

*A review of the JRC report:
“LCA of alternative feedstocks for plastics production”*

Erwin Vink, European Bioplastics

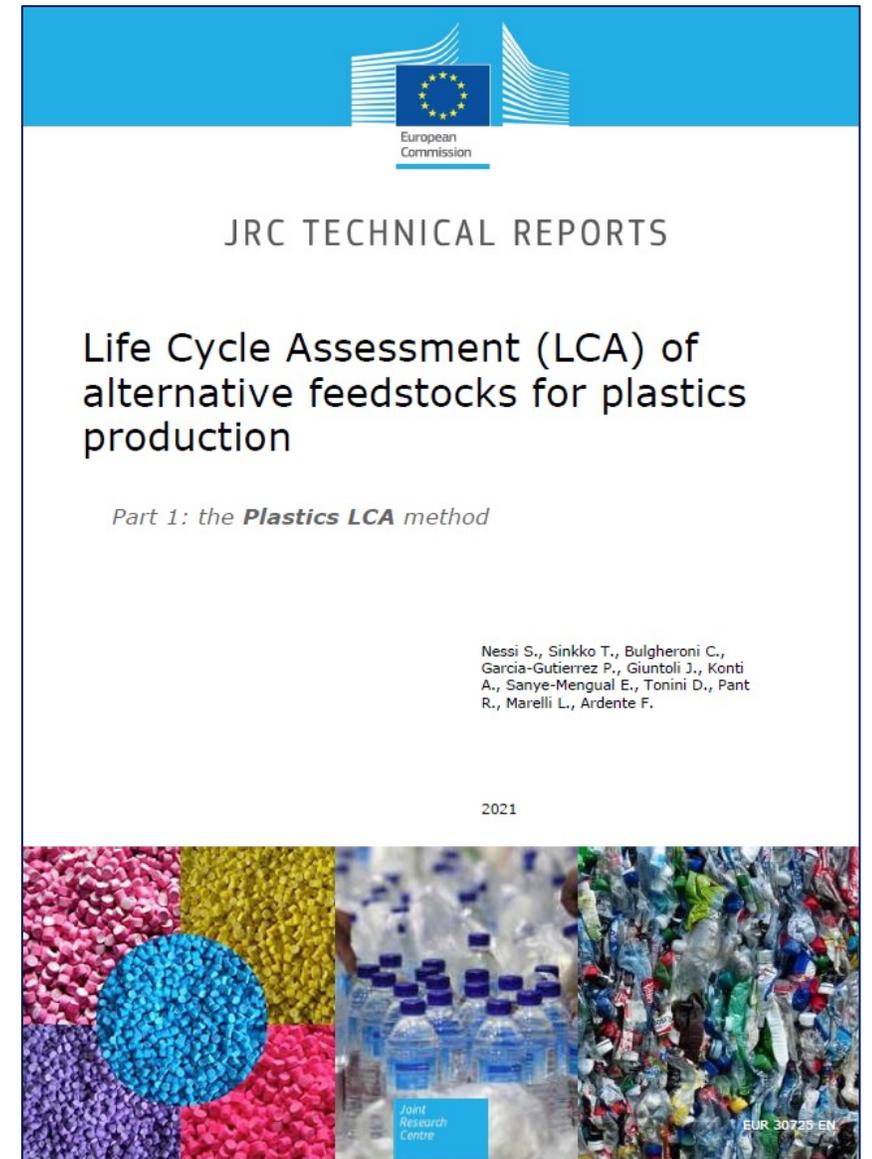
16th European Bioplastics Conference | 30 November 2021 | Berlin



Content

1. What is this review about?
2. Review of the LCA methodology based on **10** aspects.
3. Conclusion.

1. Carbon Sequestration
2. Maturity of production systems
3. Requirements on data reporting
4. Incorporation of Land Use Change
5. Incorporation of Indirect Effects
6. Requirements on providing proof
7. Biodiversity
8. Modelling EOL realities (see full slide deck)
9. Normalization and Weighting (see full slide deck)
10. Sustainable Feedstock sourcing



What is this review about? (1/2)

- Study title: ‘LCA of alternative feedstocks for plastic products’
 - Part 1: the Plastics LCA methodology
 - By: Nessi E., et al., Joint Research Center (JRC) of the European Commission, 2021.
 - LCA methodology that has been developed to compare Bio-based with Fossil-based plastic products (= from environmental performance p.o.v.).

- Possible applications:
 - Even it is not claimed the methodology could be a basis for policy development around Bio-based and Biodegradable products.
 - In the EC’s Roadmap on Policy Framework on biobased, biodegradable and compostable plastics the study is mentioned at section: “Evidence base and data collection”
 - By Policy developers on national level.
 - By LCA practitioners & Consultants in general.

