

More sustainable WB wood coatings from



Marcello Vitale
m.vitale@ivmchemicals.com



1. Problem

Sustainability State Of The Art for wood coatings

2. Goals

What we plan to improve

3. Solution

How we planned to do it

4. Implementation

How we did it

5. Assessment

Measuring success and planning the future



1.1 Problem



- 3,3 Mtonnes wood coatings (2019)
- 60 % are solventborne (SB)
- 0,8 Mtonnes volatile organic compounds (VOC)
 - Hazardous or toxic
 - Ozone-forming
 - Need energy to be made and moved
 - Mostly non-renewable
 - Carbon Footprint (CFP) of SB = 2,1 kg CO₂/kg of paint
 - Serve no purpose in final paint
- 8 Mtonnes (non-CH₄) VOC emissions in EU (2018)
- 50 % from coatings



1.2 Problem



- Wood coatings with less VOC = waterborne (WB)
- They are mostly made with polyacrylic binders
- That is with
 - petrochemical
 - hazardous
 - high CFP materials

- Acrylic-based coatings deliver some but not all desired performance and looks



1.3 Problem



- Coatings have a large CFP
- Wood coatings do as well
- VOC are a big contributor to CFP
- VOC also have other negative impacts
- WB coatings have lower VOC but also high CFP and other issues

