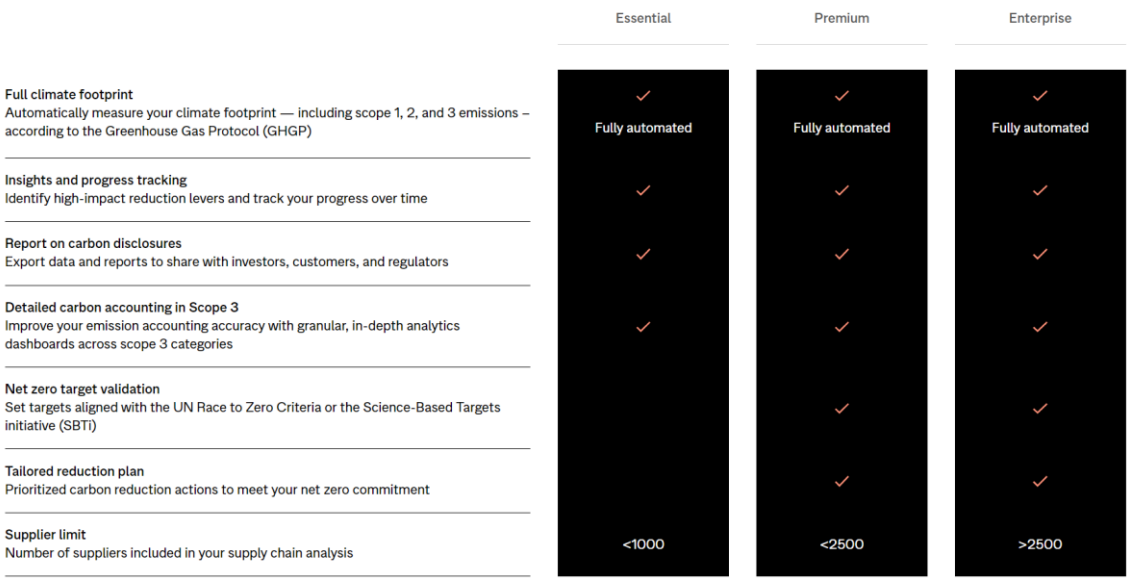


Figure 16, Normative measure plans

Given so, the group is certain that BERCO would benefit from working with one of the mentioned companies, or other companies, to have a Footprint Analysis, and if necessary, implement some measures to improve their environmental impact. The team is also convinced it would be in the company's interest to disclose this information on their website. Besides showing transparency to BERCO costumers, it demonstrates that the company is also worried with the environment and their commitment towards it.

Furthermore, the team believes this bullet point and the ESG analysis can be added and mixed in the website disclosure.

12.1.2. BERCO could develop an ESG analysis

BERCO could develop an ESG analysis and present it on the company's website by creating a separate submenu.

This disclosure is vital to companies, because nowadays, the importance of Environmental, Social and Governmental aspects of a company, is only growing. This will have a major impact on the company's image to the public.

An ESG disclosure is fundamentally showing some information to the public regarding three aspects of the company, the Environmental, Social and Governance (policies) of a company. The next three bullet points explain their meaning in more detail.

Environmental

Environmental criteria may include a company's energy use, waste, pollution, natural resource conservation, and treatment of animals. The criteria can also be used in

evaluating any environmental risks a company might face and how the company is managing those risks.

For example, there might be issues related to its ownership of contaminated land, its disposal of hazardous waste, its management of toxic emissions, or its compliance with governmental environment regulations.

Social
Social criteria look at the company's business relationships. Does it work with suppliers that hold the same values as it claims to hold? Does the company donate a percentage of its profits to the local community or encourage employees to perform volunteer work there? Do the company's working conditions show high regard for its employees' health and safety? Are other stakeholders' interests considered?

Governance
About governance, investors may want to know that a company uses accurate and transparent accounting methods and that stockholders are allowed to vote on important issues.

They may also want assurances that companies avoid conflicts of interest in their choice of board members, don't use political contributions to obtain unduly favorable treatment and, of course, don't engage in illegal practices.

This disclosure can be done through the company's website, and to fulfil the new product disclosure obligations, financial entities must classify the products they manufacture or advise on into three categories:

- Mainstream products.
- Products promoting environmental or social characteristics.
- Products with sustainable investment objectives.

12.1.3. Encourage employees to take an ecological footprint survey

In order to increase BERCO's ecological responsibility, it would be an innovative idea for the company to suggest a survey to its employees to analyze the ecological footprint of each other.

The team found a website [11]where people can do this survey.

[11] The website is: http://www.footprintcalculator.org/home/en

Unfortunately, this first option doesn't include the survey in Dutch, but it gives a wide and very interesting results. It allows you to know:

- Your "personal Earth Overshoot Day", which means, the day which you have used the environmental resources you should have spent in a year
- The number of "Earths" that would be necessary if everyone was like the person taking the survey
- A detailed analysis of your individual ecological footprint
- Information about every country average ecological footprint
- It also gives some solutions every person can take, individually.

