



Second Generation MethylMethAcrylate

*Using environmental footprinting
as a decision-tool for technology
development*

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Quantis

MMAtwo
workshop

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The MMAtwo project results presented reflect only the author's view.
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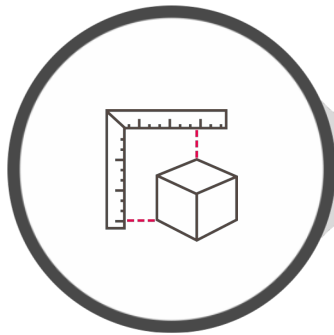
A person wearing a red jacket and dark pants stands on a rocky, snow-dusted shore, looking out over a calm lake. The lake's surface is like a mirror, reflecting the surrounding snow-capped mountains and the clear blue sky. The mountains are rugged and covered in patches of snow, with some peaks reaching into the distance. The overall scene is peaceful and majestic, capturing a moment of solitude in a winter landscape.

OUR MISSION

We guide top organizations to define, shape and implement intelligent environmental sustainability solutions.

We deliver resilient strategies, robust metrics, useful tools, and credible communications.

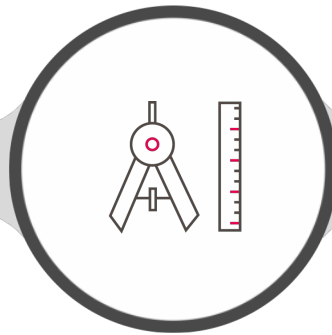
OUR WORK



METRICS

*Life Cycle Assessment
Corporate Footprint
Product Footprint*

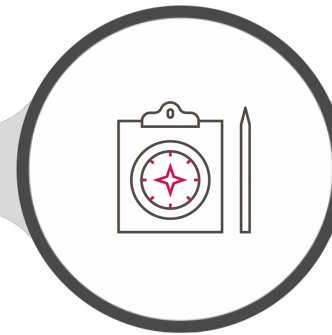
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TOOLS

*Product Footprinting
Eco-Design Tools
LCA Databases*

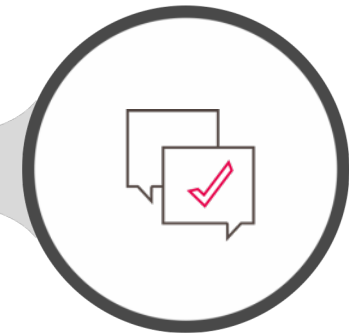
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STRATEGY

*Climate Strategy
Science-Based Targets
Materiality
Initiatives*

+++



COMMUNICATIONS

*Brand/Comms Strategy
Reporting
Engagement
Marketing Materials*

+++

OUR TEAM

A global team of diverse and dynamic experts, backed by a strong scientific background



- + Boston
- + Milan
- + Paris
- + Berlin
- + Lausanne
- + Zurich

120+

SUSTAINABILITY
CHAMPIONS

1700+

CLIENT
PROJECTS

12+

YEARS HELPING
CLIENTS

PRINCIPLES OF LCA



01



Context

Planet is under pressure





Facts and risks

FACTS



A significant increase in **greenhouse gas** concentration levels leading to climate change



Several **key mineral and fossil resources** have attained their maximum production levels



The **great sixth extinction** is underway



Increasing amounts of **toxic and harmful substances** in the environment (plastic, pesticides, hormones)

RISKS

Extreme changes in climatic conditions would limit the viability of human life as we know it

The price of non-renewable resources will go up, destabilizing a society that depends highly on metals and fossil fuels

Collapse of ecosystem services necessary for life on earth (food production, water treatment, etc.)