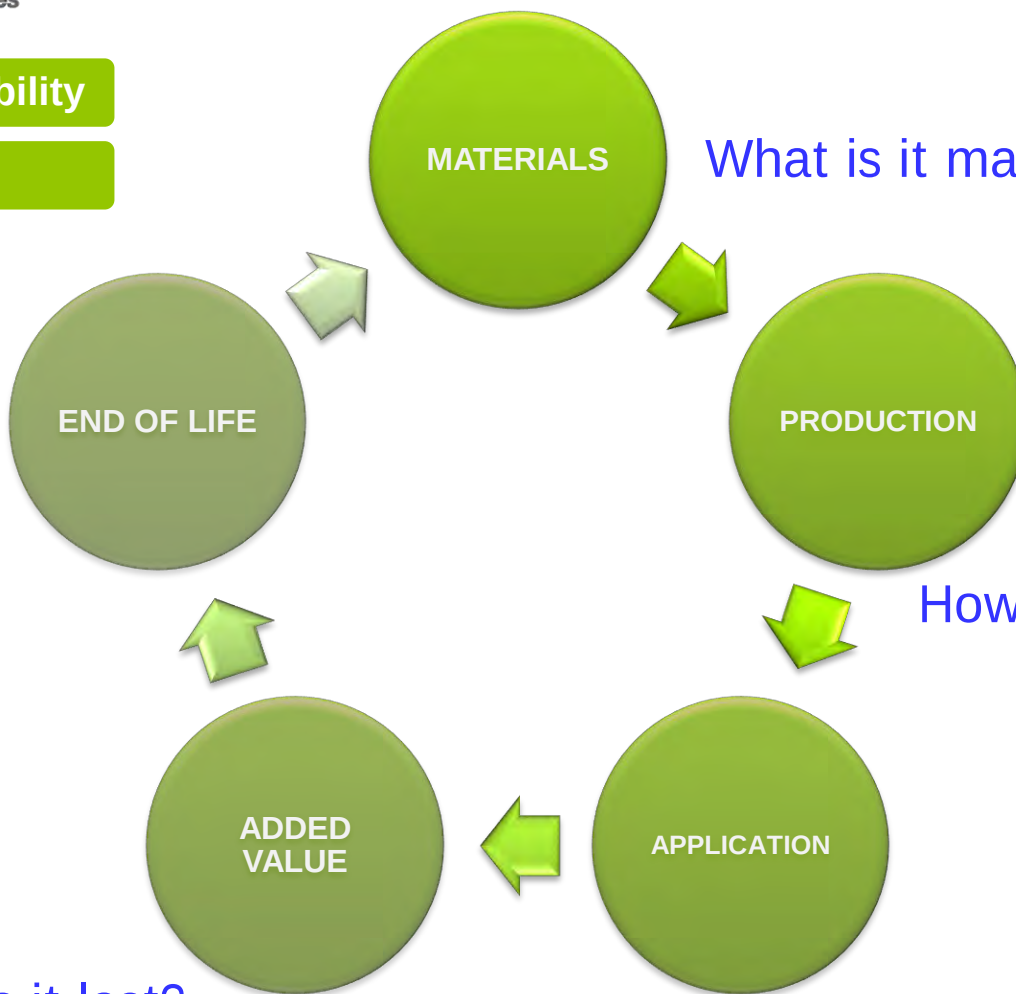


2.1 Goals

A product sustainability

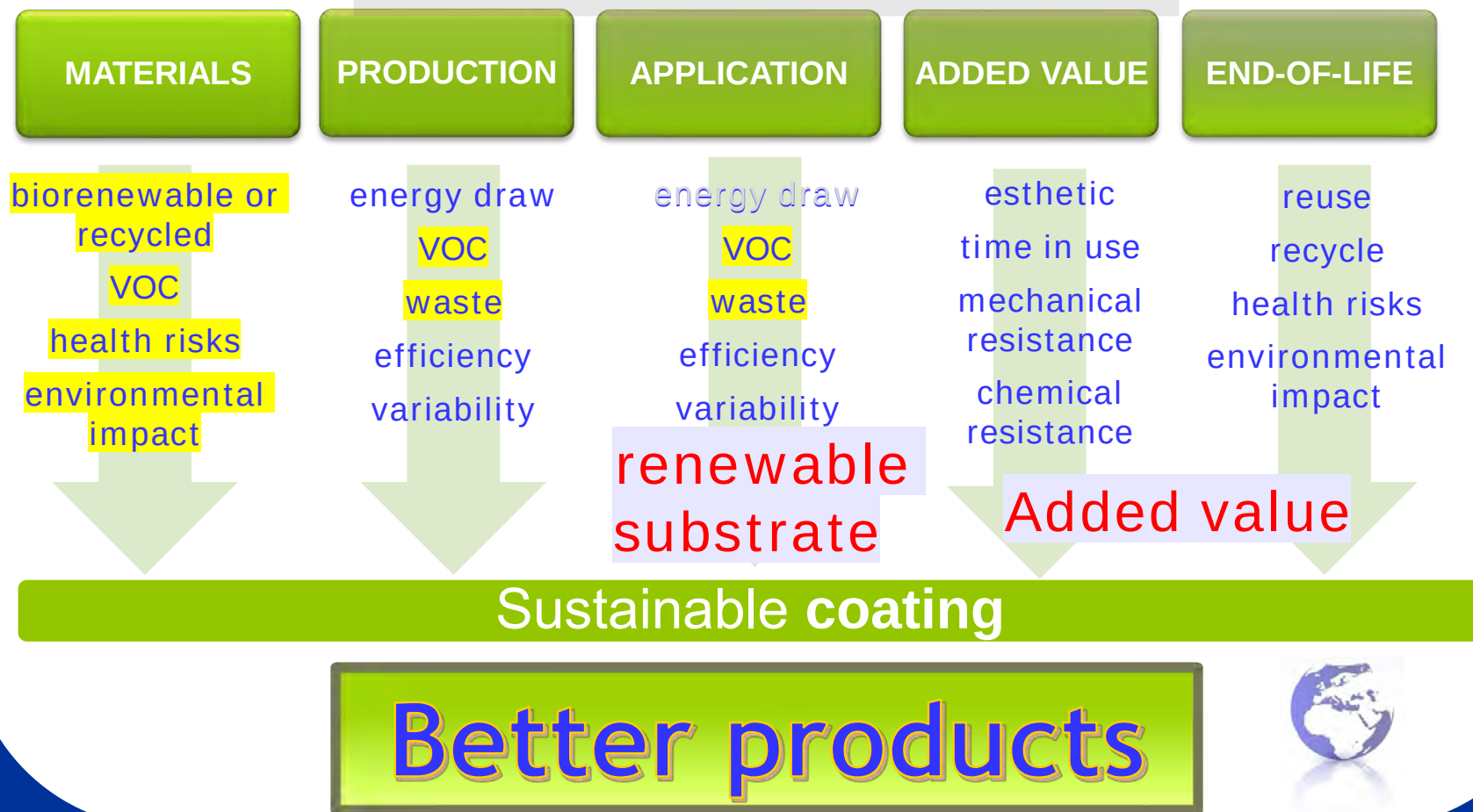
depends on:

