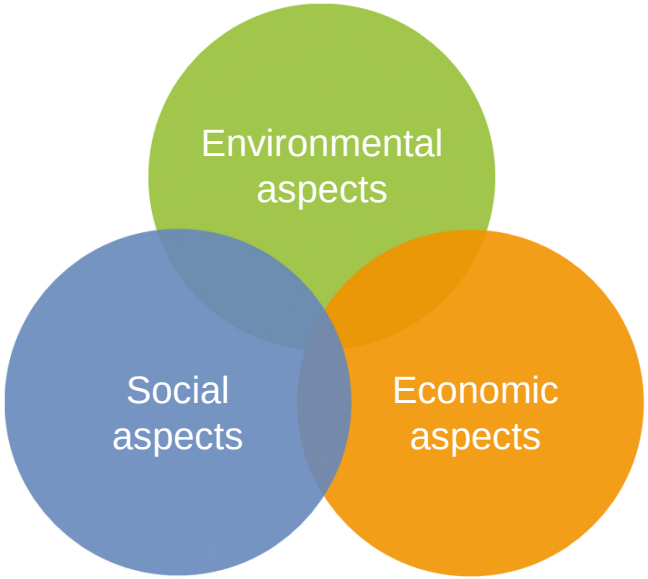
Binder Solutions Suitable for a Sustainable Architectural Coatings Industry

Dr. Constantin Tiemeyer

XIV. Conference on Pigments and Binders, Czech Republic, November 2021

To Meet the Challenges, We Need to Consider All Aspects of Sustainability Along the Entire Value Chain

Sustainability



- Triple bottom line of sustainable development: balance economic, environmental and social goals

Sustainable Development Goals (SDG)

- The UN 2030 Agenda for Sustainable Development
- #3: reduction of biocides – NEXIVA® powder paints
- #12: renewable raw materials: VINNAPAS® eco and VINNECO®

NEXIVA® Powder Binders

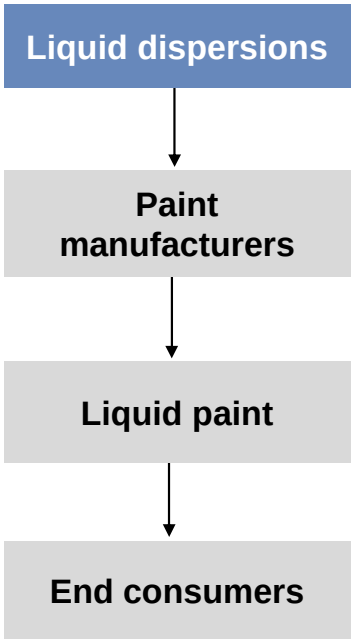
Revival of “Powder Dispersion Paints” in Germany

“Biocide-Free” Interior Paints for Allergy Sufferers (CIT, MIT, BIT …)

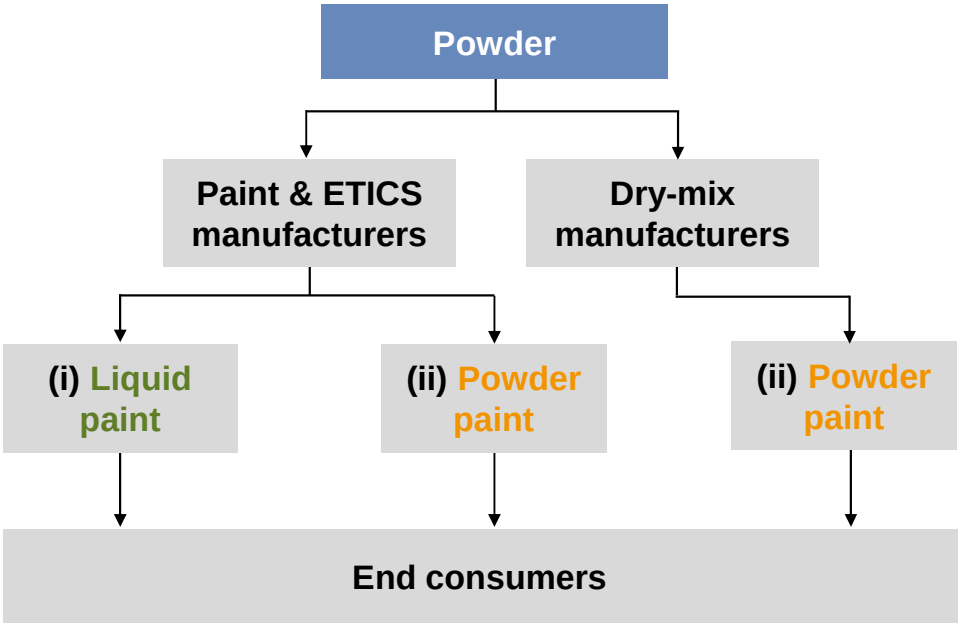
- Dispersion paints with high pH (approx. < 11.5)
  - Emulsion paint + approx. 2% waterglass (Patent: EP 1 297 079, written in 2007)
  - Emulsion paint + approx. 2% potassium methyl siliconate (Patents: DE 10 2014 013 455 and DE 2016 002 221 [or WO 2017144694])
  - Biocide free (criteria of the Blue Angel): < 2 ppm BIT, < 2 ppm MIT, < 0.5 ppm CIT
- Dispersion-modified silicate paints
- 2K-systems: normal interior paints + additive to destroy the biocide
- **Powder dispersion paints**

