



Hemp in Plastics processes: what benefits for the environment?



Jean-Marie Bourgeois-Jacquet
Sales & Business Development
Mob: +33(0)6 38 26 17 21

jean-marie.bourgeois-jacquet@apm-planet.com
www.apm-planet.com

Automotive Performance Materials (APM)

A unique proposal – meeting of 2 worlds



faurecia

Faurecia is one of the world's leading automobile suppliers specializing in:

- Seating
- Interiors
- Clean Mobility
- Faurecia Clarion Electronics

50% - 50%

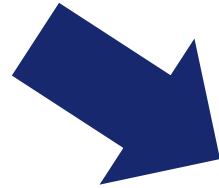
independent & non consolidated
Joint Venture



Interval is one of the major French agricultural cooperatives, gathering:

Diversified cultures with advanced and innovative outlets for bio products

Lightweight innovative materials for automotive applications



Development of grades for injection
Compounding and extrusion
Commercialization

Diversification and valorisation of the biomass



Hemp harvesting and transformation

detailed views 1/2



1 – Hemp in the fields



2 – Hemp cutting



3 – When retting is finished, the hemp is harvested



4 – After harvest, hemp is brought to the company that separates the different co-products of hemp

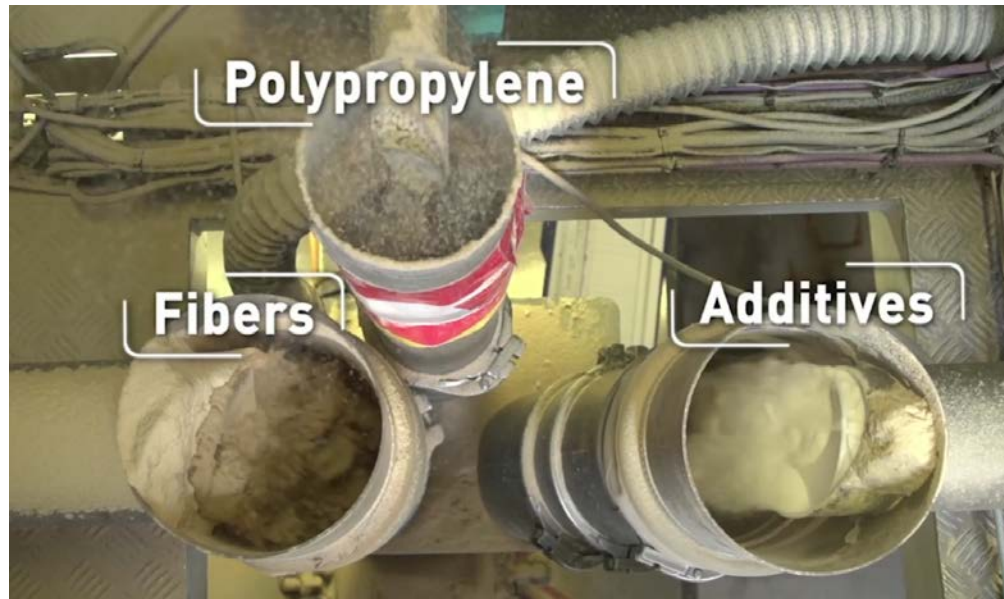


Hemp harvesting and transformation

detailed views 2/2



- 4 – Then hemp fibers are **treated** in APM to **calibrate the fibers** – but for confidentiality reasons, the equipment / process can not be shared
- 5 – Final step is **compounding** where **fibres are incorporated in plastics**



Hemp

Endless source of resources



Hemp Seeds (11%) (including oil)

- Human food – premium nutrients
- Food for animals (birds, fishes..)
- Cosmetics



Hemp hurds (43%)

- Animal litters
- Materials for buildings
- Garden mulch
- **Plastics**



Hemp Dust (14%)

- Pellets



Hemp Fibres (25%)

