SWEDISH
LIFE CYCLE
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Environmental footprint in Sweden – increased competence and communication

Lessons learned of working with Product Environmental Footprint

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Authors: Sara Palander, Swedish Life Cycle Center; Katarina Lorentzon, RISE; Torun Hammar, RISE; Karin Sanne, IVL; Johan Nilsson, IVL; Lisa Hallberg, IVL; Björn Spak, Swedish EPA
Layout: Technical secretariat, Swedish Life Cycle Center (Chalmers University of Technology)
Contact: lifecyclecenter@chalmers.se

Summary

The need to communicate the environmental impact of products in a credible way from a life cycle perspective is increasing. Part of the European Commission's initiative "Single Market for Green Products" aims to facilitate better information on the environmental performance of products and organisations. Product Environmental Footprint (PEF) and Organisation Environmental Footprint (OEF) are two methods that were developed in 2013 and have since been tested, evaluated, and developed. These methods are still being developed, and policies and legislative proposals are emerging based on PEF.

In 2021 the project "Environmental footprint in Sweden – increased competence and communication" was set up to coordinate the work among life cycle professionals in Sweden for both learning and impact on the development of Product Environmental Footprint. The project was created within the Swedish Life Cycle Center with funding from Vinnova.

The project has resulted in an increased understanding of the Environmental Footprint in Swedish industry and the public sector. Stakeholders have gained insight into both the Product Environmental Footprint methodology, and the policy and legislative processes around Environmental Footprints. Furthermore, a broadened representation in the European Commission's Environmental Footprint Technical Advisory Board (TAB) and a better understanding on how to perform a PEF study through examples from a steel product and a paper product.

Effects from the project so far are broadened competence, increased knowledge and better visibility of Environmental Footprints in Sweden and internationally. As well as a closer dialogue among both LCA and sustainability professionals.

Contents

Project information

This report was written within the project Environmental Footprint in Sweden – increased competence and communication, managed within the Swedish Life Cycle Center with funding from Vinnova, Sweden's innovation agency. The project started on November 1, 2020, and ended on December 31, 2021.

The report was written to give the reader insights of the learnings from the project, including performed case studies, with the aim to improve and share knowledge of the PEF methodology, its application and insights in ongoing policy work.

Project title

Environmental footprint in Sweden – increased competence and communication (In Swedish: Miljöavtryck i Sverige – ökad kompetens och spridning)

Funded by

Vinnova, Sweden's Innovation Agency, with in-kind contribution from SSAB, Stora Enso, Swedish Environmental Protection Agency

Aim

a) Coordinate Sweden's work on Product Environmental Footprint (PEF)
b) Engage Swedish actors in PEF
c) Give Swedish actors a better understanding of the methodological issues in PEF and the PEF policy development
d) Impact the PEF method development

Project manager

Sara Palander, Swedish Life Cycle Center

Coordination of the project

The project has been coordinated by Swedish Life Cycle Center, a national center of excellence for the advance of credible and applied life cycle thinking in industry and other parts of society.

Project management team

Björn Spak, Swedish Environmental Protection Agency; Karin Sanne, IVL Swedish Environmental Research Institute; Katarina Lorentzon, RISE Research Institutes of Sweden and Torun Hammar, RISE Research Institutes of Sweden

Time period

2020-11-01 – 2021-12-31

Acknowledgements

We would like to thank all organisations and people who have contributed to this project and report. A special thanks to Vinnova, Sweden's Innovation Agency for making this important project possible, and to SSAB, Stora Enso and organisations within the Swedish Life Cycle Center's Environmental Footprint Expert group for invaluable contributions with in-kind, competence and engagement!

About Swedish Life Cycle Center

Swedish Life Cycle Center is a joint collaboration platform for universities, industries, research institutes and government agencies for the competence building and exchange of experience to move the life cycle field forward. Current partners are Chalmers University of Technology (host of the center), KTH Royal Institute of Technology, Swedish University of Agricultural Sciences, Swedish Environmental Protection Agency, Electrolux, Essity, Nouryon, Polestar, Vattenfall, Volvo Car Group, Volvo Group, IVL Swedish Environmental Research Institute and RISE Research Institutes of Sweden. For more information about Swedish Life Cycle Center, please visit www.lifecyclecenter.se.

1. Introduction to Environmental Footprint

The need to communicate the environmental impact of products in a credible way from a life cycle perspective is increasing. Several ecolabels and different ways of communicating the environmental impact of products exist and the European Commission has therefore identified a need to develop a common methodology for companies to build their environmental claims on. The overall aim of this common method, called Environmental Footprint, is to reduce the environmental impact of consumption and production in Europe by helping companies to calculate their environmental performance and manufacture more environmentally friendly products.

The Environmental Footprint measure and communicate the environmental performance of products (both goods and services) and organisations across their whole life cycle, from raw material extraction or growing to the end-of-life management, via production, distribution and use. The Environmental Footprint includes two methods: Product Environmental Footprint (PEF) and Organisation Environmental Footprint (OEF), which are both built on scientifically developed assessment methods that have been agreed upon at international level.

The methods cover 16 environmental impact categories, including climate change, and impacts related to water, air, resources, land use and toxicity. The general methods are complemented with product- or organisation- specific calculation rules enabling comparison of environmental performances between similar products or companies active in similar sectors (European Commission 2021).