The advice given isn't mandatory by law, but it might be in the company's interest if the management wants to show consciousness for the environment.

12.1.4. BERCO could join the European Raw Material Alliance

The European Raw Material Alliance [12]– ERMA – was announced in September 2020, as part of an Action Plan on Critical Raw Materials.
ERMA has some main goals, which are:

- Establish an agile and inclusive stakeholder consulting process.
- Support EU industrial policy to mitigate regulatory and financing bottlenecks.
- Set up a Raw Materials Investment Platform (RMIP) to help leverage investments in a pipeline of key projects.
- Foster a deeper strategic awareness, including public acceptance of and forward-looking perspective on the role of raw and advanced materials in the transition to the Green and Digital Economy.

The ERMA aims to make Europe economically more resilient by diversifying its supply chains, creating jobs, attracting investments to the raw materials value chain, fostering innovation, training young talents, and contributing to the best enabling framework for raw materials and the Circular Economy worldwide.

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[12] Contact:
Email: erma@eitrawmaterials.eu
The link to join the European Raw Material Alliance is the following:
https://erma.eu/about-us/join-erma/
Participation is open to all stakeholders and is free of charge. Services as outlined above will be charged on an individual basis.
For more information, visit the organization's website: https://erma.eu/

The ERMA has two major workstreams, which are:

1. Value chain-specific consultation processes:

    a. Identify and respond to raw material challenges along industrial ecosystems and within the wider society
    b. Provide tailored solutions to industry needs
    c. Unlock regulatory bottlenecks
    d. Promote stakeholders' strong engagement and commitment through an open process

2. Investment channel for raw materials projects:

    a. Select and prioritize cases to secure primary and secondary raw materials supply for European industrial ecosystems
    b. Install Raw Materials Investment Platform (RMIP) to bring investors and investees together
    c. Define case-specific financing strategies and mechanisms
    d. Assess EU funding opportunities and financing sources for investment opportunities inside and outside Europe

In the groups opinion, it would be beneficial for BERCO to work with ERMA, since it would be one more raw material supply, and the company would be working with an organization which provides tailored solutions to industry and unlocks regulatory bottlenecks.

12.1.5. BERCO can participate in the EU Industry days

BERCO can participate in the EU Industry days[13]: it stimulates discussions across industrial ecosystems on their green and digital pathways, to strengthen the resilience of EU companies and SMEs.

[13] If the company wants to host an event, they can apply until 28 November 2021 23:59 CET in the following link:
https://ec.europa.eu/eusurvey/runner/EUIndustryWeekLocalEvent
For more information about the event, contact:
EU-INDUSTRY-DAY@ec.europa.eu
Or visit the EU website by the following link:
https://ec.europa.eu/info/policies/business-and-industry/eu-industry-days/eu-industry-days-2022-stakeholder-sessions_en

The main topics of the sessions should be:

- The green and digital transition,
- Resilience,
- Youth in Industry.

It will take place in Brussels between 8 and 11 February (2022). It is the main platform to discuss industrial challenges and jointly develop opportunities and policy responses in a broad dialogue with a wide range of stakeholders.
All organizers are free to structure local events in their preferred format and duration.

Examples include but are not limited to:

- Virtual workshops
- Seminars
- Open doors (virtual plant/factory tour)
- Business presentations; training courses
- Job and education fairs
- Other events organised in partnership with other businesses, economic development groups and universities or training centres

The European Commission will select up to 18 stakeholder meetings on the themes of the EU Industry Days 2022. The selection will be made on the basis of the following criteria:

- Relevance to the themes of the EU Industry Days 2022
- European relevance (i.e., no purely national themes)
- Dynamic and interactive formats that allow for engagement with participants.
- The following criteria are considered beneficial and are encouraged
- Appropriate geographical and gender balance of speakers
- Inclusion of young speakers/panellists/other roles (under 30 years of age).

Commission Support:

- Each selected session will be allocated an up to 90-minute timeslot on the agenda and will feature as part of the EU Industry Days official programme on the website and other related materials.
- The sessions will be virtual, and we will provide technical and IT support. We will provide successful candidates with more details of the setting at a later stage.

- We will promote the session through the EU Industry Days communication channels
- Promotion of the results: The curators and hosts of the sessions shall submit short summaries of the sessions, which may be used in the Commission's future communication about the European Industry Days.
- A studio at the venue in Brussels may be made available for the session (we will provide more details at a later stage). Nevertheless, the audience will still be attending the session online.
- For technical reasons, there will be a maximum number of speakers (we will provide more details at a later stage).