Reduction of life expectancy; increasing diseases and health problems



Hand drying systems

Go to www.menti.com and use the code 76 00 32 4

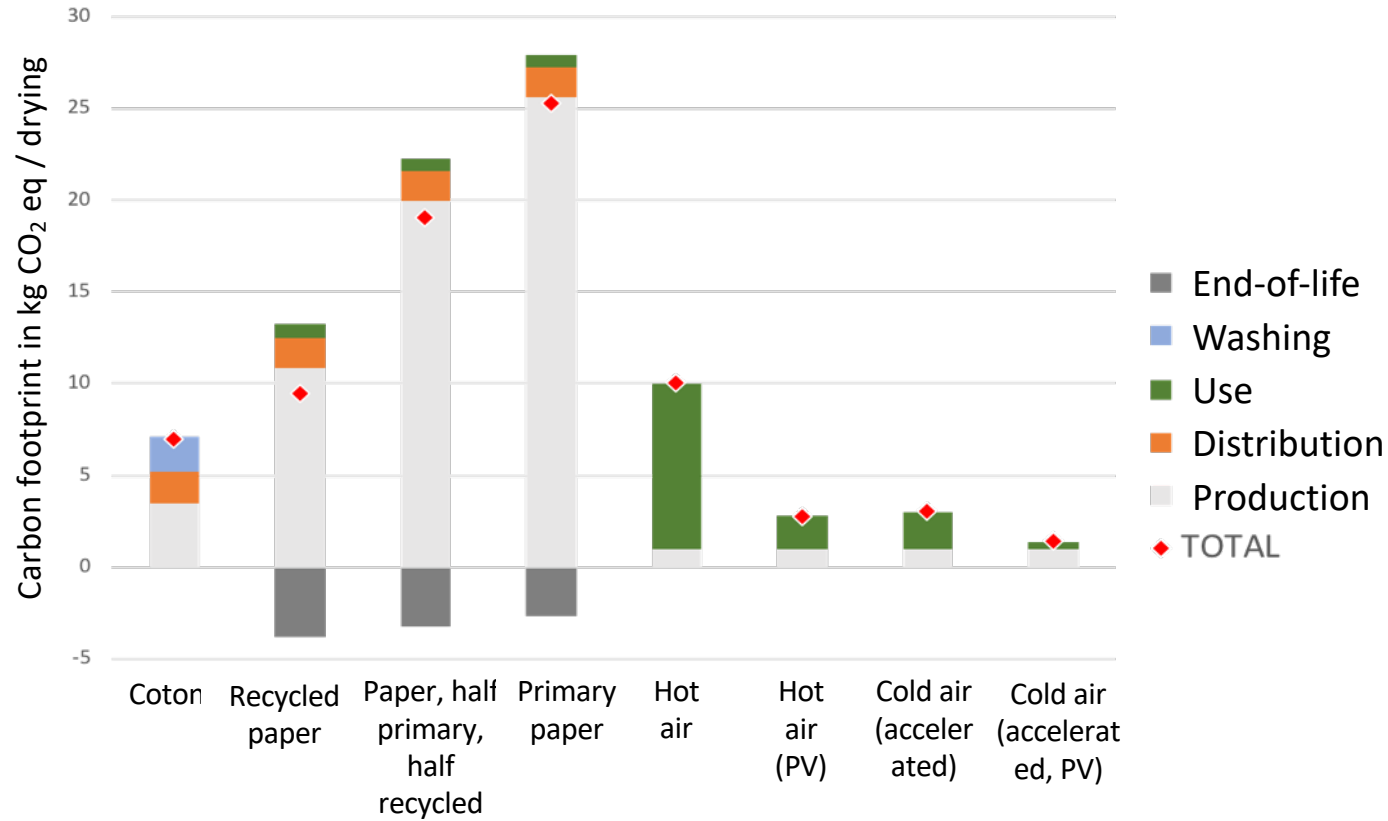


Hand drying systems

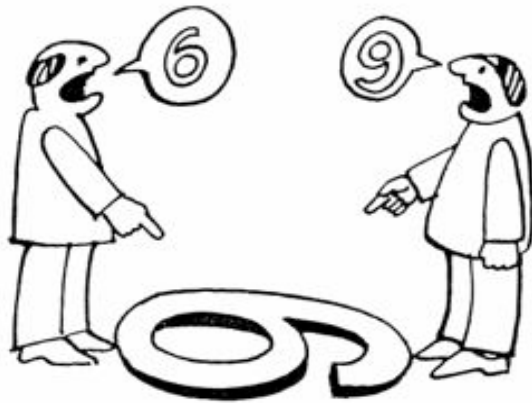




Hand drying systems



Perception...