2. Introduction to the project Environmental Footprint in Sweden

Background

Since the launch of the Single Market for Green Products Initiative by the European Commission, Swedish Life Cycle Center (a center of excellence for competence building and knowledge exchange in the field of life cycle thinking) has followed and to some extent participated in the process and the development of the Environmental Footprint methods PEF and OEF. Swedish Life Cycle Center has experienced an increased need to better understand the process, the methodology and its application, but also a great interest in influencing the methodology based on the long experience of life cycle assessment (LCA) that exists in Sweden, among industry, academia, research institutes, industry associations and authorities. The Environmental Footprint expert group, within the center, also saw a need to coordinate the work in Sweden with the aim of developing knowledge about understanding of both methodology and policy development process among companies and authorities in Sweden.

To respond to this interest, the project Environmental Footprint in Sweden has been performed in close collaboration with partners in the Swedish Life Cycle Center and in the Environmental Footprint expert group, with funding from Vinnova, Sweden's innovation agency.

"It is important that Sweden is engaged in the development of Environmental Footprint"

Webinar participant, March 30, 2021.

Results

The project has resulted in an increased understanding of the Environmental Footprint in Swedish industry, government agencies and the public sector. Stakeholders have gained insight into both the Environmental Footprint methodology and the policy and legislative processes around Environmental Footprints. Through the project, the Swedish representation in the European Commission's Environmental Footprint Technical Advisory Board (TAB) has been broadened and results from Swedish research was brought up on its agenda to contribute to the development of the methodology. The project has conducted two case studies with the aim of understanding the methodology, applied to specific products how a PEF study is conducted and its outcome. Furthermore, the aim of the case studies was also to get more companies to follow and take part in the work, discuss interpretations, methodological choices and results, and to learn from comparisons with Environmental Product Declarations (EPD). They also enabled companies that do not have in-house expertise and tools for life cycle assessment and are dependent on e.g., tools developed by an industry association to test PEF. In addition, the project has collaborated with other research projects and with other organisations, such as industry associations and research programs. The project has created forms and dialogue for collaboration in the Environmental Footprint field between experts and also gathered more stakeholders in the dialogue.

The project has carried out communication activities (workshops, webinars, news posts on social media, meetings, information materials and presentations, films), coordinated meetings between Swedish experts in TAB, and stakeholder meetings in the two case studies.

"The project has illustrated examples of and insights in methodological questions regarding the application of PEF"

Webinar participant, November 30, 2021.

Effects

Effects from the project have so far are broadened competence, increased knowledge and better visibility of environmental footprints in Sweden and internationally. This has been observed through more incoming requests, increased participation in activities related to the project and more followers in social media. Fithermore, the dialogue among experts from authorities, universities, research institutes, industry and industry associations have contributed to mutual learning and understanding. The project has also contributed to a closer dialogue with the European Commission's Environmental Footprint team and to the methodology development through increased participation in the TAB meetings and workshops.

3. Introduction to case studies

Within the project, two case studies were carried out. A stakeholder webinar/dialogue was conducted within each case study. Here we have gathered stakeholders from the industry and others gathered to participate and discuss interpretations and results. Both case studies used the guidelines for their specific product group, the Product Environmental Footprint Category Rules (PEFCR).

Environmental Product Declarations (EPDs) are recognized by companies that today in some way work with product-related environmental analysis. EPDs are based on life cycle assessment (LCA) and comply with internationally established systems for communicating the environmental impact of products and services in a life cycle perspective. Since Product Environmental Footprint (PEF) has important features in common with EPD, there was an identified interest from stakeholders and project participants to better understand these similarities and differences. Hence one of the case studies looked into this comparison.

There was an interest for conducting a PEF study from people with less experience and competence in life cycle assessment and in getting acquainted with a PEFCR where the impact on land use matters. Here, a tool developed for the specific industry was used to test the PEF method. This case study was supplemented with a webinar on biodiversity and on land use according to the LANCA method to get acquainted with different ways of calculating these impact categories and above all to understand difficulties, challenges and needs for further method development.

"This kind of project is a valuable way to engage in PEF and PEFCRs and are crucial to support the development and its application of PEF"

Webinar participant, November 30, 2021.

4. Product case of Stora Enso

Background and aim of the study

Stora Enso has prior experience in performing life cycle assessments, e.g. by calculating carbon footprints according to CEPIs (Confederation of European Paper Industries) Ten Toes framework and performing environmental product declarations according to the Paper Profile, a voluntary environmental declaration for Paper Profile member companies. However, calculations using the PEF methodology was fairly new to Stora Enso Paper Nymölla Mill. Therefore, Stora Enso expressed an interest to participate in the project.

The purpose with the Stora Enso case was to increase and share the knowledge of implementing PEF from an industry perspective through testing parts of the PEF method for one of Stora Enso's products using the PEFCR for intermediate paper products (European Commission, 2018). Evaluating experiences gained from different methodological frameworks were also part of the case study.

What has been studied?

In the case study, the PEFCR for intermediate paper products (European Commission, 2018) was applied to an offset paper roll produced in an integrated pulp and paper mill of Stora Enso (Nymölla Mill). As prescribed in the PEFCR, the functional unit was set to one metric tonne (1000 kg) of saleable paper at the paper mill gate with zero product lifetime. Also, to adhere to the PEFCR, the system boundaries included upstream and core processes (i.e. cradle to gate), while downstream processes after the paper mill gate were outside the system boundaries. The system boundaries are illustrated in Figure 1.