Note: This advice was delivered to the company in October, it was kept here for the record.

12.2. Environmental impact

12.2.1. Carpet waste problem

As seen throughout the LCA, one of the most worrying issues for BERCO is what to do with carpet waste. The lack of a recycling market in this sector means that carpet waste has a major environmental impact. Even though this market is expected to grow in the coming years, some companies such as ISOPREP[14] are already investigating this problem and have found a solution by which polypropylene, one of the main materials in carpets, can be extracted. The study has concluded that by using certain types of solvents, polypropylene can be extracted and reused in future carpets as new virgin material. The project team also thought of other ways to make use of this material. For example by shredding it and using it as stuffing for mattresses, pillows, or cuddly toys, or to transform it into a harder and more resistant material, which could be used for the manufacturing of furniture, or for foundations.

[14] Webside: A sustainable solution to challenges of the circular economy - ISOPREP

12.2.2. Energy consumption of BERCO

Figure 17, Barco's solar panel installation

BERCO is already doing an amazing job on being energy efficient. All buildings are equipped with LED lighting and motion sensors to trigger the lighting in rooms that are not commonly used (toilets, meeting rooms) which safes a lot of energy annually. In addition, Figure 17 shows that BERCO has installed solar panels on most of the factory roofs. This enables the company to not only create energy for their own production processes, because these solar panels generate more electricity than needed. Therefore, BERCO can feed the excess energy into the common energy cycle to create an additional stream of income, drastically reduce energy costs and it is a forerunner for other companies to also use their roof area for energy generation. Hence, the only advice that can be given to BERCO in regards to their energy usage and generation is to continue on their current strive for saving more energy and being as sustainable as possible.

12.1.3. Recyclable and beneficial carpet compositions

During the visits to the company, the project team had many talks with the company coach, Marijn Hermans. In these talks it became apparent that there are new carpet types that are recyclable and environmentally beneficial in the decomposing process at the end of their life cycle. BERCO is already hard at work to convince automotive manufacturers to switch to these carpet types. Despite the efforts of BERCO and the carpet supplier CONDOR, most car manufacturers still choose to order the old and mostly non-recyclable carpet compositions. This has probably several reasons, but the most influential reason is the higher cost of the newer and environmentally beneficial carpets. Even though the price difference does not seem significant for one set of carpets (two carpets in the front and two in the back of the car form a set), the sheer mass of sets that are being ordered make a huge difference in costs. This means, unless the automotive suppliers become more conscious of their sustainability measures in the lower parts of the supply chain, there will not be an impactful change to the current

orders of carpet compositions that BERCO receives from their customers. On the other hand, the carpet suppliers are also trying to develop cheaper and better compositions to make the change to more sustainable carpets easier for automotive manufacturers. Sadly, this decision variable of making the car carpet market more sustainable cannot be influenced directly by BERCO. Nevertheless, they can still continue to try and persuade OEMs to switch to better carpet compositions even though they are not the best economical, but the more sustainable choice.

12.3. Conclusion on the project methodology

As mentioned in paragraph 8.3, the project team started off by choosing the Lean methodology as their set of principles. Over the course of the project, the team started to deviate from this methodology, because it became clear, that the set of principles of this methodology is hard to apply to the project structure. In hindsight, the project team should have looked for another project methodology that would be more fitting to ensure that the project would be successful, but since the project team was confident in the current state of the project and with their self-created set of principles (paragraph 8.4), the team continued on their current trajectory. Furthermore, the risks for not using a pre-defined methodology (paragraph 8.5) were all circumvented apart from the problem of excessive workload splitting. The individual team members had trouble to combine all parts of the report, which were individually worked on, into one concise report. This could have been prevented by having more detailed internal meetings to inform all team members about their individual progress.

To put in a nutshell, the team is pleased by how the project turned out, but the team is aware that it would have been beneficial to work by a pre-defined methodology, because it would have ensured that the project would have been on the right trajectory from the start and that the mentioned problem would not have occurred in the process.

12.4. Meeting the pre-defined goals

All in all, the team members are happy with the result of all the research and the results. The four goals that have been defined in the scope in paragraph 6 have all been worked on successfully in the past months. Since the team has sent several iterations of their work to the project- and company coach, it was clear that the team was steering the project in the right direction that would ultimately lead to a successful project. The goals of paragraph 6 have been met by the following solutions:

Goal 1 & 2: The team has researched a variety of upcoming environmental legislations and has created a detailed list of advice. The results and findings have been written down in a very detailed PDF document that is part of the set of documents that are

handed in at the end of the project. In addition, the team included the most important findings to this report in paragraph 9 and the list of advice on how to handle these upcoming regulations and also the benefits for implementing the advice that has been given can be found in paragraph 12.1.