VS



...facts



Life Cycle Assessment : from Cradle-to-Grave

SEVERAL SIMPLIFIED INDICATORS FOR DECISION MAKING



A global vision on the use of resources, the emission of pollutants and the production of waste



How is Life Cycle Assessment useful?

TARGET PRIORITY ACTIONS AND AVOID FALSE GOOD SOLUTIONS



*Finally! The guys who cut the Amazonian forest accept to do something for sustainability.
From now, they will use unleaded petrol in their shearing machines.



How is Life Cycle Assessment useful?

AVOIDING IMPACT TRANSFERS



Zero emissions ?

Avoiding the transfer
of environmental
issues



Emissions elsewhere !

- From one life cycle stage to another
- From one region to another
- From one compartment to another
- From one generation to the next
- Among issues



What is LCA used for?

-  Identify **environmental hotspots** along the value chain
-  Determine **priority actions and improvement** possibilities
-  **Compare product alternatives**
-  **Eco-innovation, eco-design**
-  Encourage **supplier engagement**
-  Facilitate conversations with **stakeholders**
-  Communicate to **customers and consumers** with credible proof-points

MMATWO PROJECT



02



Mmatwo project

CONTEXT:

- PMMA is a polymer that has an extensive range of applications in everyday life, including in cameras, smartphone screens and car windows. It is, however, notoriously difficult to recycle, unless the scrap material is of very high purity. The aim of the MMAtwo project is to address this issue by constructing a novel PMMA recycling value chain in Europe.

PROJECT OBJECTIVES:

- produce - through depolymerization - a recyclate identical to virgin material in both properties and quality and avoid the down-cycling of the MMA compound in the polymer
- Develop an innovative technology enabling lead-free recycling, with lower energy use and CO₂ emissions with respect to virgin MMA
- Ultimately, develop a new innovative value chain in Europe with the potential to widen the range of scrap PMMA waste fit for recycling