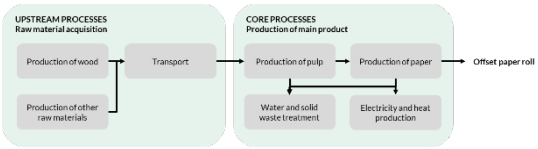


Figure 1. Simplified flow chart and system boundaries.

To perform the work, Stora Enso used the PEF calculating tool developed by CEPI, the European association representing the paper industry, and compared the results with those from previous calculations using CEPI Ten Toes framework. Although all default environmental impact categories from the PEF guidance (European Commission, 2017) were assessed, only climate change (including fossil, biogenic, land use and land use change emissions) and impact on land use using the LANCA® method (Beck et al 2010 and Bos et al 2016, in European Commission 2017), identified as of particular interest, were analysed in more detail.

Results

The environmental footprints "climate change" and "land use" are illustrated in Figure 2-3.

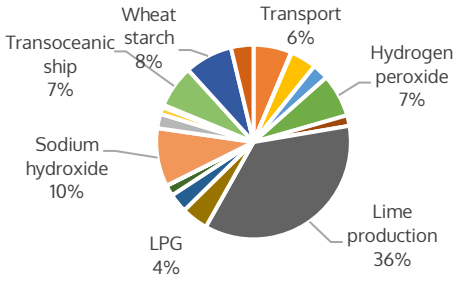


Figure 2. Environmental footprint climate change – total, i.e. including fossil, biogenic, land use and land use change as part of total.

The total climate impact was in line with previous results from the CEPI Ten Toes framework, and 99% of the total climate impact originated from fossil emissions. According to the PEFCR for intermediate paper, there are two options for modelling biogenic carbon dioxide (CO_2): (1) simplified modelling approach (biogenic carbon flows are not inventoried and characterization factor equals 0) or (2) standard modelling approach (biogenic carbon flows are inventoried and characterization factor equals 0), which was applied in this case study. Both modelling approaches disregards the fact that many biobased products, except paper, end up in long-lasting products and therefore actually store biogenic carbon. In a webinar with stakeholders to the case study, it was suggested to remove the simplified modelling approach from the PEFCR and to change the standard modelling approach so that biogenic CO_2 is both inventoried and attributed a characterization factor of -1 for biogenic carbon entering the system and 1 for biogenic carbon leaving the system, which would be in line with the provisions in EN15804:2012+A2:2019 (i.e. the core product category rules for construction products under the International EPD system).

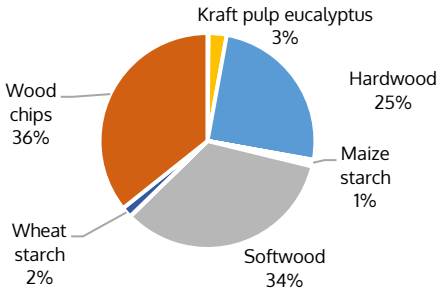


Figure 3. Environmental footprint from land use

The PEFCR for Intermediate Paper (European Commission 2018) claims that the results from the land use impact category calculated with the LANCA® method "are to be interpreted with caution as they may overestimate impacts" and that "results do not accurately reflect different forest management practices in semi-natural forests" (European Commission, 2018). This is due to the way the sub-indicators were rescaled and aggregated, how the reference status was defined and that current secondary datasets on forestry do not properly capture sustainable forest management practices. However, the LANCA® method is under development and an improved version is expected in 2023 (Horn, R,. personal communication, November 2021).

At the site of the integrated pulp and paper mill of Stora Enso Paper Nymölla, Gasum has a biogas plant built in partnership with Stora Enso. The biogas plant produces biogas from wastewater as a by-product that is sold externally. However, there are no provisions on how to allocate this kind of by-product in the PEFCR or PEF tool; neither the provisions on mass allocation for material by-products nor the energy allocation rules for heat and electricity are fully applicable. Hence, the PEF tool does not account for the biogas. However, in the case study, the provisions on compost and anaerobic digestion/wastewater treatment from the chapter on End of life (7.18.20) in PEF guidance version 6.3 (European Commission, 2017) was identified as applicable. Despite some limitations, the PEF tool was easy to use also for a non-LCA practitioner well acquainted with the production and the supply chain of the product. Occasionally, the PEFCR guide was consulted to ensure correct interpretation of nomenclature in the PEF tool, in this project with support from the researchers at RISE. However, considerable effort was needed to collect and verify all data required as input. Furthermore, it took time to interpret the results, and, of course, even more time will be required to make use of the results in e.g. sustainability management.

Conclusions

Thanks to the PEF tool, calculating the environmental footprint of intermediate paper was carried out by a sustainability engineer without previous experience from LCA and LCA software.

However, the tool has some limitations regarding modelling of biogas (a by-product from digestion of pulp wastewater) and data (some processes and raw materials are missing and some datasets are quite old).

Without the results from calculations according to CEPI Ten Toes framework, it would have been difficult to assesswhether the results were accurate, since there are no benchmark values included in the PEFCR for intermediate paper.