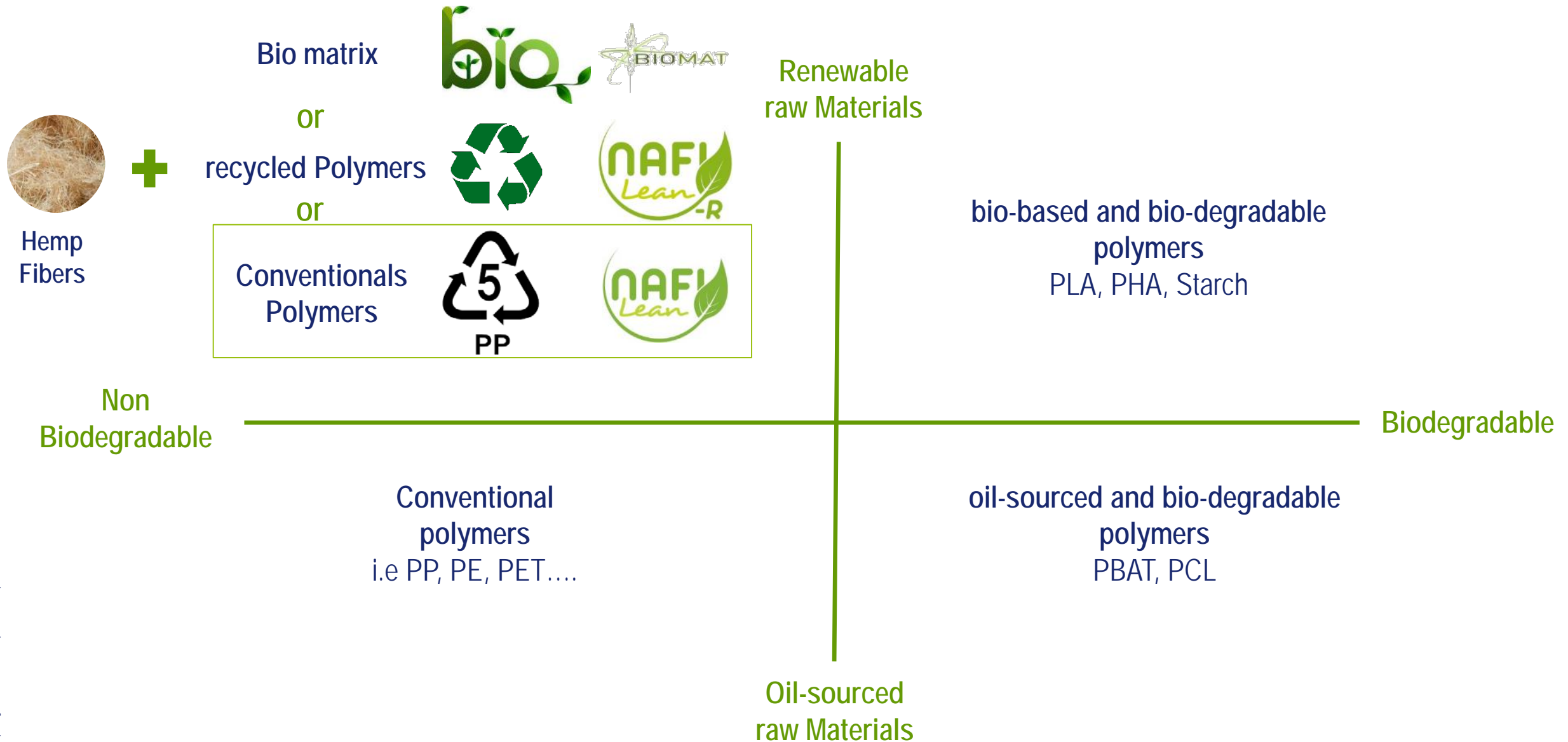
- Special papers
- Insulation
- Textiles
- **Plastics**



- Farming **without phytosanitary** (herbicide, fungicide or insecticide) products – GMO-free – with strong **biomass**
- **No need for irrigation**, hemp is well drought resistant thanks to its deep root system (up to 3,5m), **regenerating soils**
- **Biodiversity reservoir**, thanks to the height and density of the crop, it is appreciated by predators of pests