What is this review about? (2/2)

- Over the past 3 years, industry stakeholder, including EuBP, were given several opportunities to provide input.
- The industry experts invested significantly in providing feedback.
- Main Question: is this a good and a fair methodology to compare the environmental life cycle performance of bio-based with fossil-based products and is it subsequently a good basis to build Policies on?

Conclusion: Scientists of EuBP have reviewed the LCA methodology based on **ten aspects, and it will show that the methodology is not sufficiently developed to deliver good, fair and complete comparisons.**

Aspect 1. Carbon sequestration (1/2)

Issue 1. Characterization factors for biogenic CO₂ uptake and emissions are set to zero in the Impact Assessment. This is an old heritage from the biofuels industry where one only has one EOL option, which is incineration.

- Probably OK for biofuels, but for biomaterials this is questionable.
- Biomaterials can be incinerated, but also recycled, composted, or landfilled, where the carbon flows into other systems and can be stored for certain periods of time.

Issue 2. Text says: *“Effects associated with temporary and permanent carbon storage and/or delayed carbon emissions shall not be considered in the calculation of the Climate Change impact indicator.”*

Here the value of bio-based products is denied. Basically, the starting point is very simple: every ‘day’ atmospheric Carbon is stored in products, it cannot contribute to Climate Change, and that should be reflected in the methodology.

Conclusion: Both rules deny the key advantage of Bio-based products: that is taking CO₂ out of the atmosphere, sequester it into products, so it cannot contribute anymore to Climate Change.

Aspect 1. Carbon sequestration (2/2)

Case 1.

Atmospheric C stored in product for 50 years and then released: **No credit !**

Case 2.

Same system, but after 50 years the product is incinerated and a new product is made at the same day; the atmospheric C is captured again and stored into a product for another 50 years: so, in total, 100 years: **No Credit !**

Case 3.

If one continuously repeats Case 2, one still gets no credit.

Conclusion:

Both rules undermine the key advantage of Bio-based products: that is taking CO₂ out of the atmosphere, sequester it into products, so it does not contribute to Climate Change anymore.

Aspect 2. Maturity of Production System

Fossil-based Plastic Products

- Production, Conversion, Logistics and EOL are optimized for the last 50-70 years.

Bio-based Plastic Products

- Production, Conversion, Logistics and EOL are still in their early stage of development (< 1% of market).

Question: does the methodology facilitates to make fair comparisons between mature production systems and systems in their early stage of development?

1. Study says: “*particular care shall be taken*”, but no guidance or rules HOW to compare are provided.
 - ➡ This will result in practice, that all products are just compared as all being mature.
2. The study even goes one step further by saying that *data of products based on innovative or emerging technologies cannot be communicated externally*.
 - ➡ How can one inspire the market if you are not allowed to communicate?

Conclusion: Both are clear restrictions, and especially negative for biobased materials.

Aspect 3. Requirements on data reporting (1/3)

- Study says: “LCA studies typically look at normal (average) production conditions, excluding burdens and potential impacts from accidents, disasters or conflicts, such as those from accidental oil spills and oil fires during extraction activities, or from military operations performed to protect oil supply.”
- This is a very old, and a still very beneficial “rule” if you are in the fossil-polymers industry.
- So, no reporting required on such things as:



Conclusion: it would be good for all stakeholders involved that JRC finally improves the methodology to include these aspects in a consistent way.

Aspect 3. Requirements on data reporting (2/3)

A few other examples of irregularities observed:

Bio-based Polymers	Fossil-based polymers
✓ 8 pages with specific requirements.	✓ 2 pages with specific requirements.
✓ Company specific data <u>shall</u> be used.	✓ General requirement is <u>not</u> followed. Industry average data is still allowed. It is highly aggregated data, often not clear what the data exactly represents nor what is included and excluded (black boxes).
✓ All detailed inputs and emissions from agricultural systems <u>shall</u> be reported.	✓ Text says: <i>“relevant emissions directly to seawater, (such as oil, metals and coatings) from oil exploration, drilling, extraction and transport are frequently excluded”</i> ; ✓ Jungbluth* study: “unintentional methane need to be considered”, “carbon footprint of fossil-based products is underestimated”, “full emissions are not recorded”.
✓ Include specifics on machinery use in agriculture.	✓ No requirements concerning including machine use, while for ‘oil from tar sands’ and ‘oil fracking’ these could be significant.

* <https://www.linkedin.com/pulse/update-life-cycle-inventory-data-crude-oil-natural-gas-jungbluth/?trackingId=TWvvxXgcQteCogirrQ423g%3D%3D> + extra slide at the end.