5. A comparison between PEF and EPD to declare the environmental impact of SSAB steel

Background and aim of the study

In this case study, the differences between the Environmental Product Declaration (EPD) framework and Product Environmental Footprint (PEF) were reviewed and analysed. SSAB is one of the leading producers of high-strength steel products. The EPD framework has so far been their primary method to analyse the environmental impacts of their products. Because the European Commission's initiative PEF is now aspiring to become the EU common framework for calculating environmental footprints, SSAB wanted to analyse the differences between the two frameworks. In this study, the main objects for comparison were:

i. Environmental indicators
ii. Allocation methods for steel scrap,
iii. Requirements for generic vs specific data and its impact on the LCA modelling of the product system, and
iv. Transition to low carbon steelmaking; what happens to the PEF/EPD when the cradle-to-gate global warming potential (GWP) becomes lower than the net scrap value at end-of-life?

What has been studied?

The case under study was hot rolled steel sheet production in Raahe, Finland. In 2020 a new EPD was developed for this value chain (SSAB, 2020). This EPD served as the basis for the comparison in this study.

How environmental impact of the assessed product shall be modelled is described in the guidance document of the respective framework. For the EPD framework, the broader set rules in the General Programme Instruction (GPI) are further specified in Product Category Rules (PCR) (EPD International, 2021). The EPD that was used in this case study was based on PCR 2012:01 for construction products (EPD International, 2018), which in turn is based on the European standard EN 15804. Main PCRs, such as 2012:01 can be further specified in complementary sub-PCRs, called c-PCR in the updated version of EN 15804, see Figure 4. Currently, there is no sub/c-PCR for metal products within the international EPD system. Therefore, the main PCR was used alone when the EPD in question was developed.

In the PEF framework, the main guiding documents are the "PEF method" and the "PEFCR guidance 6.3" (Zampori & Pant, 2019; European Commission, 2017). The former provides the general rules, and the latter provides instructions on how to develop a PEFCR. If a PEFCR for a product category is lacking, the calculation may be based on the PEF method document (Zampori & Pant, 2019). Furthermore, if there is an applicable PEFCR for the product in question the PEF method document shall be used in addition to the requirements in the PEFCR (Zampori & Pant, 2019). In this case there is a PEFCR for "Metal sheets for various applications", which was used in this study.

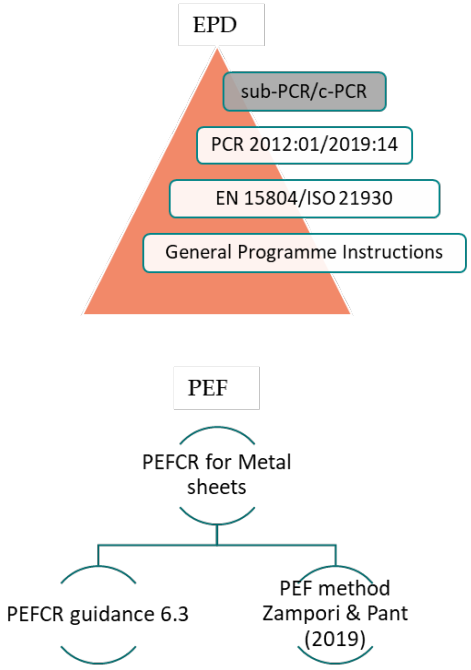


Figure 4. Conceptual overview of the different guiding documents. The figure at the top illustrates the hierarchy of documents in EPD and the figure at the bottom illustrates the structure of guiding documents in PEF.

Results

Environmental indicators

For this product category PEF and EPD apply the same environmental indicators. However, some differences in the characterisation methods were identified. The major identified difference is that PEF does not include biogenic carbon dioxide (CO_2) in the calculation of the climate impact, while EPD does. In the EPD framework, biogenic carbon entering the system shall be modelled as a negative biogenic CO_2 emission.

Moreover, any carbon leaving the product system shall be modelled as a fictive biogenic CO_2 emission. This often results in a net-zero biogenic CO_2 emission over the life cycle. However, there are some exceptions for example when the biogenic carbon is transformed into other GHGs than CO_2, for example methane (CH_4) which has a higher climate impact than CO_2. Another identified difference is that the two frameworks apply different characterisation factors for biogenic CH_4, 36.8 for EPD and 34 for PEF. When comparing the results from the steel production, with the different frameworks, we saw that the biogenic GWP indicator was 5 times higher for the EPD calculation, this had, however, an overall low influence on the overall result. Furthermore, we saw that the non-cancer human toxicity indicator was about 2% higher in the EPD calculation. This was not further analysed.

Allocation methods for steel scrap

EPD and PEF also applies different methods for allocation of waste. According to PCR 2012:01 allocation of waste shall be handled with the cut-off method based on the polluter pays principle. This means that the waste processing shall be assigned to the product system that generates the waste until the end-of-waste state is reached. For EPDs based on the PCR for construction products the environmental effects from reuse, recycling or energy recovery that occurs beyond the system boundary shall be declared in the Module D. The environmental impact from Module D can be negative and positive, depending on scenario and assumptions made. Except for module D, the EPD framework uses a strict attributional approach. In contrast, the PEF framework applies the Circular Footprint Formula (CFF) where the benefits and burdens from the waste are allocated between the waste generator and the user of the recovered material in the subsequent product system. The allocation between the two product systems is determined by factor A. For steel scrap, the default value of factor A is 0.2.