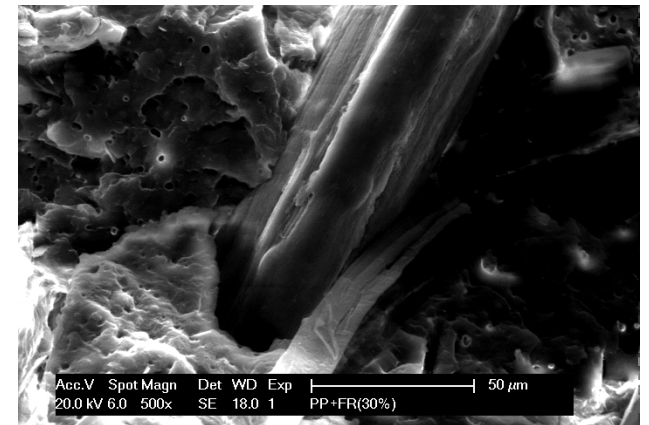
Bio material Approach

Combination of hemp fibers and different matrixes



NAFILEan combines hemp natural fibers and thermoplastics PP to create a **bio composite thermoplastic material**

- The advantages are
 - A **lower density**, in comparison with standard materials like PPMD20, PP GF 20
 - Performances permitting to **optimize parts** by thickness reduction
- Reduction of the environmental impact
 - Diminution of the **quantity of plastic**
 - Introduction of **renewable ressource (20%)**
 - renewable cycle : 1 year
 - Carbon sequestrator



➔ In automotive application,
NAFILEan permits to win up to 25%
of weight on structural interior parts