Goal 3 & 4: During the project, the has conducted a Life Cycle Assessment to ultimately find the environmental footprint of the five most produced carpets by BERCO. This was done in paragraph 11 by following the four steps of an LCA. The results were implemented by using graphs and tables that were created in Excel. Furthermore, the team has made the results as clear and concise as possible to make them understandable for everyone. The team is very happy with the outcome of the LCA, since the was limited and some parts had to be cut short in order to finish the final report in time. As a sidenote, all Excel documents are part of the set of documents that are being handed in by the team at the end of the project.

12.5. Final thought

To sum up the entire project, the team is very happy about the outcome of the project and about the valuable experience that has been obtained over the last few months. Furthermore, the team has gained a lot of insight on how to conduct research, visualize results, the inner workings of an automotive supplier and much more. During the project the team has also learned by the mistakes that were made, for example the lack of communication after splitting the workloads to the individual team members as explained in paragraph 12.3 and also the lack of presence at the company in the first weeks of the project.

As a final word, the team is very thankful for the project coach Luc Claessens and the company coach Marijn Hermans for their great help during the project and for giving the project team advice if there were any questions that needed answering.

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ISO 14064-1:2018 Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.

Car and Airplane (per person) g of CO2 / km

https://projekt-enera.de/blog/wie-viel-co2-verbraucht-ein-auto/

Train g of CO2 / km / person

https://www.tagesspiegel.de/wirtschaft/vorsprung-beim-klimaschutz-so-viel-co2-stoesst-ein-bahnfahrer-aus/25383050.html

Distance to moon

https://spaceplace.nasa.gov/moon-distance/en/

Earth circumference

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Average CO2 US household
https://www.ccfpd.org/Portals/0/Assets/PDF/Facts_Chart.pdf

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Carbon Savings Achieved by Recycling

Carbon Saving achieved by Recycling (cbalance.in)

Recycling carpet company

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14. List of documents and their contents

The team has created separate documents that are partly included in this final report document. For more information, these documents can also be reviewed:

- **Final report:** *contains all information in a concise manner*
- **Excel document "Carpet compositions and CO2 equivalents":** *It contains a visual representation of in the form of an interactive Dashboard. Additionally, it contains most of the calculations that have been made to be able to create the graphs. Lastly, it also contains the conversions of CO2 equivalents to more understandable values.*
- **Excel document "Gantt Chart":** *contains the Gantt Chart that the team has created.*
- **Excel document: "PROCESS FLOW Berco Car Carpets**": *It contains the process flow diagrams that were created during the research of the second part of the LCA (LCI – Life Cycle Inventory analysis).*
- **Excel document "Total CO2 of wasted carpet":** *It contains a Table that calculates the total number of CO2 equivalents of the carpet waste that has been produced by BERCO in 2020.*
- **PDF document "Upcoming Environmental Legislations":** *This document contains the entire research that has been conducted on the topic of upcoming environmental legislations, including more detailed explanations and further information that is not included in the final report document.*

APPENDIX A Calculation of CO2 Equivalents

The group is going to calculate CO2 equivalents of the components of the carpets. For this purpose, by means of the combustion reaction generated by burning the components, it was researched how many grams of CO2 gases are emitted into the atmosphere when 100g of each of the components is burnt.

To achieve this, the number of moles in 100g of each material is first calculated. The molar weight is used to perform this operation.
Afterwards, the combustion reaction, which is properly balanced, is used to calculate the moles of CO2 produced with the previously calculated moles of the component.
Finally, once again using the molecular weight, this time of CO2, the team converts the result from moles to grams.

Once this is known, the CO2 equivalents of the components of the 5 most used carpets by the company will be calculated.

Molar weights:

$C_{10}H_8O_4$ → 192 g/mol
C_2H_4 → 28 g/mol
$C_6H_{10}O_2$ → 114 g/mol
C_5H_8 → 68 g/mol
$C_6H_{11}ON$ → 113 g/mol
CO_2 → 44 g/mol

PES

$$C_{10}H_8O_4 + 10\ (O_2 + 3{,}76\ N_2) \rightarrow 10\ CO_2 + 4H_2O + 37{,}6\ N_2$$

$$100g\ \mathrm{C10H8O4} \times \frac{1\ mol\ \mathrm{C10H8O4}}{192\ g\ \mathrm{C10H8O4}} = 0{,}5208\ mol\ \mathrm{C10H8O4}$$

$$0{,}5208\ mol\ \mathrm{C10H8O4} \times \frac{10\ mol\ \mathrm{CO2}}{1\ mol\ \mathrm{C10H8O4}} = 5{,}208\ mol\ \mathrm{CO2}$$

$$5{,}208\ mol\ \mathrm{CO2} \times \frac{44\ g\ \mathrm{CO2}}{1\ mol\ \mathrm{CO2}} = 229{,}17\ g\ \mathrm{CO2}$$