HOW LCA CAN BE USED AT AN EARLY DESIGN STAGE



03

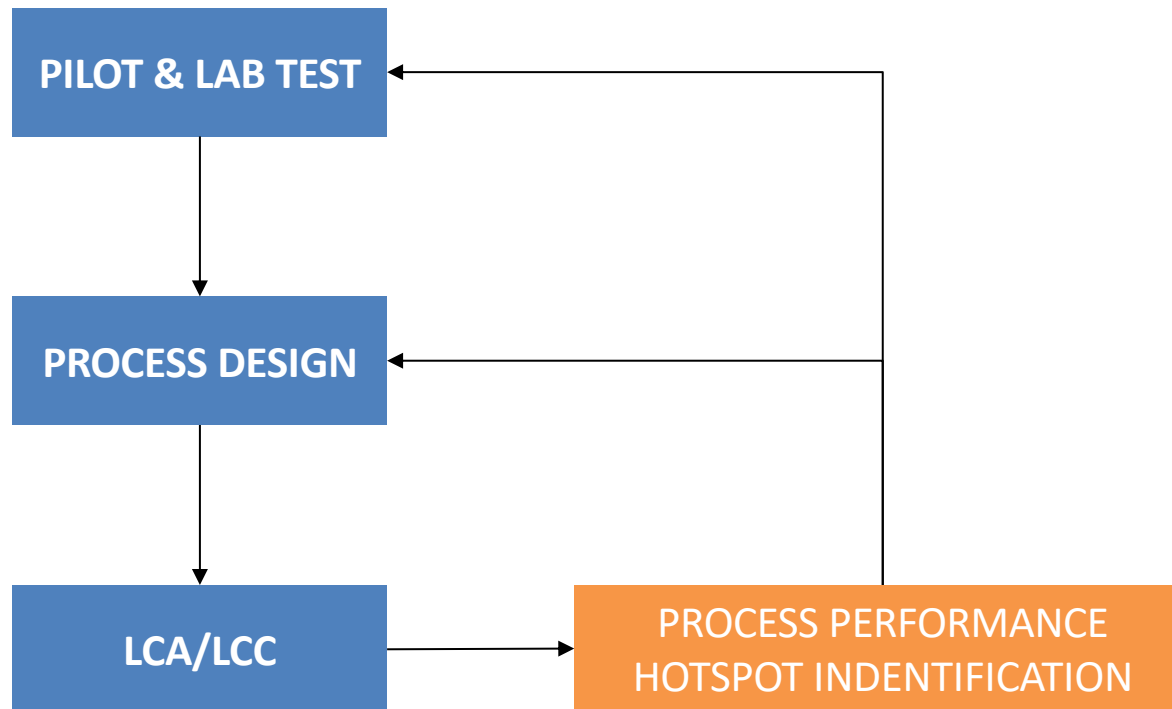


Objective of the LCA/LCC in the MMAtwo project

- Perform an environmental Life Cycle Assessment and a Life Cycle Costing of the different value chain design options
- Compare the environmental performance of the production of the recycled and conventional virgin PMMAs
- Identify the most probable environmental hotspots along the life cycle of the recycled PMMA
- Guide the design and strategy development of the recycling value chain towards more sustainable solutions and provide best-practice recommendations



