



# Life Cycle Assessment of alternative feedstocks for plastics production – an overview

*Joint Research Center – European Commission*

*Meeting of the of the Civil Dialogue  
Group "Arable Crops - Starch"  
9.9.2021*

# Context and Objectives of the project

## CONTEXT

- **EU Plastics Strategy** (COM(2018) 28 final), calling for actions aimed at *investigating and better understanding the life-cycle impacts of the use of alternative feedstocks for plastics production*



## OBJECTIVES

- Elaborate an appropriate **LCA-based method** to consistently evaluate the potential environmental impacts of plastic products based on conventional and alternative feedstocks at the EU level, taking into account available methods in the existing EU legislation and relevant European and international standards
- Evaluate and demonstrate the practical applicability of the method through a number of **illustrative case studies** on selected plastic products



# Development process: main steps

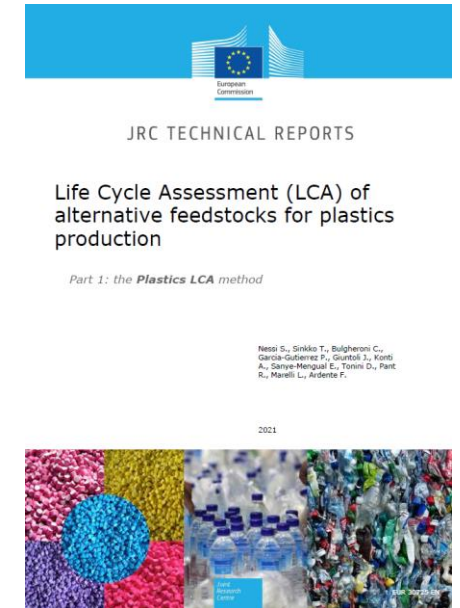


- **Participatory process** involving interested stakeholders at different stages via:

- ✓ **Written and oral consultations** to collect technical comments and feedback on early and advanced drafts of relevant project reports (Nov-Dec 2018 & June 2020)
- ✓ **Calls for data** to collect data, information and suggestions to develop the illustrative case studies (summer 2018 & spring 2019)

# Main output: the *Plastics LCA* method

- Published in June 2021
- Provides detailed guidance (methodological and modelling rules) to conduct as much as possible **consistent, robust, transparent, reproducible and verifiable LCA studies** of plastic products from different feedstock sources, suggesting a common harmonised methodological framework at the EU level
- Covered feedstock sources include:
  - Conventional fossil-based resources (oil & gas)
  - Plastic waste (post-consumer)
  - Biomass (e.g. agricultural crops, forestry products, bio-based waste and by-products)
  - CO<sub>2</sub> captured from gaseous effluents





# The *Plastics LCA* method - 1

- *Based on and fully aligned with the methodological and modelling rules of the **EU Product Environmental Footprint (PEF) method\***, as suggested for update by the JRC in 2019\*\**
- Taking into account:
  - The results of an initial **systematic review of selected LCA studies** on plastic products (included as an Annex to the report)
  - **Technical inputs** (comments/feedback) from two stakeholder consultation processes