$$229{,}17\ g\ \mathrm{CO2} \div 100 = 2{,}2917\ g\ \mathrm{CO2}$$

1 g of PES produce 2,2917 g of CO_2

LDPE

$$C_2H_4 + 3\ (O_2 + 3{,}76\ N_2) \rightarrow 2\ CO_2 + 2\ H_2O + 11{,}28\ N_2$$

$$100g\ \mathrm{C2H4} \times \frac{1\ mol\ \mathrm{C2H4}}{28\ g\ \mathrm{C2H4}} = 3{,}57\ mol\ \mathrm{C2H4}$$

$$3{,}57\ mol\ \mathrm{C2H4} \times \frac{2\ mol\ \mathrm{CO2}}{1\ mol\ \mathrm{C2H4}} = 7{,}14\ mol\ \mathrm{CO2}$$

$$7{,}14\ mol\ \mathrm{CO2} \times \frac{44\ g\ \mathrm{CO2}}{1\ mol\ \mathrm{CO2}} = 314{,}286\ g\ \mathrm{CO2}$$
$$314{,}286\ g\ \mathrm{CO2} \div 100 = 3{,}1429\ g\ \mathrm{CO2}$$

1 g of LDPE produce 3,1429 g of CO_2

EVA

$$C_6H_{10}O_2 + 7{,}5\ (O_2 + 3{,}76\ N_2) \rightarrow 6\ CO_2 + 5\ H_2O + 28{,}2\ N_2$$

$$100g\ \mathrm{C6H10O2} \times \frac{1\ mol\ \mathrm{C6H10O2}}{114\ g\ \mathrm{C6H10O2}} = 0{,}877\ mol\ \mathrm{C6H10O2}$$
$$0{,}877\ mol\ \mathrm{C6H10O2} \times \frac{6\ mol\ \mathrm{CO2}}{1\ mol\ \mathrm{C6H10O2}} = 5{,}262\ mol\ \mathrm{CO2}$$
$$5{,}262\ mol\ \mathrm{CO2} \times \frac{44\ g\ \mathrm{CO2}}{1\ mol\ \mathrm{CO2}} = 231{,}528\ g\ \mathrm{CO2}$$
$$231{,}528\ g\ \mathrm{CO2} \div 100 = 2{,}3153\ g\ \mathrm{CO2}$$

1 g of EVA produce 2,3153 g of CO_2

LATEX

$$C_5H_8 + 7\ (O_2 + 3{,}76\ N_2) \rightarrow 5\ CO_2 + 4\ H_2O + 26{,}32\ N_2$$

$$100g\ \mathrm{C5H8} \times \frac{1\ mol\ \mathrm{C5H8}}{68\ g\ \mathrm{C5H8}} = 1{,}47\ mol\ \mathrm{C5H8}$$
$$1{,}47\ mol\ \mathrm{C6H10O2} \times \frac{5\ mol\ \mathrm{CO2}}{1\ mol\ \mathrm{C5H8}} = 7{,}35\ mol\ \mathrm{CO2}$$
$$7{,}35\ mol\ \mathrm{CO2} \times \frac{44\ g\ \mathrm{CO2}}{1\ mol\ \mathrm{CO2}} = 323{,}4\ g\ \mathrm{CO2}$$
$$323{,}4\ g\ \mathrm{CO2} \div 100 = 3{,}234\ g\ \mathrm{CO2}$$

1 g of LATEX produce 3,234 g of CO_2

PA

$$C_6H_{11}ON + 8{,}25\ (O_2 + 3{,}76\ N_2) \rightarrow 6\ CO_2 + 5{,}5\ H_2O + 31{,}02\ N_2$$