Workstream



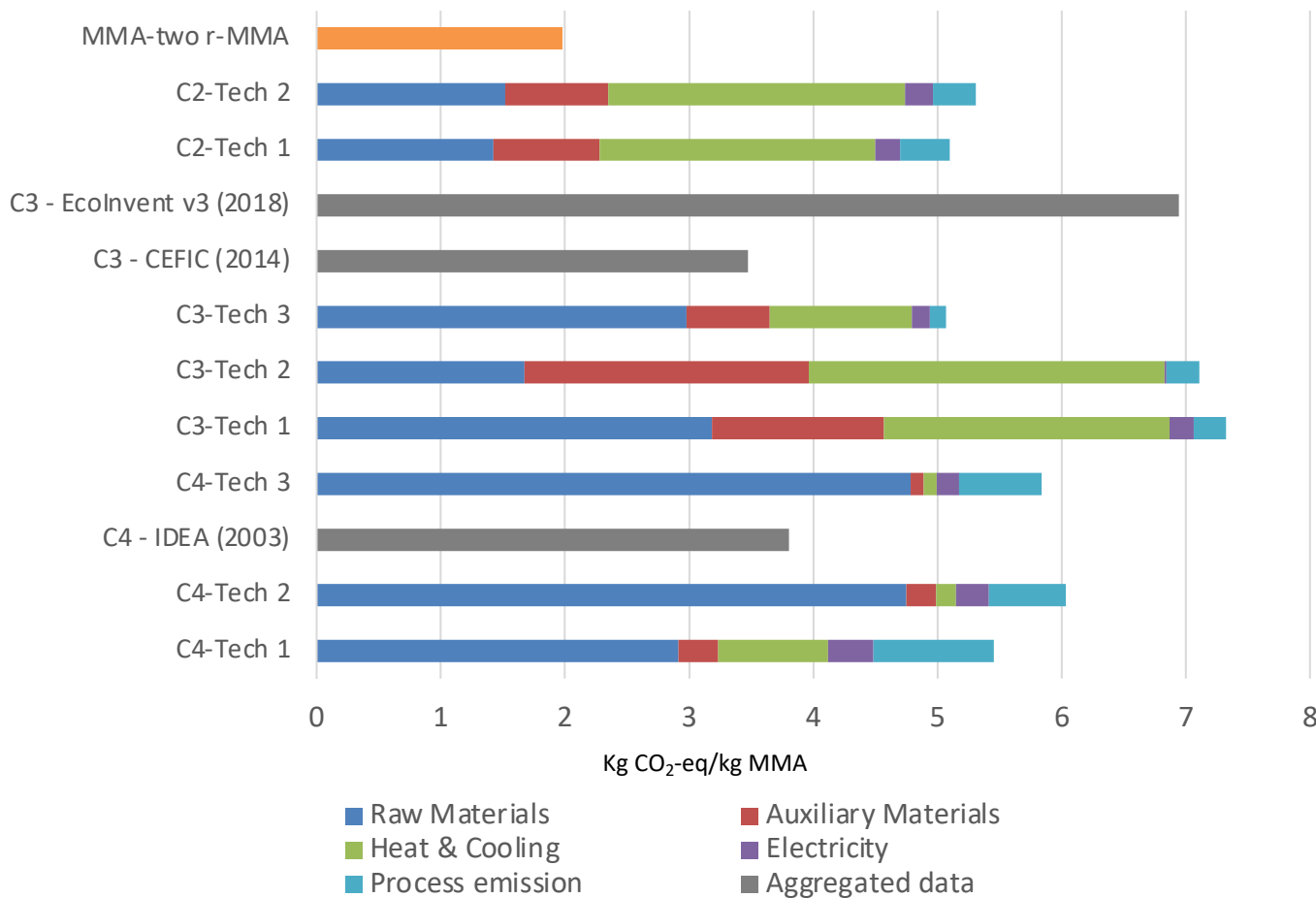
INITIAL FINDINGS



04



Carbon footprint of virgin MMA production



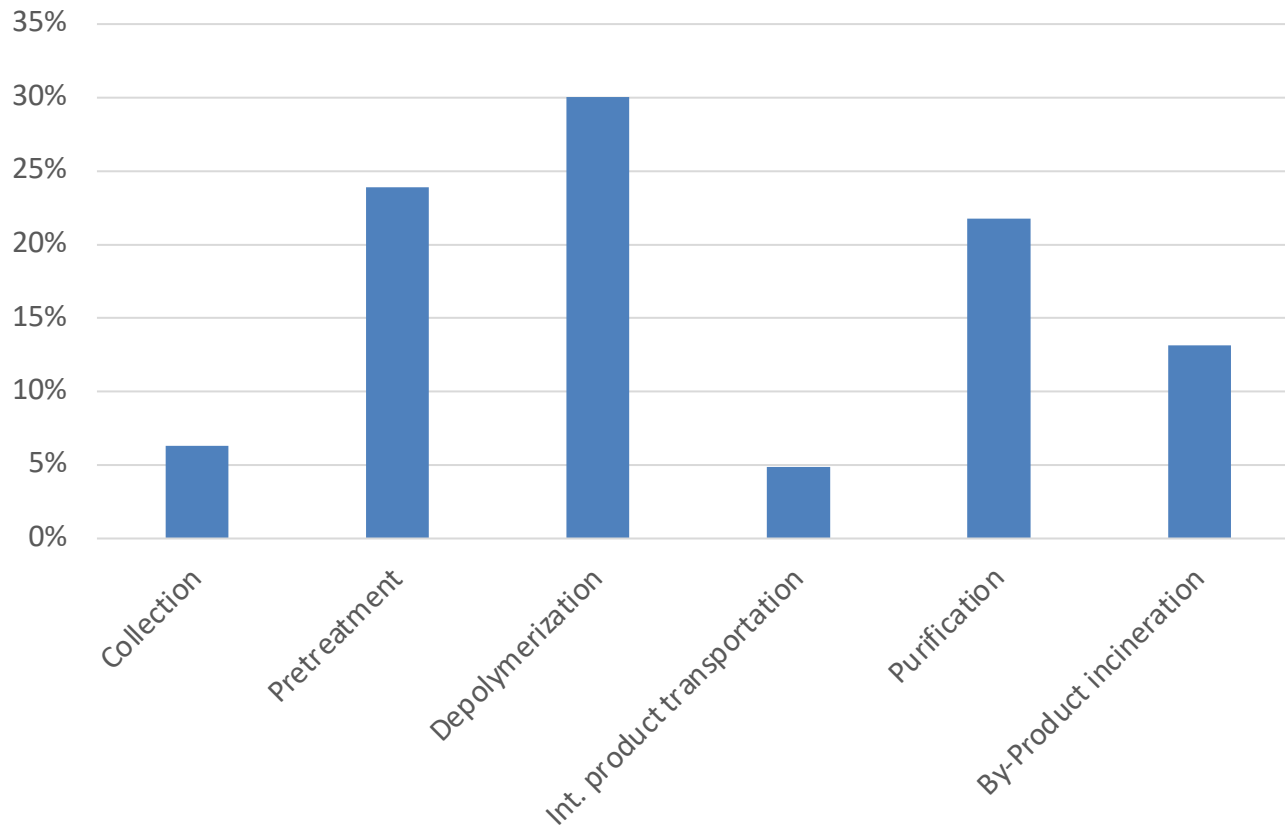
Climate
Change

Preliminary results:

- Cx routes were developed on mass end energy balance (with no energy optimization)
- EcolInvent and CEFIC datasets represent European average production from real plants
- IDEA dataset represent Japanese average production from real plants
- Virgin MMA Carbon footprint ranges from 3.5-7 kg CO₂-eq/kg MMA
- Initial results for MMA-two technology show an impact reduction -44% to -73% depending on the virgin technology considered



Preliminary results of the mmatwo technology