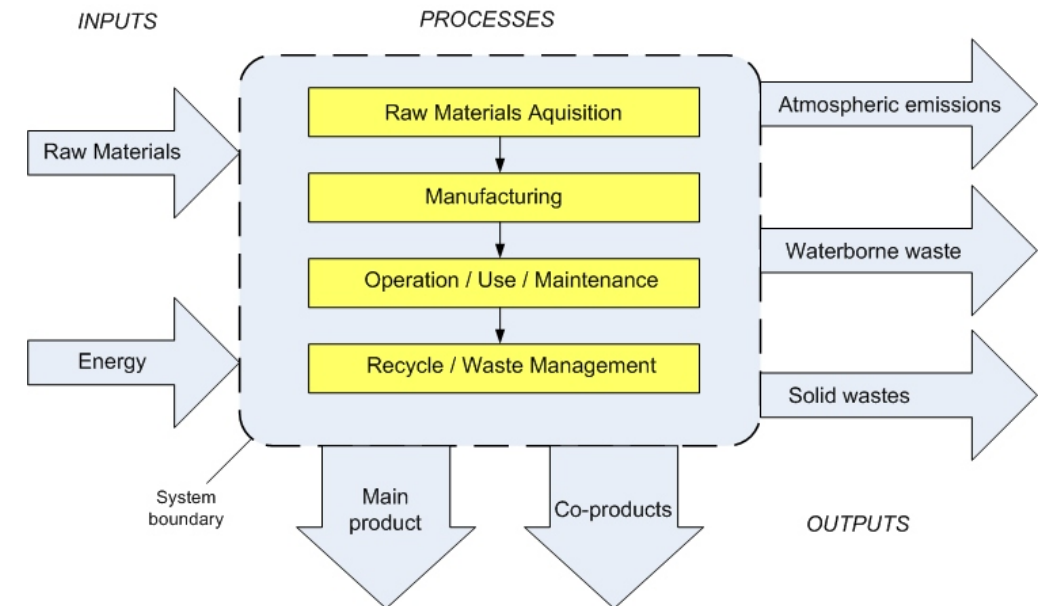
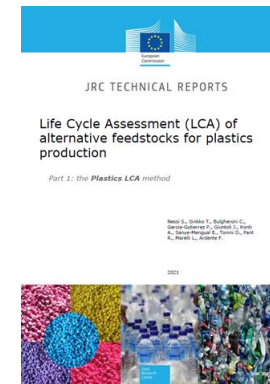
(\*) Recommendation 2013/179 EU on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations.

(\*\*) Zampori L. and Pant R. (2019) Suggestions for updating the Product Environmental Footprint Method. JRC Technical Report.



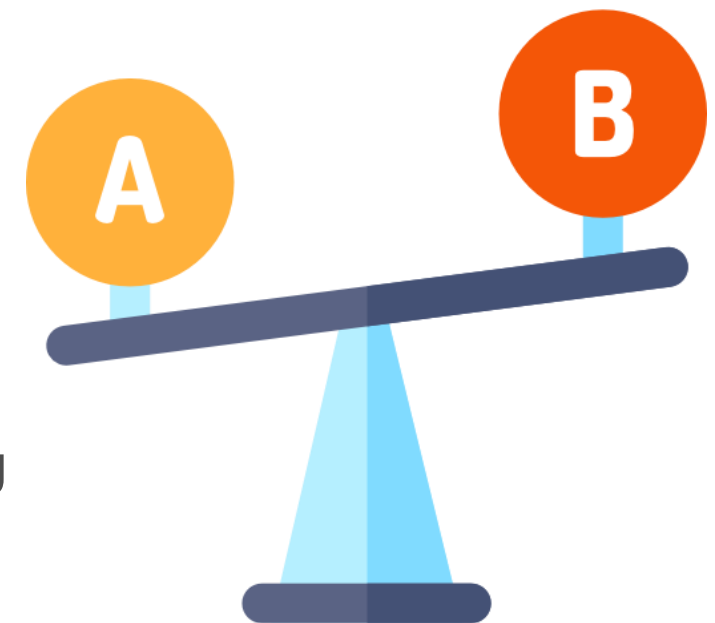
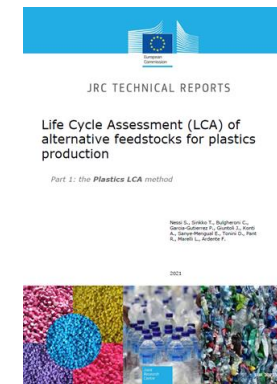
# The *Plastics LCA* method - 2