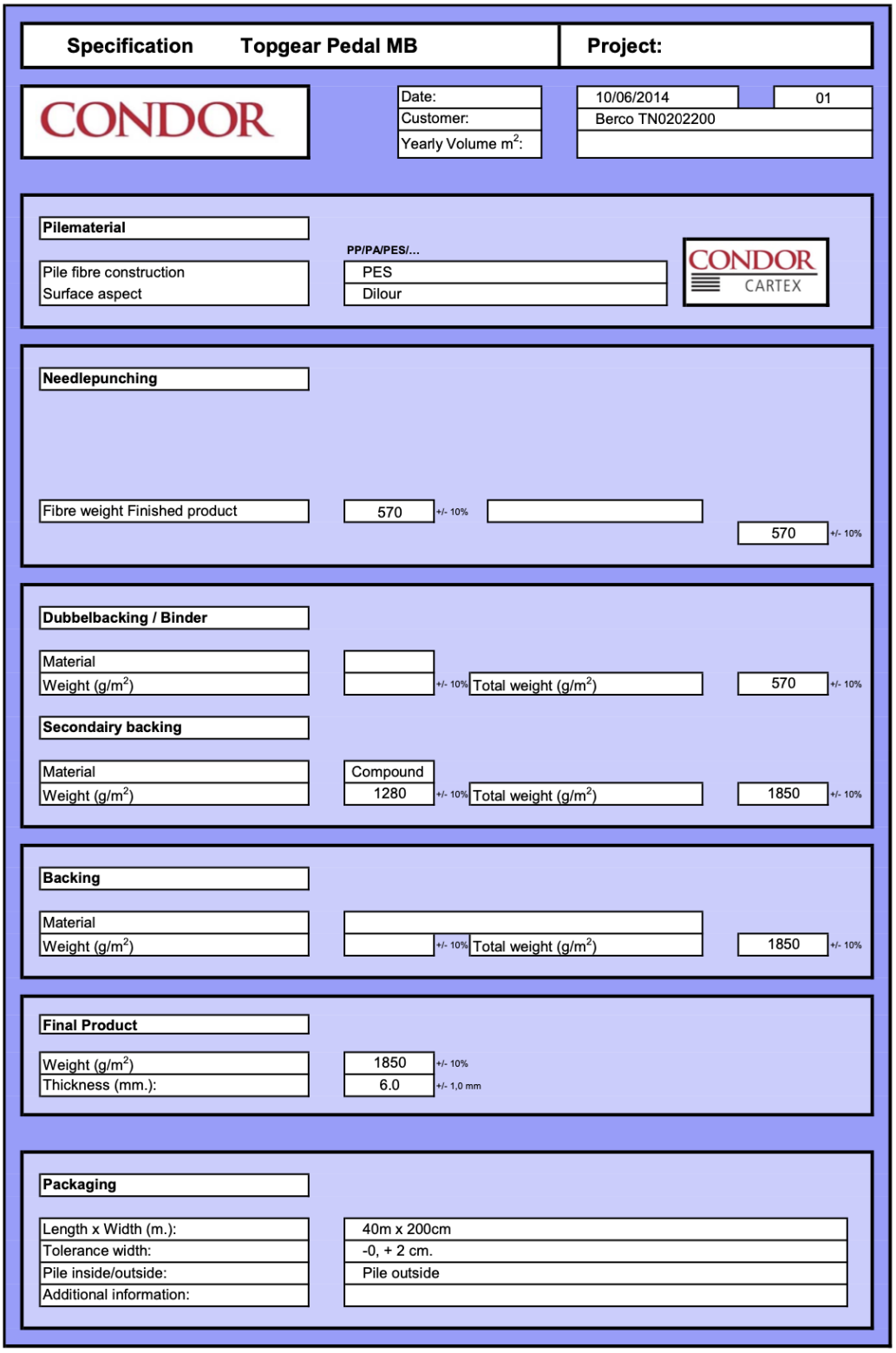
$$100g\ \mathrm{C6H11ON} \times \frac{1\ mol\ \mathrm{C6H11ON}}{113\ g\ \mathrm{C6H11ON}} = 0{,}885\ mol\ \mathrm{C6H11ON}$$
$$0{,}855\ mol\ \mathrm{C6H11ON} \times \frac{6\ mol\ \mathrm{CO2}}{1\ mol\ \mathrm{C6H11ON}} = 5{,}31\ mol\ \mathrm{CO2}$$
$$5{,}31\ mol\ \mathrm{CO2} \times \frac{44\ g\ \mathrm{CO2}}{1\ mol\ \mathrm{CO2}} = 233{,}63\ g\ \mathrm{CO2}$$
$$233{,}63\ g\ \mathrm{CO2} \div 100 = 2{,}3363\ g\ \mathrm{CO2}$$

1 g of PA produce 2,3363 g of CO_2

APPENDIX B Carpet Composition PDF files

These PDF files contain the composition and the production steps of the respective carpet.

Carpet 1: TN0202200 – Topgear Pedal MB



Specification	Topgear Pedal MB	Project:	
CONDOR	Date:	10/06/2014	01
	Customer:	Berco TN0202200	
	Yearly Volume m^2:		

Pilematerial	PP/PA/PES/...	
Pile fibre construction	PES	CONDOR CARTEX
Surface aspect	Dilour	