Natural fibers Portofolio

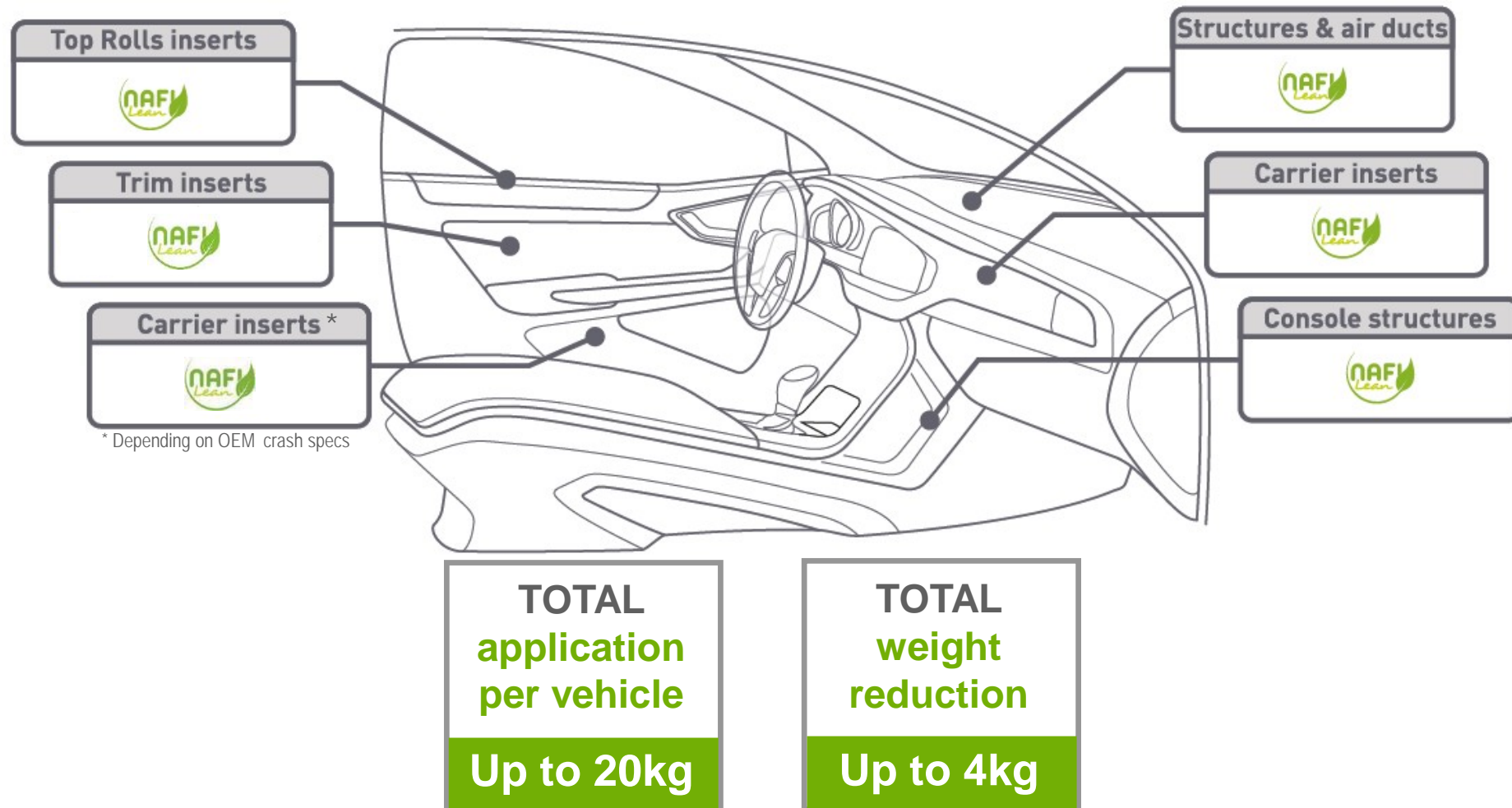
developed for automotive applications



	2011	2014	2016	2017	2018	Next gen
	<p>P/E NF20</p>	<p>PBS NF25</p>	<p>P/E NF20 + 2% blowing agents</p>	<p>P/E(recyc.) NF20</p>	<p>P/E NF20</p>	
	The pioneer massively deployed	Full Alternative to oil	The Lightest NAFI grade with high stiffness / no warpage due to microcells structure	CO2 Positive grade	Performance equivalent to PP GlassFibers Tensile Module : 3650 MpA	
Tensile Module	2650 MpA	2650 MpA	N/A	2650 MpA	3650 MpA	
Thickness	2,0-2,2 mm	2 mm	1,8 → 3,2 mm	2,2 mm	2,2 mm	
density	0,98	1,31	N/A	0,99	0,98	
Lightweight	-25% vs PP MD 20	-8% vs PC-ABS	-29% PP LGF 20	-24% vs PP MD 20	-11% Vs PP LGF 20	
CO2 emission factors	1,36 kg CO2 - 19% vs PP MD 20	2,54 kg CO2 - 80% vs PC-ABS	1,36 kg CO2	- 0,16 kg CO2	1,36 kg CO2 - 40% Vs PP LGF 20	
Perimeter	IP structures DP (medallion, top roll) CC structure	DP (medallion)	IP structures DP (medallion, top roll) CC structure	IP structures DP (medallion, top roll) CC structure	IP structures CC structure	
Time to market	In Serial on 14 car models	M3 Ready for quote	M3 Ready for quote	M3 Ready for quote	In serial in 2021	

Applications:

- Covered or non visible injected parts for Instrument Panels / Door Panels / Center Consoles



NAFILEan™ (Natural Fibers for Lean Injected Design)

Material implemented from high volume cars to Premium level



Land Rover Velar (Grand Evoque)



Premium vehicle
In serial prod. in April 2017

2.05kg /veh: Top rolls + Trims
→ 685g saved (25%)

Jaguar I-Pace



Electric vehicle
In serial prod. in July 2017

1.85kg /veh: Top rolls+ Trims
→ 568g saved (24%)

New Peugeot 508



Premium vehicle
In serial prod. in Nov. 2019

3,7kg /veh: IP structure+Trims
→ 1062g saved (22%)