The results from the comparison are presented in Figure 5. The results from the EPD calculation are extracted from the EPD document, where A+C represents the total climate impact over modules A1-A3 and C3-C4 and loads and benefits outside the system boundary, in module D. The PEF result is divided into climate impact from the primary and secondary material used, loads and benefits from the material recycling and the disposal of waste not recycled. A difference between the two frameworks is that in EPD framework modules A1-A3, C3, C4 and D shall be declared separately, while the PEF result is declared as one number representing the total impact from the studied product system.

In PEF, factor A has a large influence on the result. The default value 0.2 means that 80% of the benefits and burdens from the recycled material is allocated to the waste generator. This means that if A is set to 1 or 0, none or all burdens and benefits, respectively, are allocated to the waste generator. In our case study, we saw that A = 1 yielded a total climate impact close to A+C in the EPD calculation and A = 0 resulted in a total climate impact close to A+C+D.

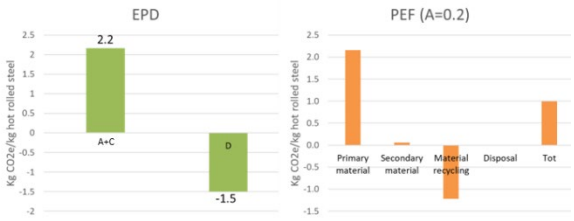


Figure 5. Results from the calculation of the climate impact using the different frameworks. The left figure displays the climate impact based on the EPD framework, while the right figure shows the result based on PEF.

Data requirements

For the EPD framework, specific data derived from specific production processes shall be used primarily. Moreover, specific data shall be used for the processes that the producer of the product has influence over. Generic data may be used for the processes the producer cannot influence. Any generic data that fulfils the listed requirements in the PCR can be used. These requirements include, for example, representativeness in terms of time and geographical coverage.

In the PEF framework, the level of data requirements depends on the level of influence the company has over the process. The PEF Guide divides the influence into three different situations 1, 2 and 3. According to this division, this case study would qualify as Situation 1, which hold the situation where the company performing the case study is also running the process under study. In this situation, the PEF guide specifies that for all processes run by the company, specific data shall be used, which is similar to the rules set in the EPD framework. Furthermore, in PEF studies the secondary data that is used needs to be PEF compliant, when available. The PEFCR lists a number of secondary datasets to be used primarily.

Transition to low carbon steel making

In the last part of the case study, we analysed the effect on the EPD and PEF when analysing steel production with low CO_2 emissions. Here we assumed a cradle-to-gate impact of 0.4 kg CO_2 (iron-ore based steel production) per kg steel product. For the PEF calculation, this entailed a total negative result.

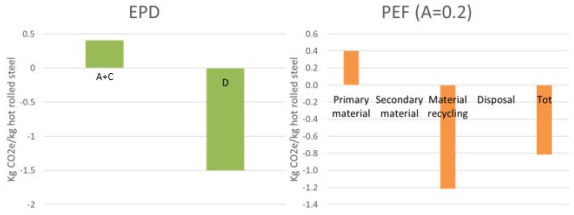


Figure 6. Calculated climate impact of the scenario for low carbon steel making, using the two LCA frameworks.

Conclusions

This case study highlights some of the major differences between the two frameworks, where the most obvious one is for waste allocation (i.e. mainly scrap allocation). The frameworks are probably more similar for this product category since in other product categories it is not allowed to include benefits at all from recycled material. Since there is no c-PCR for metal products in the EPD system, but a PEFCR for metal sheets in PEF, the calculation rules for metal products, used in construction, is in general more specific in PEF. As a result of this, the EPD framework is more open for interpretation compared to the PEF framework. However, The European committee for standardization (CEN) is, at the time of writing, developing a c-PCR for steel and aluminium structures, which is planned to be adopted in the international EPD system (https://environdec.com/product-category-rules-pcr/get-involved-in-pcr-development#pcrsunderdevelopment).

When this c-PCR is published the rules for calculating EPDs for steel products in the construction sector will be more specific. Another major difference is that EPD results shall be declared separately for each module while PEF is declared as one aggregated result. When looking at the scenario analysis for a low carbon steel production, where the PEF calculation resulted in a negative climate impact, this might have a large influence on how the result is interpreted by the user of the EPD or PEF.

Moreover, the two frameworks have different rules for how generic data shall be selected and applies how to assess the biogenic GWP. The overall impression is that although efforts have been made to harmonize there are still major differences between frameworks.

"Useful information about PEF and comparisons with EPD to evaluate how and why results can differ between the two methodologies"

Webinar participant, November 30, 2021.

6. Lessons learned of working with PEF

The case study participants were interviewed to give the reader some insights in performing a PEF study and being part of this project. The interviews have been merged, together with the panel dialogue that was held on the project's final webinar EU Environmental Footprint – industrial experiences & updates on the policy process on November 30, 2021.

Everyone who was interviewed agreed on the importance of conducting a PEF study in order to get a deeper understanding of the method itself. The interviewees also expressed that they gained a deeper understanding of the overall method, implementation and potential effects of the methods in place.