Aspect 3. Requirements on data reporting (3/3)

And..

Bio-based Polymers	Fossil-based polymers
✓ Heavy metal emissions in agriculture <u>shall</u> be modelled.	✓ No specific requirements, while many fossil resources contain heavy metals.
✓ Chemicals like fertilizers and pesticides use and their emissions <u>shall</u> be modelled.	✓ No specific requirements, while chemicals are widely used in e.g., 'oil fracking' & 'oil from tar-sand' industry.
✓ Detailed requirements on crop type and, country and region specific averages.	✓ No hard requirements on the origin of fossil resources.
✓ Details on water consumption, including irrigation, <u>shall</u> be modelled.	✓ No specific requirements on water consumption. (e.g. about water injected in oil/gas fields)

Conclusion: It is fine by EuBP to include all these requirements for biobased polymers, but then the same requirements shall be valid for the fossil-based polymers as well. Concerning data requirements there is clearly no level playing field.

Aspect 4. Incorporation of Land Use Change (1/2)

- Bio-based Polymers:
 - “LUC burdens shall be included”
- Fossil-based Polymers:
 - “LUC shall be accounted for, but these are typically not captured in LCA”
 - So, again no hard requirements for fossil related LUC.
- This means: No need to report LUC impacts for:



Oil from tar sand



Oil pollution



Long term oil production



Oil fracking

Conclusion: *Another pretty beneficial “rule” for the fossil-polymers.* Also for LUC the same requirements should be valid for the bio-based and fossil-based products. It is necessary to fill the gaps in the methodology.

Aspect 4. Incorporation of Land Use Change (2/2)

- Bio-based Polymers:
 - LUC, as a result of increased soil carbon storage, due to improved agricultural practices#, and LUC, as a results of taking land out of production along e.g. river sides##
 - can only be included as ‘additional environmental information’.

Conclusion: Also for LUC the same requirements should be valid for the biobased and fossil-based products. It is necessary to fill the gaps.

Regenerative farming is already a reality. The US initiative promoted by Indigo regarding regenerative farming able to produce CO₂ credits. <https://www.indigoag.com/carbon/for-farmers>

<https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/>

Aspect 5. Incorporation of Indirect Effects (1/2)

- Study says: “One of the most commonly acknowledged indirect effects for bio-based (plastic) products is indirect Land Use Change (iLUC)...”
- What happens in practice? ILUC is often just included or mentioned despite of the lack of proof and the lack of a commonly accepted methodology.
- What does the LCA methodology say about the Indirect effects of fossil-based plastics?
- Are there Indirect Effects? A few examples are mentioned:
 - IE by road construction and accessing oil fields.
 - IE by military and security operations of oil field and oil supply routes.
 - IE of changes in oil production and subsequent availability of refinery co-products.
- The contribution to climate change for each single effect can be up to 6%.
- Study says: “Indirect effects of those reported above shall not be included in LCA studies, nor for reporting of additional environmental information.”

Conclusion: A clear biased approach. In order to get to a level playing field these different approaches are obstacles that need to be removed.

Aspect 5. Incorporation of Indirect Effects (2/2)

- A big challenge for the current LCA methodology are the direct and indirect effects of the leakage of plastics into the environment.
- Study says: *“impacts on biodiversity, landscape, toxicology, etc. are currently not captured”*
- Study says: *“These aspects should be reported as additional environmental information. “*



Conclusion: the effects of leakage into the environment is a big omission in LCAs. EuBP urges JRC to explore new methods to include the effects into the LCA; just reporting as additional information is not sufficient to support decision-making activities. Impacts are just left ‘outside’ the LCA, especially if one works with a ‘single-score’ output.

Aspect 6. Requirements on providing proof

Requirements on providing proof is not consistently applied. For example:

- For **positive** effects of bio-based products, such as soil carbon storage by improved agricultural management (e.g. tillage practices, cover crops), proof is required,
- While for **negative** indirect effects of bio-based products, like iLUC no proof is required if the ILUC actually takes place.

Conclusion: in order to get to a level playing field these different approaches are obstacles that need to be removed. Also for iLUC proof needs to be provided.

Aspect 7. Biodiversity

- Study says: “Currently there is no international consensus on a LCIA method capturing biodiversity.”
- Study says: “Biodiversity indicators shall be included under ‘additional environmental information’”

Bio-based Plastics Products:

- Study also says: “the assessment should refer to materials that end up in the final product or have been used during the production such as.....sugarcane, maize or other crops used as feedstock to produce plastic precursors....”
- So, for the topic of Biodiversity there is a strong focus on the production of Bio-based plastics.