Alfa Romeo Giulia



IP Upper
Structure

Premium vehicle
In serial prod. since May 2016

3,5kg /veh: IP Upper+structure
→ 1050g saved (23%)

DS7 Crossback



Premium vehicle
In serial prod. in October 2017

5,06kg /veh: IP structure+Trims
→ 1342g saved (21%)

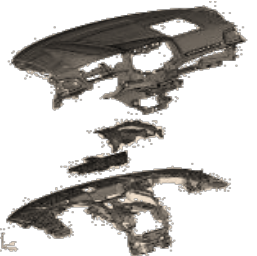
Peugeot 308



High volume production
In serial prod. since July 2013

1.2kg /veh: Top rolls+ Trims
→ 400g saved (25%)

Renault Mégane

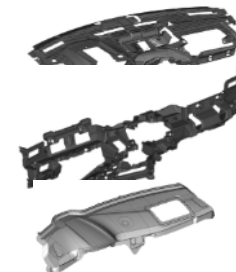


IP Upper
Closures
Structure

High volume production
In serial prod. On June 2017

5.4kg /veh: IP Upper+structures
→ 1260g saved (23%)

Renault Clio



IP Structural
Duct
IP instrument
panel
IP Upper

New Renault Clio
In serial prod. in March 2019

3,8kg /veh: IP Upper + structure
+ IP Instrument panel
→ 743g saved (16%)

New vehicles soon unveiled



+ APPLICATIONS ON
NON AUTOMOTIVE
MARKET

17 production vehicles planned with NAFILean, impact of a fleet of 13 Million vehicles:



NATURAL RESOURCES DEPLETION REDUCTION

→ Renewable resources
introduction with
6 500 Tons natural fibers



CO2 EMISSIONS REDUCTIONS

→ **100 000 Tons**
through average 21%
weight reduction of
automotive systems



FUEL ECONOMY FOR VEHICLES

→ **Additional
811 Million kms**
with same fuel quantity

Life Cycle Assessment to measure environmental impact

"Cradle to cradle" approach sorted by categories

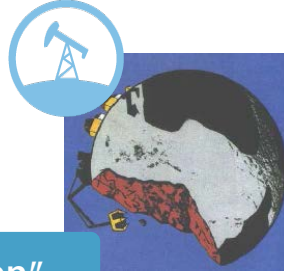


Short recap of the **environmental impact types** considered by the ISO 14040-44 norm "Life Cycle Assessment" (LCA):

ADP

Abiotic Depletion Potential

"Natural resources exhaustion"



AP

Acidification Potential

"Acid rain"



GWP

Global Warming Potential

"Greenhouse effect"



EP

Eutrophication Potential

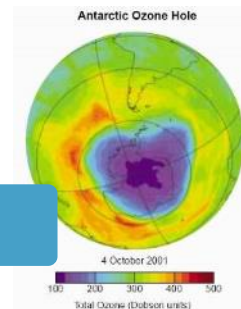
"Aquatic Env't over enriched"



ODP

Ozone Layer Depletion potential

Stratos "ozone hole"