Model to be refined



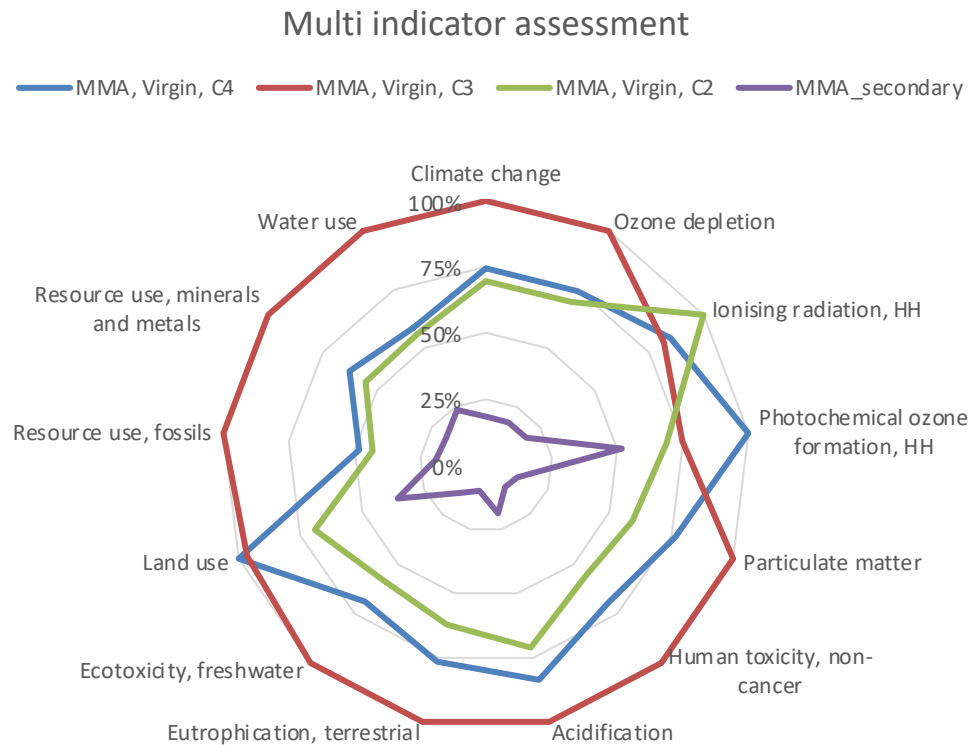
Climate
Change

Preliminary results:

- Major hotspots are depolymerization, pre-treatment and purification (approx. 75%-80% of the total impacts)
- Model to be refined for collection & pre-treatment and by-product incineration



Preliminary results of the mmatwo technology



Model to be refined

Preliminary results:

- Recycling results in lower environmental footprint compared to virgin production
- C3 production route results in higher impact for most of the indicators



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www.mmatwo.eu



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