Fossil-based Plastic Products:

- The effects on biodiversity of the use of fossil-based plastics are briefly mentioned in the methodology report. There is only a reference to biodiversity impacts due to crude oil drilling.
- However, the main reasons for the decrease in biodiversity is overpopulation, global warming, deforestation, and pollution. And according the latest IPCC report, Global warming is largely driven by emissions from fossil resources and agriculture (dominated by livestock).

Conclusion: 1. there is no clear link mentioned between the incineration of fossil plastics and biodiversity. 2. the effects on biodiversity is of key importance, but alike leakage of plastics into the environment, it is another big omission in LCAs. Information is pushed in the category “additional environmental information” and left ‘outside’ the LCA. 3. EuBP urges JRC to explore new methods and to apply them consistently to biobased as well as to fossil based materials.

Aspect 8. Modelling EOL realities



Comparing on
product level or
waste stream level?



- In many comparative LCAs, EOL is modelled on product level: what is the best EOL of e.g. a spoon? Is it incineration, landfill, recycling or composting?
- This is problematic in two ways: 1. because, in reality, a waste stream never consists of a bag of spoons and 2. in this way the real value of Industrial composting is not captured.
- Comparison should be made on waste stream level: e.g. what is the best EOL for this bag of waste, consisting of a mix of cutlery, plates, napkins, cups and food waste? Is it recycling, incineration, landfill or industrial composting?
- In reality you have to deal with the whole bag of waste.

Conclusion: this is not captured well in the LCA methodology report.

Aspect 9. Normalization and Weighting

In this LCA method it is mandatory step, while weighting factors are based on value choices and so are subjective.

Questions that can be raised:

1. It are 2018, JRC weighting steps; how do they compare with other sets?
2. How representative are they today and even more important, in the years to come?
3. How scientifically sound is it to apply EU weighting factors on non-EU production systems?

Conclusion: Weighting can make sense, and therefore EuBP expects JRC in co-operations with other experts to come with the right weighing factors, representative for the years to come.

Aspect 10. Sustainable Feedstock sourcing

- For biobased plastics feedstock several certification schemes such as RSB, ISCC PLUS, Bonsucro are developed and in use.
- They are dealing with a wide range of topics such as deforestation, biodiversity, protection of soil, air and water quality, carbon sequestration, safe working conditions, compliance with human, labor and land rights and laws and treaties.
- However, nothing is in place for fossil-based feedstock.
- This aspect is totally excluded from a methodology comparing and judging the life cycles of bio-based with fossil-based systems. How can this result in objective and complete comparisons?

Conclusion: sustainable feedstock sourcing needs to be included in LCA, or at least attached to it, especially in those comparisons where the major differences are coming from the feedstocks themselves.

Conclusion

- **EUBP and the allied stakeholders, consider the LCA methodology, not fit for the purpose of comparing bio-based with conventional fossil-based plastics.**
- In many aspects the methodology is not suitable and still provides advantages for the fossil-based plastics.
 - It undermines the deliverables of the EU Green Deal.
 - It does not ‘listen’ to IPCC and COP26: reduce dependency on oil and reduce GHG emissions.
 - Jeopardizes the potential of innovation.
 - Just does not work towards a bio-based circular economy.
- **We urge the Commission to stop the wider dissemination or application of this LCA and to start a new review of the LCA methodology. Otherwise, it will adversely affect EU progress in the field of sustainable and renewable climate-neutral materials.**