POCP

Photochemical Ozone Creation Potential

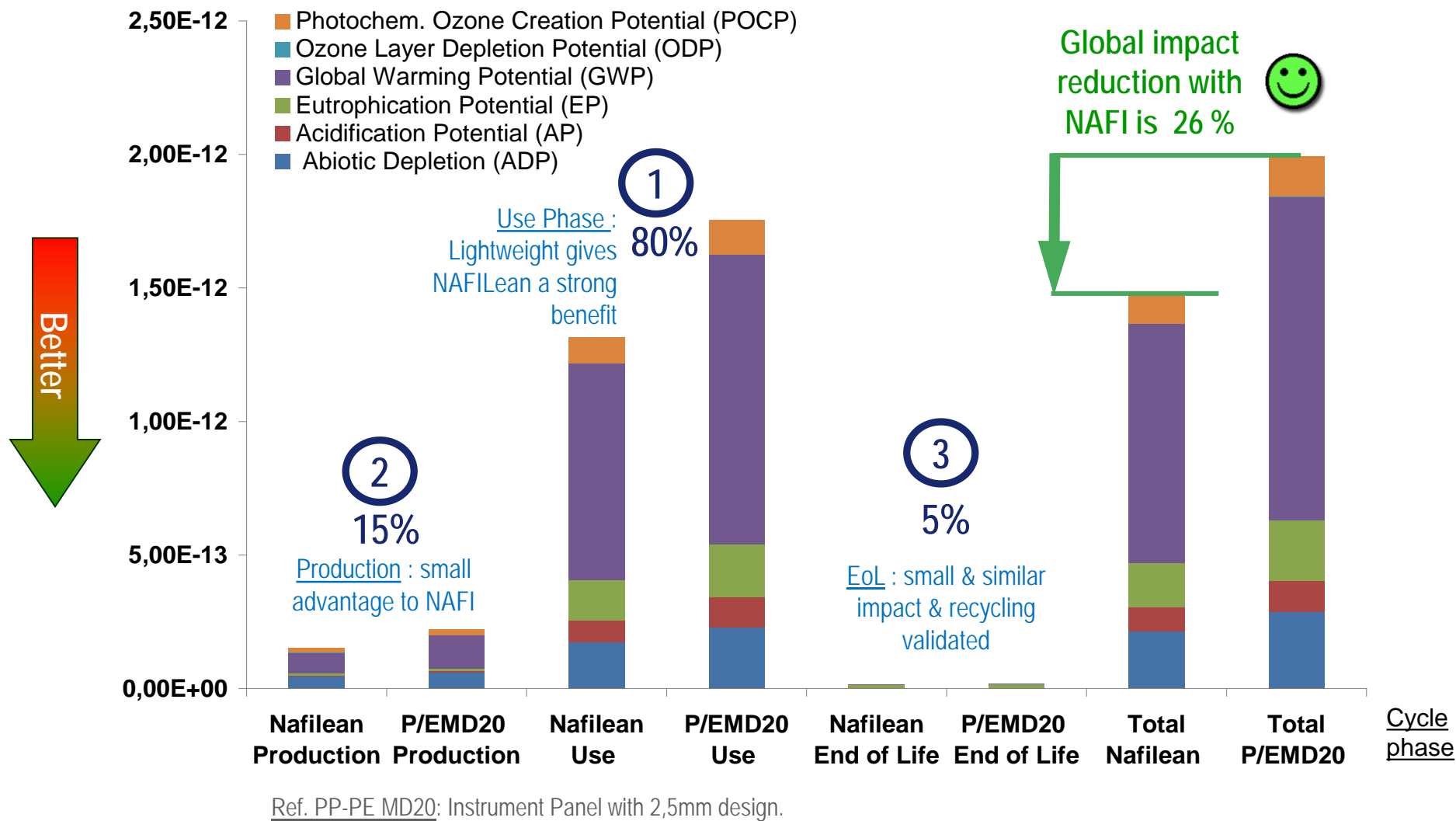
"Summer Smog"



CML2001-dec07, IKP experts (Southern Europe)

LCA applied to NAFILean systems

Split by types of impacts



NAFILEan recycling :

End of Life **FULLY VALIDATED** (PP recycling)



NAFILEan End of Life recycling study:
Recyclability from a PST recycling company from semi-industrial tests

- 1 Trial run: 1 000 NAFILEan instrument panels parts produced and introduced directly into the recycling industrial channel (real serial ASR plastic fraction)
- 2 Mix done ✓
NAFILEan R 10 %
+ PP R 90%
- 3 Sorting vs ASR ✓
NAFI chips go into the light
PP fraction (= recycled)
- 4 Extrusion & filtration
Shredder parameters ✓
Industry parameters ✓
- 5 Material characterisation
Compatible with
regenerated PP ✓