How can it be
upcycled,
recycled or
disposed of?



2.2 Goals

WATERBORNE COATINGS



2.3 Goals



WB coatings

- with lower VOC
- with lower CFP
- with less hazardous components
- with less petrochemical components
- that have greater physical and chemical resistance
- that can provide looks now not delivered by WB coatings



Wood coatings become sustainable solutions

IVM is uniquely placed:
it produces
both resins and coatings



NEW RESINS
FOR NEW COATINGS



from here...



....there



Process and plant innovation



MATERIALS

SCOPE 3

NEW RESINS

REPLACING

WB short oil, high Mwt alkyd polyols

Safer

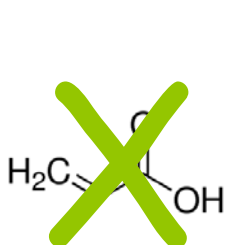
No VOC

Low climate and environmental impact (by LCA)

About 65 % biobased content on solids

components

- unsafe
- polluting
- with high GHG



SCOPE 1

PRODUCTION

Design and build the pilot of a novel resin production line

Extrusion emulsification

By dispersing alkyds in water rather than solvents, no VOCs are emitted

Consume less energy than current plants

Produce minimal (water) waste

Ensure maximum product quality, repeatability and reliability



3.5 Solution



The paints using such WB resins would be able to fill application niches now using:

- traditional SB 2K PU paints
reducing VOC emissions, CFP and dangerous chemicals
- UV or UPE SB paints (spray/curtain)
reducing VOC emissions, CFP and dangerous chemicals
- WB paints made from petrochemicals
increasing biorenewable content
- WB paints made from dangerous components such as acrylic acid
reducing health and environmental risks



LIFE is the main EU financing tool
for environmental and climate progress

LIFE funds projects aiming to:

- Improve environment and health
- Lower impact of human activities on environment and climate
- Enhance greater biodiversity
- Protect nature

LIFE by numbers

2021-2027 budget = **€5,4 billions**
(increasing from €3,4 billion in 2014-2020 budget)

Funding of LIFE-BioPaint certifies
IVM's technical capability
and commitment
to sustainable development



4.1 Implementation



Emulsification process within the screw extruder:

1. hot ($>100^{\circ}\text{C}$) resin input
 - already with dissolved emulsifier
2. neutralization stage:
 - basic water added
 - water-in-resin emulsion formed
 - reaction of the acid groups to emulsification pH
3. emulsion inversion stage:
 - water is added
 - viscosity peak reached and passed
 - resin-in-water emulsion forms
4. dilution:
 - more water added
 - pH adjusted and buffered for stability