Needlepunching				
Fibre weight Finished product	570	+/- 10%		570 +/- 10%

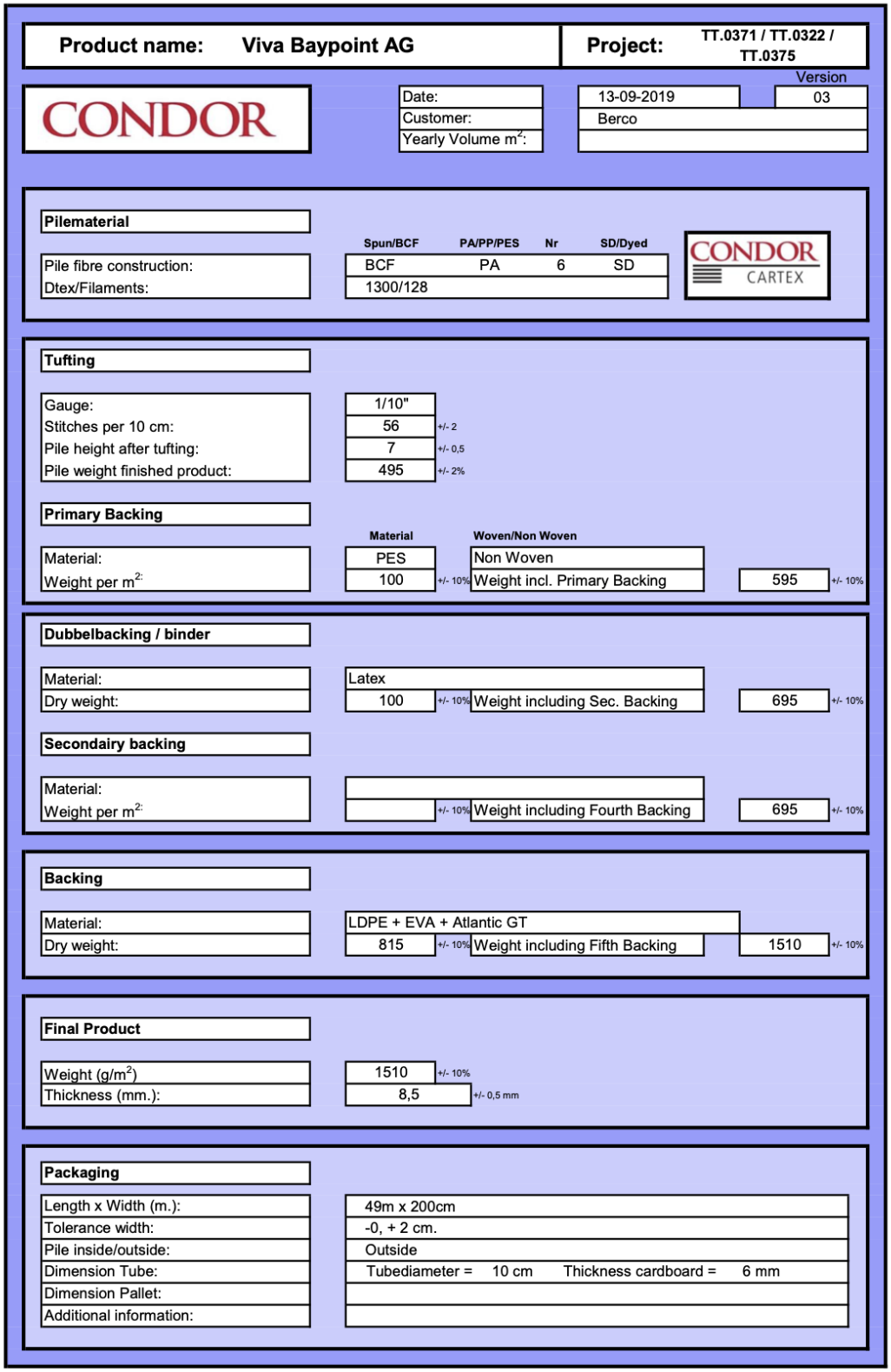
Dubbelbacking / Binder					
Material					
Weight (g/m^2)		+/- 10%	Total weight (g/m^2)	570	+/- 10%
Secondairy backing					
Material	Compound				
Weight (g/m^2)	1280	+/- 10%	Total weight (g/m^2)	1850	+/- 10%

Backing					
Material					
Weight (g/m^2)		+/- 10%	Total weight (g/m^2)	1850	+/- 10%

Final Product		
Weight (g/m^2)	1850	+/- 10%
Thickness (mm.):	6.0	+/- 1,0 mm

Packaging	
Length x Width (m.):	40m x 200cm
Tolerance width:	-0, + 2 cm.
Pile inside/outside:	Pile outside
Additional information:	

Carpet 2: TT0371200 – Viva Baypoint AG



Product name:	Viva Baypoint AG	Project:	TT.0371 / TT.0322 / TT.0375
			Version
CONDOR	Date:	13-09-2019	03
	Customer:	Berco	
	Yearly Volume m²:		

Pilematerial

	Spun/BCF	PA/PP/PES	Nr	SD/Dyed
Pile fibre construction:	BCF	PA	6	SD
Dtex/Filaments:	1300/128			