"One result of the project is that the Swedish public sector is better prepared to handle the European Commission's work with the Sustainable Product Initiative and Green Claims"

Björn Spak, Swedish Environmental Protection Agency & Sweden's representative in TAB

Interviewees

Björn Spak, LCA expert and working with Ecodesign and Environmental Footprint related issues at the Swedish Environmental Protection Agency.

Carina Larsson, Engineer and Sustainability specialist at Stora Enso Nymölla Mill.

Johan Nilsson, Researcher with long experience in working with LCA and EPD, the last two years at IVL Swedish Environmental Research Institute.

Jonas Larsson, Director of Environmental Affairs and responsible for product-related environmental issues such as life cycle assessment (LCA), environmental product declarations (EPD), environmental goals and follow-up within SSAB.

Torun Hammar, Researcher working with environmental system analysis, e.g. life cycle assessment and environmental product declaration, at RISE Research Institutes of Sweden.

Interview insights

The Swedish EPA has been engaged in the development of the Environmental Footprint method since the very beginning, and Björn Spak recognizes the framework as essential in achieving the aims outlined in the European Green Deal. “Since legislative measures relying on the EF are about to be drawn up, the project has been a very effective way to prepare ourselves and interact with other stakeholders in Sweden”, he says.

And when Torun Hammar points out that it is valuable for her as a researcher to learn how others work with PEF, Carina Larsson agrees. ”The importance of collaboration and the value of the network that we have built during the project are definitely some of the biggest benefits of our participation in the project”.

“I think the most valuable outcome of the project is the general building of a common Swedish Environmental Footprint awareness and competence. And for us at the Agency, the increased engagement and participation in the Environmental Footprint Technical Advisory Board which amongst others has brought Swedish research findings funded by the Swedish EPA to the table”. Björn Spak says. Further explaining that the project also gave an opportunity to the project participants and the stakeholders to deepen the understanding and knowledge in both EPDs and PEF.

An advantage that Johan Nilsson also highlights. He feels that one of the greatest advantages with being part of this project was that it gave him an opportunity to really look into PEF on a deeper level. “There are many differences between the EPD system and the PEF method, but we were maybe not expecting to find so many similarities between EPD and PEF”, he says.

Jonas Larsson agrees with him and adds another important finding. “Participating in the project made us realize that using a life cycle perspective, which PEF does to a much higher degree than EPDs, gives us a more accurate result. Although end-of-life is also in EPDs, it's being handled separately. In PEF, all steps are declared as an aggregated result, which is why PEF takes a broader approach. EPDs, on the other hand, are closer to the raw data than PEF. Both have their benefits”.

The overall impression is that although efforts have been made to harmonize these two, there are still major differences between the two frameworks. For ore-based steel, the results are almost identical but as Sofia Poulikidou presented at the webinar (November 30, 2021), there is a large difference between the methods for waste-based biofuels. On the question about the main challenges when conducting a PEF study, the need for data turned out to be one of the biggest ones together with own interpretations.

“Since this is a new method, we couldn't look at how others have done the calculations and interpretations before us”, says Johan Nilsson. “We needed to do a lot of interpretations of our own, which will hopefully make things easier for us, and hopefully for others as well, in the future”. Torun Hammar concurs. “Occasionally we had to consult the PEFCR guide to ensure correct interpretation of nomenclature”, she tells us. “It has been a challenge to also keep track of different documents and versions, and some parts of the documentation could be simplified”.

Carin Larsson also found that it was a big effort to collect and verify all data required as input and that it was very time consuming to interpret the results. She thinks that overall, the biggest challenge was to find the relevant data and the fact that benchmark values were missing. There are no benchmark values included in the PEFCR for intermediate paper.

When we asked for their recommendations for others who want to start using PEF is, all interviewees recommend getting involved in the development of PEFCRs together with Swedish and European industry associations and finding out in what way you can participate in their work. “Just get started”, says Johan Nilsson and Torun Hammar. Johan continues, “One thing that you can start with is making EPDs if you still

haven't done so. Get in touch with an LCA expert and get started".

Jonas Larsson has the same recommendation. "If there is no PEFCR for your product, but there is a PCR for an EPD, you can start with making an EPD. This way you will be well prepared when and if any new legislation comes into force. Many will wait for the EU decisions and customer demands before taking the decisive steps. But I really recommend that they start working with their data now".

It takes a lot of time, Carina Larsson says, emphasizing the importance of making time for a PEF. "But you can also start building a network with other committed people, both within and outside of your own organization". Björn Spak continues, "firstly one needs to understand how it will affect one's business. Once you have done that, it will be easier to argue for the resources to prioritize the area. Build your competence in-house AND in co-operation with other actors through e.g., Swedish Life Cycle Center".

When asked what the participation has meant for their respective companies Jonas Larsson points out that they have definitely gained an even stronger interest in working with PEF and that they are well prepared for when and if it becomes mandatory. "For us, it led to PEF getting a higher position on our agenda than before as an important outcome. For me as an individual, I now have a much higher level of competence in working with PEF than I had before the project started. At Nymölla Mill, where I work, there is also a much stronger commitment to PEF than before, Carina Larsson tells us.