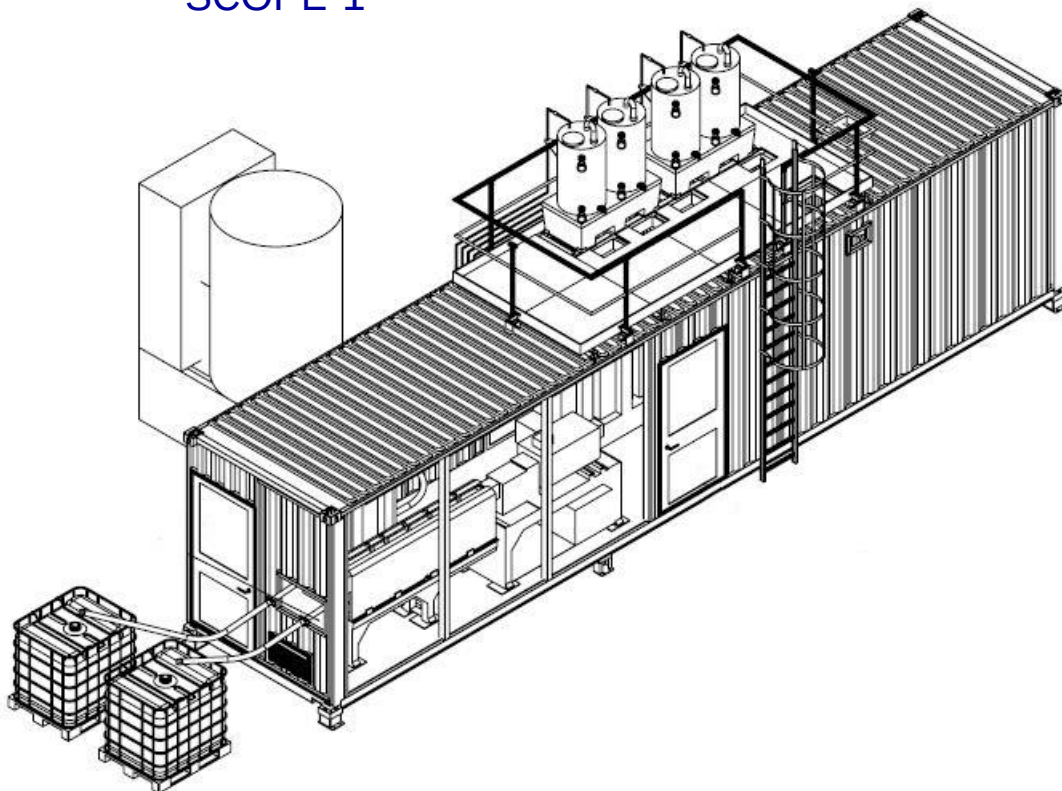
4.2 Implementation



PRODUCTION

Extrusion emulsification in a box

SCOPE 1



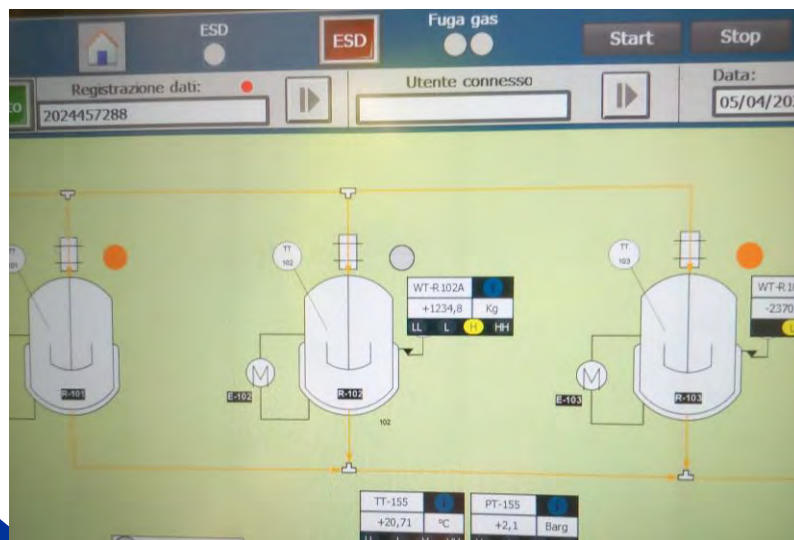
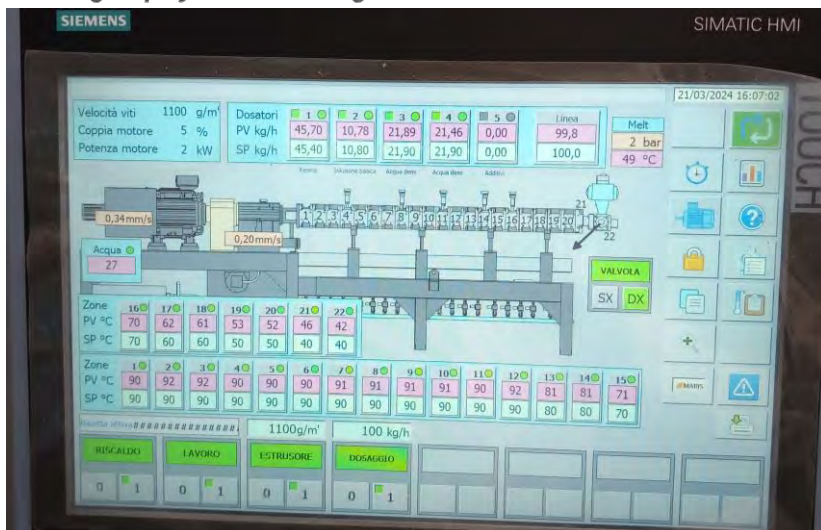
- Maximum production flexibility
- Compatible with ATEX production environment