CONDOR CARTEX

Tufting

Gauge:	1/10"	
Stitches per 10 cm:	56	+/- 2
Pile height after tufting:	7	+/- 0,5
Pile weight finished product:	495	+/- 2%

Primary Backing

	Material		Woven/Non Woven		
Material:	PES		Non Woven		
Weight per m²:	100	+/- 10%	Weight incl. Primary Backing	595	+/- 10%

Dubbelbacking / binder

Material:	Latex				
Dry weight:	100	+/- 10%	Weight including Sec. Backing	695	+/- 10%

Secondairy backing

Material:					
Weight per m²:		+/- 10%	Weight including Fourth Backing	695	+/- 10%

Backing

Material:	LDPE + EVA + Atlantic GT				
Dry weight:	815	+/- 10%	Weight including Fifth Backing	1510	+/- 10%

Final Product

Weight (g/m²)	1510	+/- 10%
Thickness (mm.):	8,5	+/- 0,5 mm

Packaging

Length x Width (m.):	49m x 200cm
Tolerance width:	-0, + 2 cm.
Pile inside/outside:	Outside
Dimension Tube:	Tubediameter = 10 cm Thickness cardboard = 6 mm
Dimension Pallet:	
Additional information:	

Carpet 3: TT3771200 – Twist 780 tuft b lam

Product name:	**Twist 780 tuft b lam**	**Project:**	**TT.3771.200 (Charcoal Solid)** **TT.3772.200 (Blond)**

CONDOR

		Version
Date:	07-05-2018	03
Customer:	Berco	
Yearly Volume m^2:		

Pilematerial

	Spun/BCF	PA/PP/PES	Nr	SD/Dyed
Pile fibre construction:	BCF	PA	6	SD
Dtex/Filaments:	950/68*2			

CONDOR CARTEX

Tufting

Gauge:	1/10"	
Stitches per 10 cm:	58	+/- 2
Pile height after tufting:	6,5	+/- 0,5
Pile weight finished product:	780	+/- 2%

Primary Backing

	Material		Woven/Non Woven		
Material:	PES		Non Woven		
Weight per m^2:	100	+/- 10%	Weight incl. Primary Backing	880	+/- 10%

Dubbelbacking / binder

Material:	Precoat				
Dry weight:	490	+/- 10%	Weight including Sec. Backing	1370	+/- 10%

Secondairy backing

Material:					
Weight per m^2:		+/- 10%	Weight including Fourth Backing	1370	+/- 10%

Backing

Material:	LDPE + EVA + Tuftbacking				
Dry weight:	620	+/- 10%	Weight including Fifth Backing	1990	+/- 10%

Final Product

Weight (g/m^2)	1990	+/- 10%
Thickness (mm.):	8,5	+/- 0,5 mm

Packaging

Length x Width (m.):	40m x 200cm
Tolerance width:	-0, + 2 cm.
Pile inside/outside:	Outside
Dimension Tube:	Tubediameter = 10 cm Thickness cardboard = 6 mm
Dimension Pallet:	
Additional information:	

Carpet 4: TT3461200 – Veron single loop uni Charcoal Solid Tuft Backing TB

Product name:	**Veron single loop uni Charcoal Solid Tuft Backing TB**	**Project:**	**TT.3461.200 (Charcoal Solid) TT.3462.200 (Blond)**

CONDOR

		Version
Date:	30-08-2017	01
Customer:	Berco	
Yearly Volume m^2:		

Pilematerial

	Spun/BCF	PA/PP/PES	Nr	SD/Dyed
Pile fibre construction:	BCF	PA	6	SD
Dtex/Filaments:	1300/168*2			

CONDOR CARTEX

Tufting

Gauge:	1/10"	
Stitches per 10 cm:	61	+/- 2
Pile height after tufting:	4,5	+/- 0,5
Pile weight finished product:	765	+/- 2%

Primary Backing

	Material		Woven/Non Woven		
Material:	PES		Non Woven		
Weight per m^2:	100	+/- 10%	Weight incl. Primary Backing	865	+/- 10%

Dubbelbacking / binder

Material:	Precoat				
Dry weight:	490	+/- 10%	Weight including Sec. Backing	1355	+/- 10%

Secondairy backing

Material:					
Weight per m^2:		+/- 10%	Weight including Fourth Backing	1355	+/- 10%

Backing

Material:	LDPE + EVA + Tuftbacking				
Dry weight:	620	+/- 10%	Weight including Fifth Backing	1975	+/- 10%

Final Product

Weight (g/m^2)	1975	+/- 10%
Thickness (mm.):	8,0	+/- 0,5 mm

Packaging

Length x Width (m.):	48m x 200cm
Tolerance width:	-0, + 2 cm.
Pile inside/outside:	Outside
Dimension Tube:	Tubediameter = 10 cm Thickness cardboard = 6 mm
Dimension Pallet:	
Additional information:	