On the question 'How do you see PEF in the coming years?' Björn Spak ends by saying, "My guess is it will have a very wide application no matter what the outcome of the Sustainable Products Initiative and Green Claims Initiative will be, especially regarding carbon footprints. I think we will see further development in methods and in communication". He continues. "The launch of the Green Claims Initiative and Sustainable Products Initiative are the top picks for companies and authorities to follow in the coming year. Also, the development of the proposed battery regulation and suggested Eco-design rules for photovoltaics very interesting regarding carbon footprint, as well as other development under the current Eco-design framework, including the revision of the Methodology for the Ecodesign of Energy Related Products (MEErP) method. In addition, one should keep an eye on the announced revision of the building products directive with associated standards.

7. Outcomes, reflections and recommendations

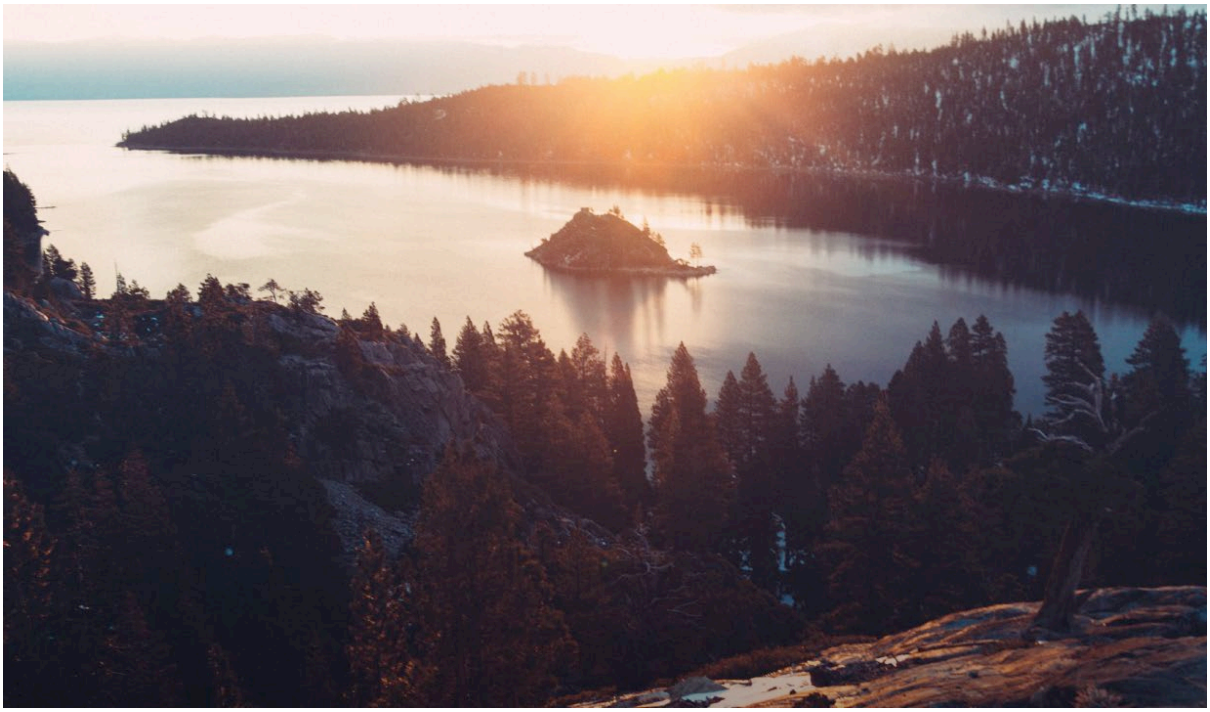
The project resulted in increased dialogue between LCA experts both on methodological issues and on the PEF development for mutual learning and understanding. This dialogue is also ongoing outside Sweden at a European level. The project coordinated and increased the representation from Swedish LCA competence has increased in the European Commission Environmental Footprint Technical Advisory Board. Both project participants and Swedish Life Cycle Center have broadened their collaboration and network among professionals. Engagement in activities for learning and impact on the development have increased (with LCA experts, practitioners and with non-LCA experts).

The overall PEF process has definitely increased the interest for LCA in general and many discussions and collaborations have been possible thanks to PEF. There is so much work behind just one number that is requested and presented, and the learning process behind that number is crucial for environmental improvements.

The harmonization between methods, systems and approaches is both requested and needed and the LCA community needs to be involved in this harmonization process.

It is important to test the PEF methods, for both learning and method improvements, and therefor data needs to be accessible. It could be good to have access to a tool for testing the methods, a tool that would aim for methodology improvements.

Industry associations have an important role for developing new PEFCRs and for competence building within sectors. Supporting actions for SMEs are needed and there are some opportunities to learn from other work in within EU, e.g. in the work on Ecodesign, where a calculations template has been developed.