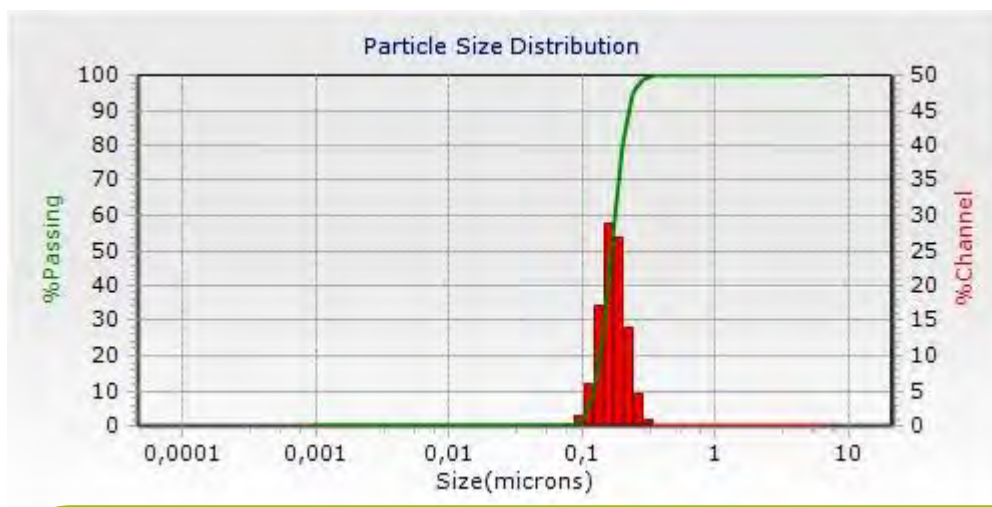
4.3 Implementation



4.4 Implementation



4.5 Implementation



Emulsion characterization

- pH = 6,5 – 7,5
- particle size 0,2 – 0,3 μm
- polymer content in water = 40% - 50%
- stability checked by centrifugation test