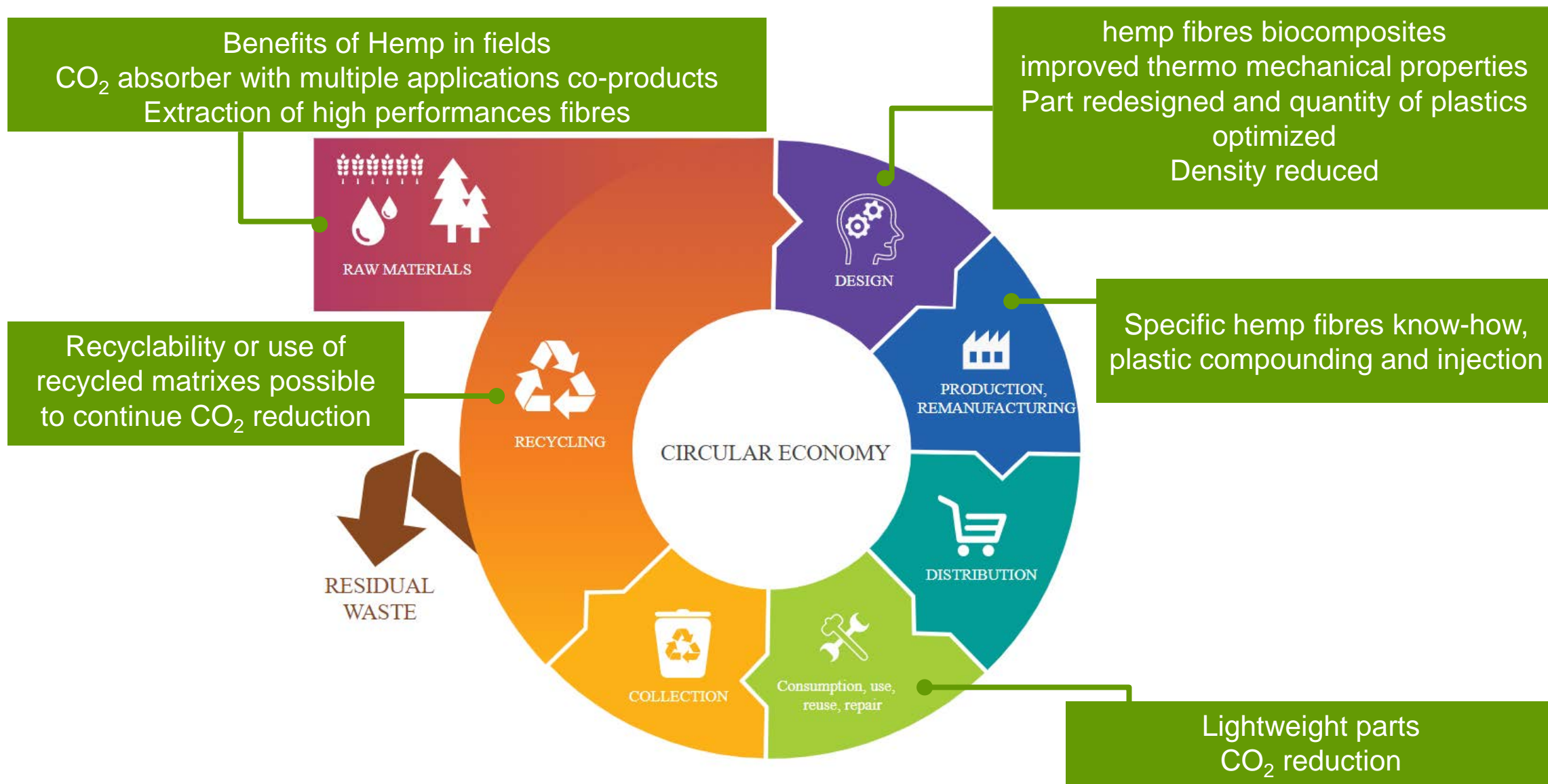


CONCLUSION :

NAFILEan can be recycled

- From Industrial Wastes (reused in injection directly after grinding of production scraps)
- From End of Life Recycling from Post Shredding Technology (after vehicle life)

Hemp bio composites plastics for circular economy





biomaterials for real.