- Includes **additional methodological and modelling guidance/rules** for specific aspects relevant to plastic products, e.g.:
  - ✓ Modelling of applicable feedstock sources (e.g. plastic waste, primary biomass, bio-based waste and by-products)
  - ✓ Modelling of relevant End-of-Life options (e.g. composting and in-situ biodegradation)
  - ✓ Methods to provide/calculate relevant *additional environmental information* (e.g. potential iLUC impacts on Climate Change and estimated macro-/micro-plastics generation and release)
- Specifies further** a number of existing requirements (e.g. type of *additional environmental information* that should/may be provided in the LCA study)



# The *Plastics LCA* method - 3

- Especially addressed to **commercially available products manufactured in industrial-scale facilities** (and only in this case the results can be used for external communication)
- Any **comparisons and comparative assertions** among different products can be made only in the presence of **specific product category rules** (PEFCRs - Product Environmental Footprint category rules) for the relevant product category
- PEFCRs provide **a consistent set of product-specific rules** to calculate the potential environmental impacts of products belonging to the same product category
- **PEFCRs will have to be developed in the future**, based on industry-driven processes and involvement of relevant stakeholders



# Plastics LCA case studies - 1

## PURPOSE

- **support the development** of the *Plastics LCA* method (e.g. in defining modelling rules for specific aspects), **test/demonstrate its practical applicability**, and **evaluate reliability** of results
- **Not** intended to provide **conclusive estimates of the potential environmental impacts** of the investigated products
- **Not** intended to **compare the different scenarios** analysed for a given product (see next slide)





# Plastics LCA case studies - 2

## LOGIC and GENERAL SCOPE

- Assess a number of **alternative scenarios** considering the use of different feedstocks and/or materials for a specific product
- Ensure **illustration of all relevant methodological and modelling rules** specified in the *Plastics LCA* method (including an example of application to non-commercially available products, for company-internal studies)
- Reflect the **current (2020) or recent past average situation at the EU level** (in terms of e.g. applied feedstock sources, polymers, End of Life options/scenarios and reference technology)
- Any **future or prospective scenarios were excluded** (out of scope, additional uncertainty, no established/agreed methods)

**Table 4.1.** LCA scenarios assessed for the beverage bottles case study and respective End of Life options and scenarios.

Scenario	Polymer	Monomer or Co-polymer	Feedstock	End of Life options /scenario <sup>(1)</sup>
1 - Conventional polymer 1	PET	MEG <sup>(2)</sup> PTA <sup>(3)</sup>	Fossil-based (crude oil/natural gas)	Recycling (60%) Incineration (21%) Landfilling (19%)
2- Conventional polymer 2	HDPE	Ethylene	Fossil-based (crude oil/natural gas)	Recycling (64%) Incineration (19%) Landfilling (17%)
3 - Alternative polymer 1	R-PET (24% recycled content)	MEG <sup>(2)</sup> PTA <sup>(3)</sup>	Waste PET (post-consumer)	Recycling (60%) Incineration (21%) Landfilling (19%)
4 - Alternative polymer 2	R-HDPE (16% recycled content)	Ethylene	Waste HDPE (post-consumer)	Recycling (64%) Incineration (19%) Landfilling (17%)
5 - Alternative polymer 3	Bio-PET	Bio-MEG <sup>(2)</sup> PTA <sup>(3)</sup>	Sugarcane (BR) Crude oil/natural gas	Recycling (60%) Incineration (21%) Landfilling (19%)
6 - Alternative polymer 4	Bio-HDPE	Bio- Ethylene	Sugarcane (BR)	Recycling (64%) Incineration (19%) Landfilling (17%)
7 - Alternative polymer 5	PEF	Bio-MEG <sup>(2)</sup> FDCA <sup>(4)</sup>	Sugarcane (BR) EU mix of starch crops <sup>(5)</sup>	Recycling (60%) Incineration (21%) Landfilling (19%)

<sup>(1)</sup> The impacts of each scenario were calculated considering an EU-average End of Life scenario combining the listed End of Life options according to the reported shares. A sensitivity analysis individually considering the application of each listed option was also conducted.

<sup>(2)</sup> MEG: Mono Ethylene Glycol.

<sup>(3)</sup> PTA: Purified Terephthalic Acid.