5.1 Assessment



	% solids	% alkyd		drying speed	resistance to liquids	notes		
		emulsion on formula	solids on tot binder					
2K clear topcoat for industry	37,03	0	0	= (in oven)	>	more glossy, less grey, long pot life		
	37,51	50	71					
2K white topcoat for industry	46,59	0	0	= (in oven)	=	more glossy, whiter		
	46,87	20	35					
2K clear self-sealer	26,96	0	0	= (at RT)	=	more glossy, less grey, much fuller		
	26,93	60	100					
2K clear topcoat max resistance	28,52	0	0	= (at RT)	<	lower scratch resistance to be recovered, less grey, long pot life		
	28,35	35	68					
1K clear topcoat	31,99	0	0	< (at RT)	<	needs most work to select Ac and Alk		
	31,80	41	58					
2K white topcoat, minimal cost	46,59	0	0	< (at RT)	=	more glossy, needs less TiO ₂ , no VOC needed		
	46,54	45	100					
UV WB clear topcoat	33	0	0	=	=	more glossy	less grey fuller	much
	33	30	42					
1K/2K white basecoat, general use	58	0	0	= (at RT) = (in oven)	=	whiter, needs less TiO ₂ , no VOC needed, fuller		
	58,2	40	55					



5.2 Assessment

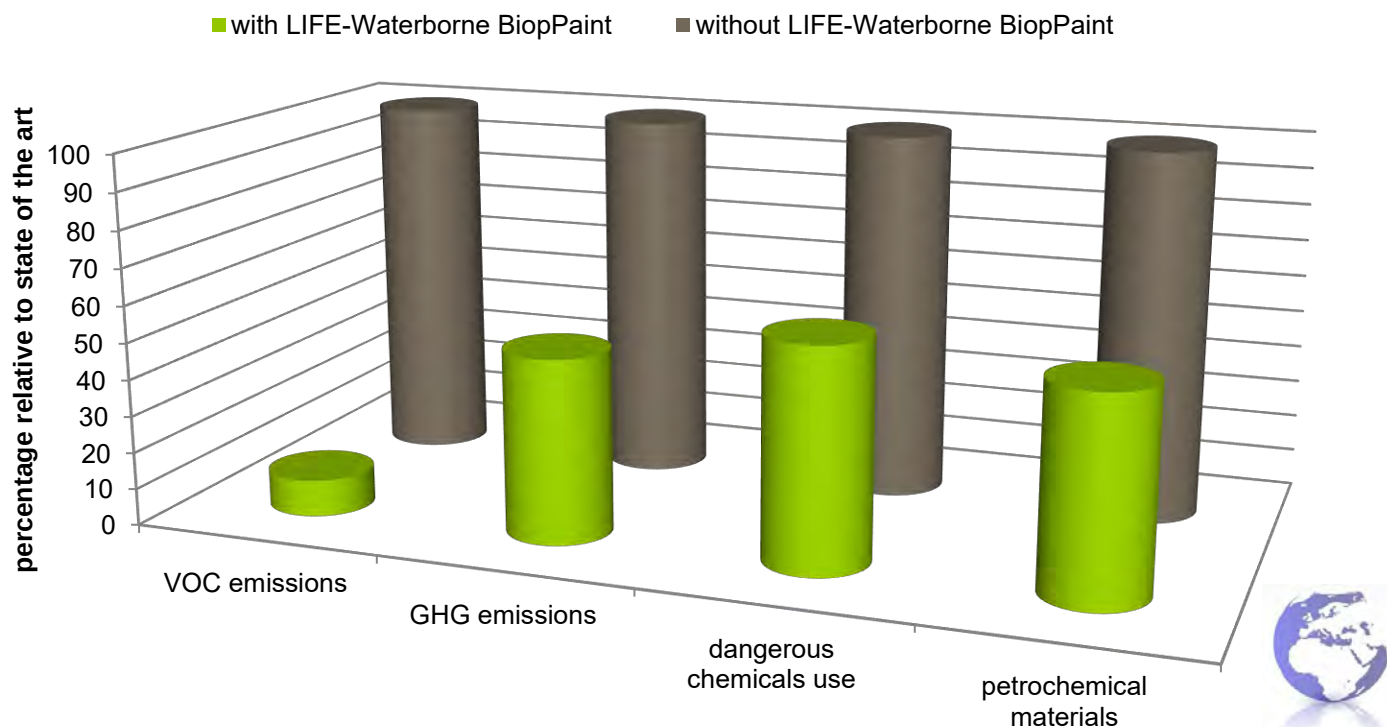


50% lower CO2 emissions

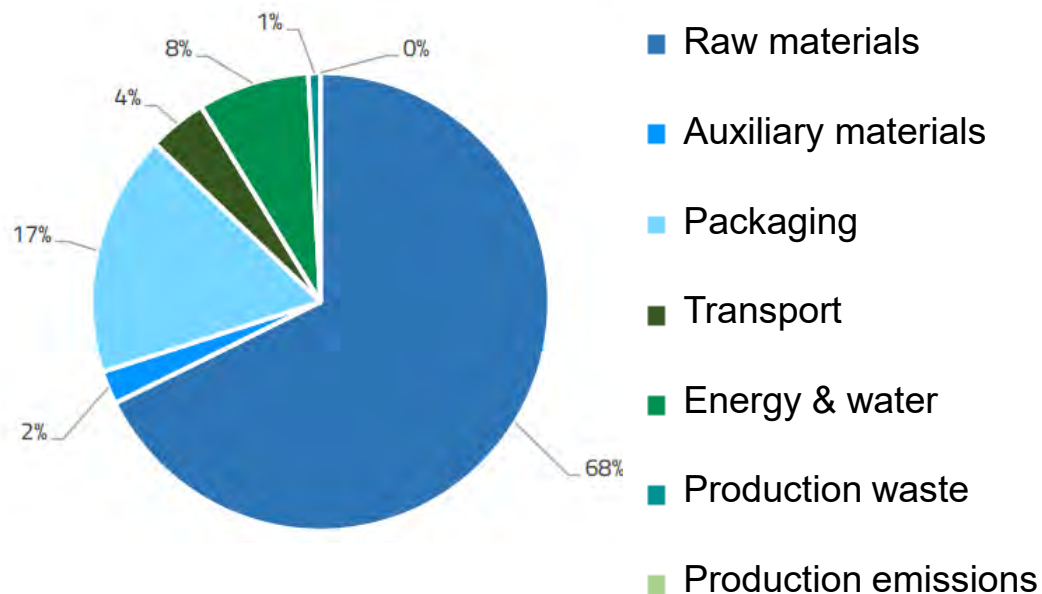
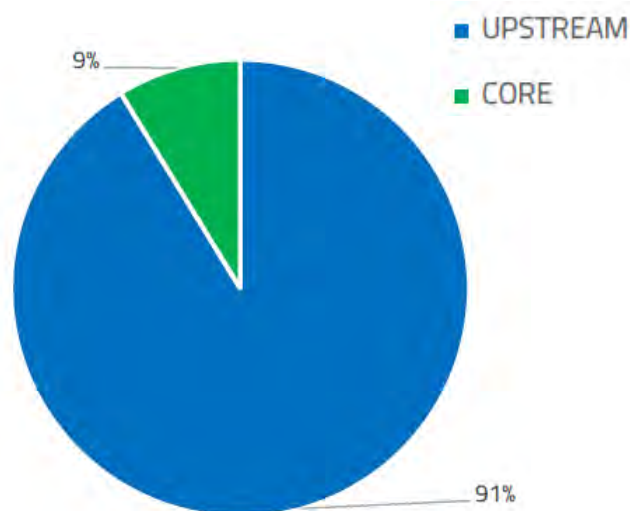
90% lower VOC emission