Position of European Bioplastics

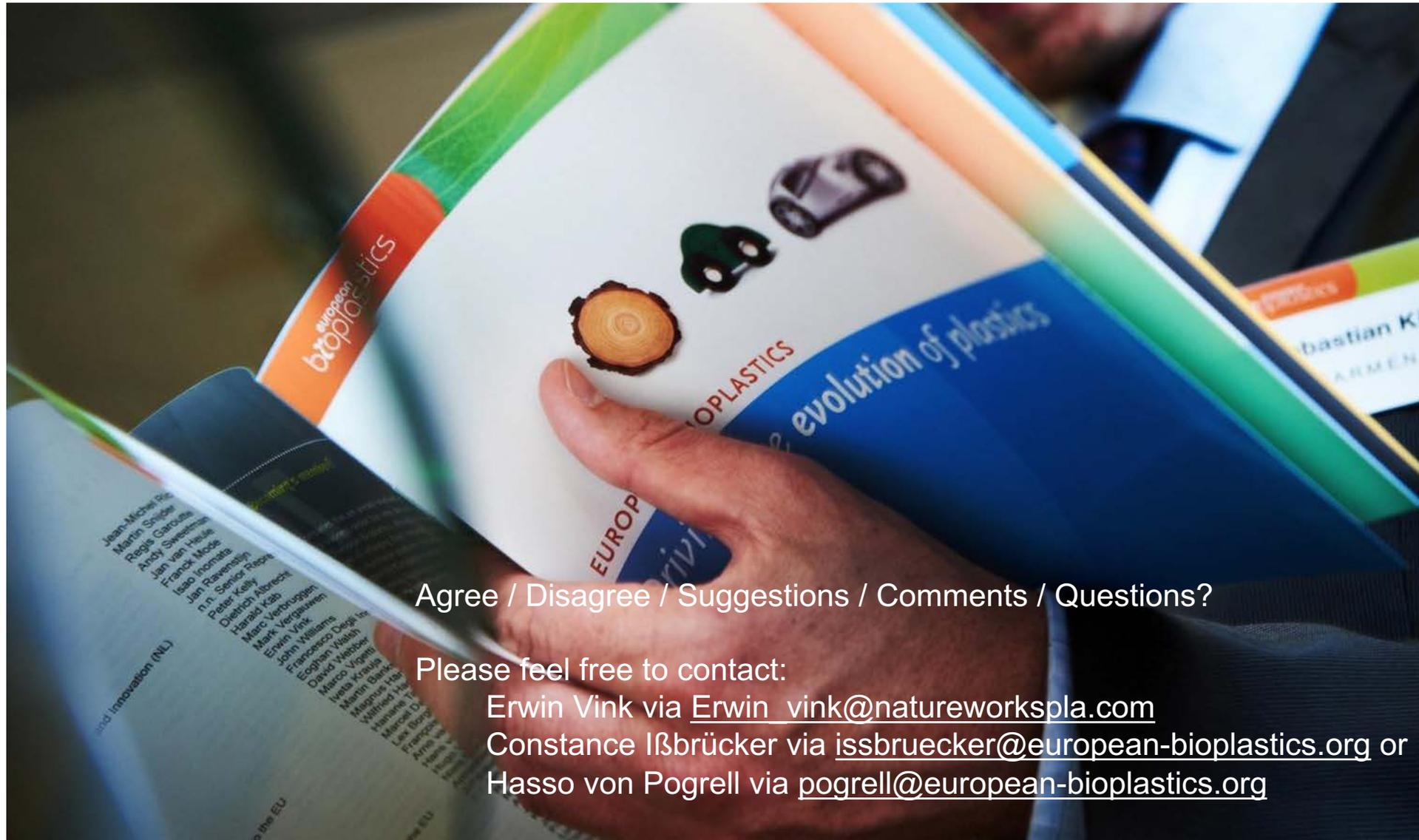
The methodology as presented by the JRC is:

- Very relevant for our industry on the mid and long term,
- Very relevant to extend a circular, bio-based Economy in Europe and
- Very relevant for the acceptance of our products by all stakeholders.

But the current methodology:

- Is not suitable for making well-balanced and complete LCA comparisons between bio-based and fossil-based plastics.
- It structurally tends to favour fossil-based plastics, and so undermines many of the deliverables set out by the European Green Deal.
- We therefore urges the JRC to stop the wider dissemination of this methodology and start a new review.

Thank you!



Agree / Disagree / Suggestions / Comments / Questions?

Please feel free to contact:

Erwin Vink via Erwin_vink@natureworkspla.com

Constance Ißbrücker via issbruecker@european-bioplastics.org or

Hasso von Pogrell via pogrell@european-bioplastics.org

Aspect 3. Requirements on data reporting (2/3)

Additional information on Jungbluth's study:

"These findings have several implications for the discussion of the role of fossil-based products in climate change:

- Unintentional methane emissions need to be considered when discussing current emissions due to the use of fossil resources.
- The avoidance of such emissions is a low-hanging fruit and needs to be followed up and monitored by the companies active in the field of oil and gas extraction.
- So far, the carbon footprint of fossil-based products is underestimated in LCA databases such as ecoinvent, which has important implications for the comparison with non-fossil products (e.g. biofuels or biomaterials). The advantage of such materials in this regard becomes higher under consideration of these new findings.
- The full emissions are currently not recorded in environmental reports and LCA studies published by industries such the International Association of Oil & Gas Producers (IOGP), Eurobitume and Plastics Europe.
- <https://www.linkedin.com/pulse/update-life-cycle-inventory-data-crude-oil-natural-gas-jungbluth/?trackingId=TWvvxXqcQteCoqirrQ423g%3D%3D>
- <https://www.beyondplastics.org/plastics-and-climate>