<sup>(4)</sup> FDCA: Furan Dicarboxylic Acid.

<sup>(5)</sup> The mix includes Maize (54%) and Wheat (46%), in terms of starch product equivalents (Starch Europe, 2019).

## Plastics LCA case studies - 3

# STATUS

- **A selection of the 10 initially developed case studies** is currently **under revision**, to reflect the final version of the *Plastics LCA* method and relevant stakeholders comments
- The focus is on studies expected to be more **complete, representative, solid, consistent** and internally quality-checked (after the revision)
- **Main aspects** addressed in the revision: *input/LCI data and assumptions, covered processes/activities, limitations and critical assumptions, description of lifecycle models, presentation and interpretation of results*



# Information and documents


- Information on the project, its status and on available documents can be found in a dedicated webpage of the **European Platform on Life Cycle assessment (EPLCA)**:  
<https://eplca.jrc.ec.europa.eu/plasticLCA.html>
- The **Plastics LCA** method is accessible at:  
<https://publications.jrc.ec.europa.eu/repository/handle/JRC125046>
- For the **case studies**, the draft report submitted to the latest stakeholder consultation is currently available

## European Platform on Life Cycle Assessment

Home About us Methods ▾ Data ▾ LCA Projects ▾ Library Contact

### PLASTICS LCA

Life Cycle Assessment of Alternative Feedstocks for Plastics Production




In January 2018, the European Commission adopted the [European Strategy for Plastics in a Circular Economy](#) (COM(2018) 28 final). In the set of implementing measures, the strategy also includes actions aimed at investigating and better understanding the life-cycle impacts of the use of alternative feedstocks for plastics production (see [Annex I](#) to the Strategy).

In this context, the Joint Research Centre (JRC) has been entrusted by the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) with a project focusing on Life Cycle Assessment of plastic products derived from different feedstocks, as described in this webpage.

#### Objectives and outcomes

The overall objective of the project was to:



- elaborate a solid method** enabling as far as possible consistent, harmonised, transparent and reproducible LCA studies of plastic products based on different feedstocks (including fossil resources, plastic waste, biomass and captured CO<sub>2</sub>) at the EU-level.
- test and demonstrate the practical applicability of the method** (and support its development) through a number of illustrative case studies on selected plastic articles.

As main output, the project provides interested companies, stakeholders and practitioners with a common, harmonised methodological framework to evaluate and communicate the potential environmental impacts of plastic products relying on different feedstocks. The framework is referred to as the **Plastics LCA** method, and includes detailed methodological and modelling rules for LCA studies of plastics products, building upon and conforming to the general structure, logic, and rules of the EU **Product Environmental Footprint (PEF)** method (following [the latest update proposal formulated in 2019](#)). It also includes complementary

JRC TECHNICAL REPORTS

Life Cycle Assessment (LCA) of alternative feedstocks for plastics production

Part 1: the Plastics LCA method


JRC TECHNICAL REPORTS

Comparative Life-Cycle Assessment of Alternative Feedstock for Plastics Production

Draft report for stakeholder consultation – Part 2

10 LCA case studies

Deadline for consultation comments: June 30, 2020



# Conclusions

- A **common, harmonised methodological framework** is proposed to guide companies, stakeholders and practitioners in conducting more **robust, consistent, transparent, reproducible and verifiable LCA studies** of plastic products from different feedstock sources
- The application of a **life-cycle perspective** is expected to help **preventing any unintended “shifting of burdens”** among different life-cycle stages, different impact categories and different locations throughout the world
- In this perspective, a **broad range of impact categories** is covered, in line with the spirit and most recent developments of the PEF method and of the EF initiative in general
- A number of **case studies** is currently under review to illustrate how the most relevant methodological steps and rules of the proposed **Plastics LCA** method may be applied in practice
- **Continuous involvement of industries** is fundamental to develop product-specific rules (PEFCRs) and further testing the applicability of the method to real products on the market

# Thank you

For more information: <https://eplca.jrc.ec.europa.eu/plasticLCA.html>