45% less petrochemicals

40% less dangerous materials



5.3 Assessment



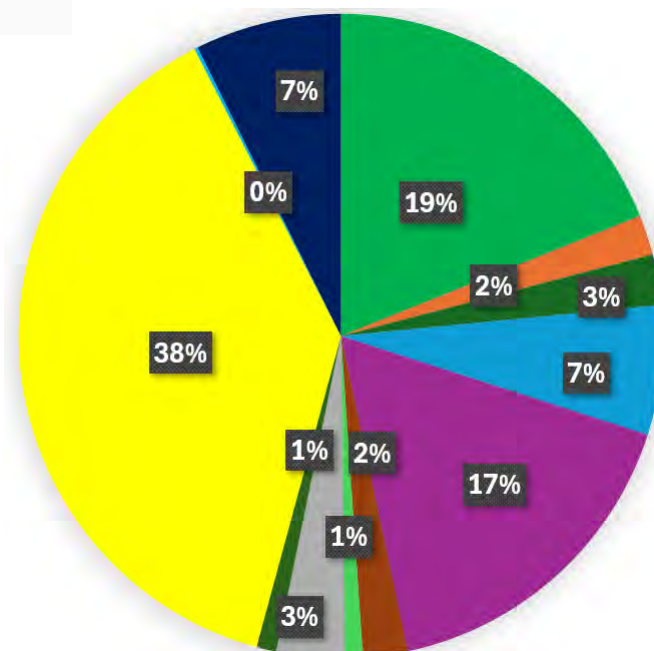
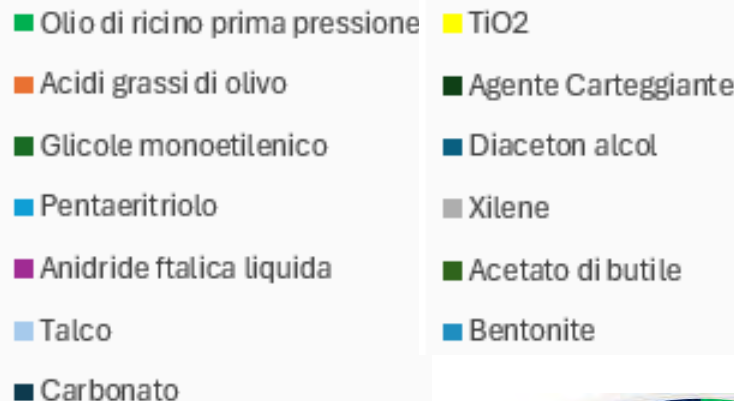
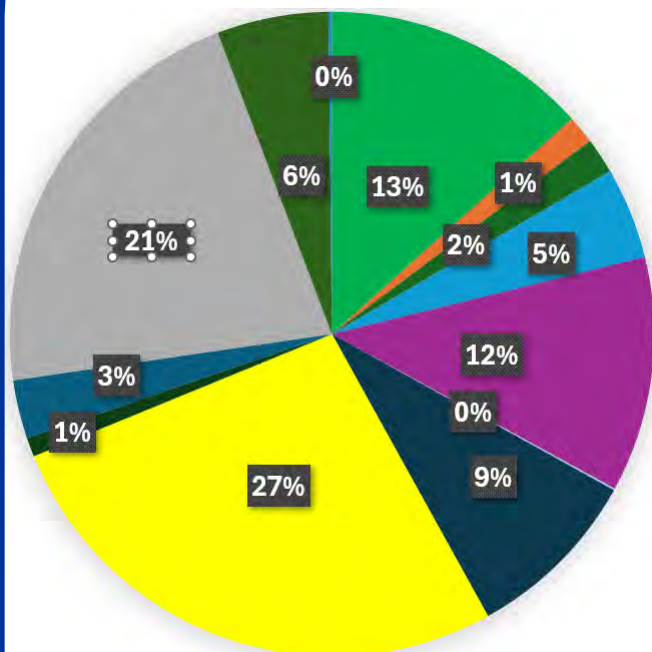
GHG from LCA as in ISO 14040:2006 and ISO 14044:2006)

CFP (kg CO ₂ / kg paint)	SB	WB	new WB
pigmented basecoat	2,1	1,85	1,6
clear topcoat	2,4	2	1,65

biobased resins
must come from
ISCC-certified
sources to avoid
land-use change
impact



5.4 Assessment



GHG from LCA as in ISO 14040:2006 and ISO 14044:2006)

QUESTIONS?

For any info: [*m.vitale@ivmchemicals.com*](mailto:m.vitale@ivmchemicals.com)