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Personal communication

Horn, R. Fraunhofer, PEF seminar on Biodiversity and LANCA method, Swedish Life Cycle Center Webinar, November 24, 2021. Presentation available at https://www.lifecyclecenter.se/wp-content/uploads/2.-LANCA_Rafael-Horn.pdf

9. Further reading

Environmental Footprint – An introduction to the initiative of the European Commission, https://www.lifecyclecenter.se/publications/environmental-footprint-an-introduction-to-the-initiative-of-the-european-commission/

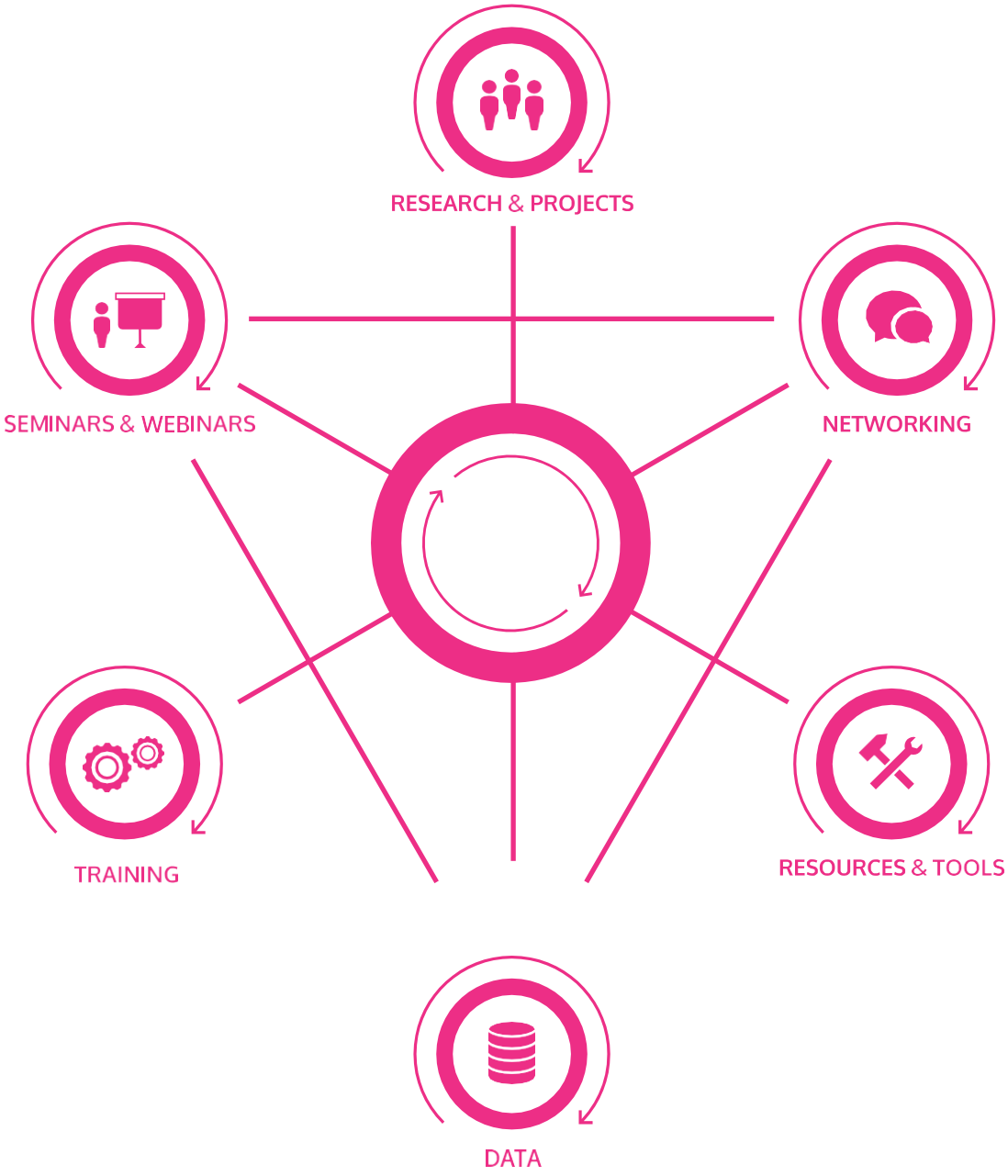
Ppt presentation: Environmental Footprint - An introduction to the initiative of the European Commission (including speaker script), https://www.lifecyclecenter.se/publications/ppt-presentation-environmental-footprint-an-introduction-to-the-initiative-of-the-european-commission/

Overview of the Product Environmental Footprint (PEF) method - What is PEF? (Presentation at webinar & workshop on March 30, 2021), https://www.youtube.com/watch?v=PAmja7nwOlA&t=10s

Introduction to the LANCA method (Land Use Indicator Value Calculation in Life Cycle Assessment) & ongoing developments and Example of approaches to quantify biodiversity in LCA in relation to PEF (Presentations at webinar on November 24, 2021), https://www.youtube.com/watch?v=zUGW60gRtSM&t=2s

Introduction to Product Environmental Footprint, Product Environmental Footprint in Sweden, Updates on the Environmental Footprint - methodology and policy development (Presentations at webinar on November 30, 2021), https://www.youtube.com/watch?v=O53ql30eoBE

PEF on a steel product, PEF on a paper product, Similarities and differences between PEF and EPD (Environmental Product Declaration) and a panel dialogue on experiences of working with PEF (Presentations and a panel dialogue at webinar on November 30, 2021), https://www.youtube.com/watch?v=2QAL7GtlY1Y&t=3s



SWEDISH LIFE CYCLE CENTER

Chalmers University of Technology
SE – 412 96 Göteborg
Vera Sandbergs Allé 8
+46 (0)31-772 56 40
lifecyclecenter@chalmers.se
www.lifecyclecenter.se