Concepts of Dispersible Polymer Powders (DPP) – Depending on Customer Structure

Conventional Approach



New Approaches: Marketing & Logistics



Paint and dry-mix manufacturers will have different understandings of paint quality!

Advantages of NEXIVA® Powder Paints

Biocide Free

No Water, No Biocide:

- NEXIVA® based powder paints can be produced without the use of biocides

Weight Saving

40% Less Weight:

- Reduced transportation cost from production to location of sale
- Easier storage, transport & handling

98% Plastic Waste Reduction

Using Paper Bags with PE Liners:

- 0.75 g of plastic / 1 L of paint is used versus 30 g (for conventional packaging)

Advantages of NEXIVA® Powder Paints

Responsible Use of Resources

- Only use what you need and reduce environmental impact

Prolonged Shelf Life

- Absence of water allows for improved shelf-life stability, whether in a hot or cold climate

Safe on the Road and at Home

- Powder paints are easier to handle in the event of leakage
- NEXIVA® can be formulated to very low VOC (<1 g/L) levels and conforms with major eco-labels

NEXIVA® Based Powder Paint – Economical TiO_2-Free Starting Formulation

Raw Material	Description	Quantity [g]
NEXIVA® CT 115	Polymer binder	93.0
Tylose MH 2000 YP2	Thickener	4.0
Calgon N	Dispersant	2.0
Sachtolit L	**White pigment**	46.0
Omyacarb 2GU	Calcium carbonate	120.0
Socal P2	Fine calcium carbonate	176.0
Dorkafill Pro Dura	Hard pigment for scrub resistance	120.0
Arbocell BE 600/30 PU	Fibers for improved redispersibility	37.0
Agitan P801	Defoamer	2.0
Water	Add the powder in water	400.0
Total		**1,000.0**

Easy-to-Disperse Formulation for Interior Wall Paint Application

Key Property	
PVC	~ 83%
Scrub resistance	47 µm, Class 3
Hiding Power @ 8 m²/L	97 %, Class 3
Appearance/ Gloss @ 85°	Matt / 5.0 GU

This formulation can be easily tweaked to improve the opacity (different filler package or more white pigment).

Ultra-matt, easy to disperse and cost-effective formulation with only 5% of white pigment

NEXIVA® Based Powder Paint – High Quality Starting Formulation

Raw Material	Description	Quantity [g]
NEXIVA® CT 115	Polymer binder	120.0
Tylose MH 2000 YP2	Thickener	3.0
Calgon N	Dispersant	1.0
Agitan P804	Defoamer	0.2
Sachtolit L	**White pigment**	150.0
Socal P2	Fine calcium carbonate	140.0
Mattex Pro	Hard pigment for scrub resistance	100.0
Arbocell BE 600/30 PU	Fibers for improved redispersibility	36.0
Water	Add the powder in water	450.0
Total		1,000.2

Premium Formulation with Good Wet Scrub Resistance

Key Property	
PVC	~ 76%
Scrub resistance	14 µm, Class 2
Hiding power @ 7 m²/L	98%, Class 2
Appearance/ gloss @ 85°	Matt

Premium formulation with good wet abrasion resistance

NEXIVA® Based Powder Paints – Coloration Options

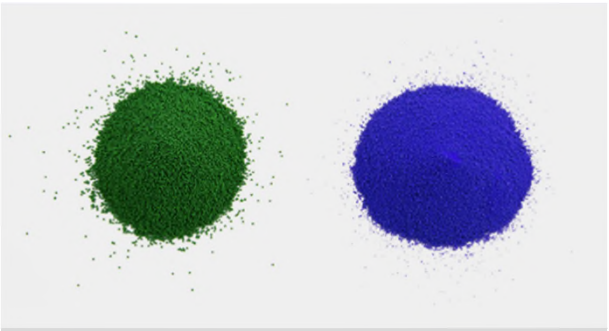
Water-Based Pigment Paste

- Coloration with standard water-based pigment paste possible after having added the water

Pigment in Powder Form

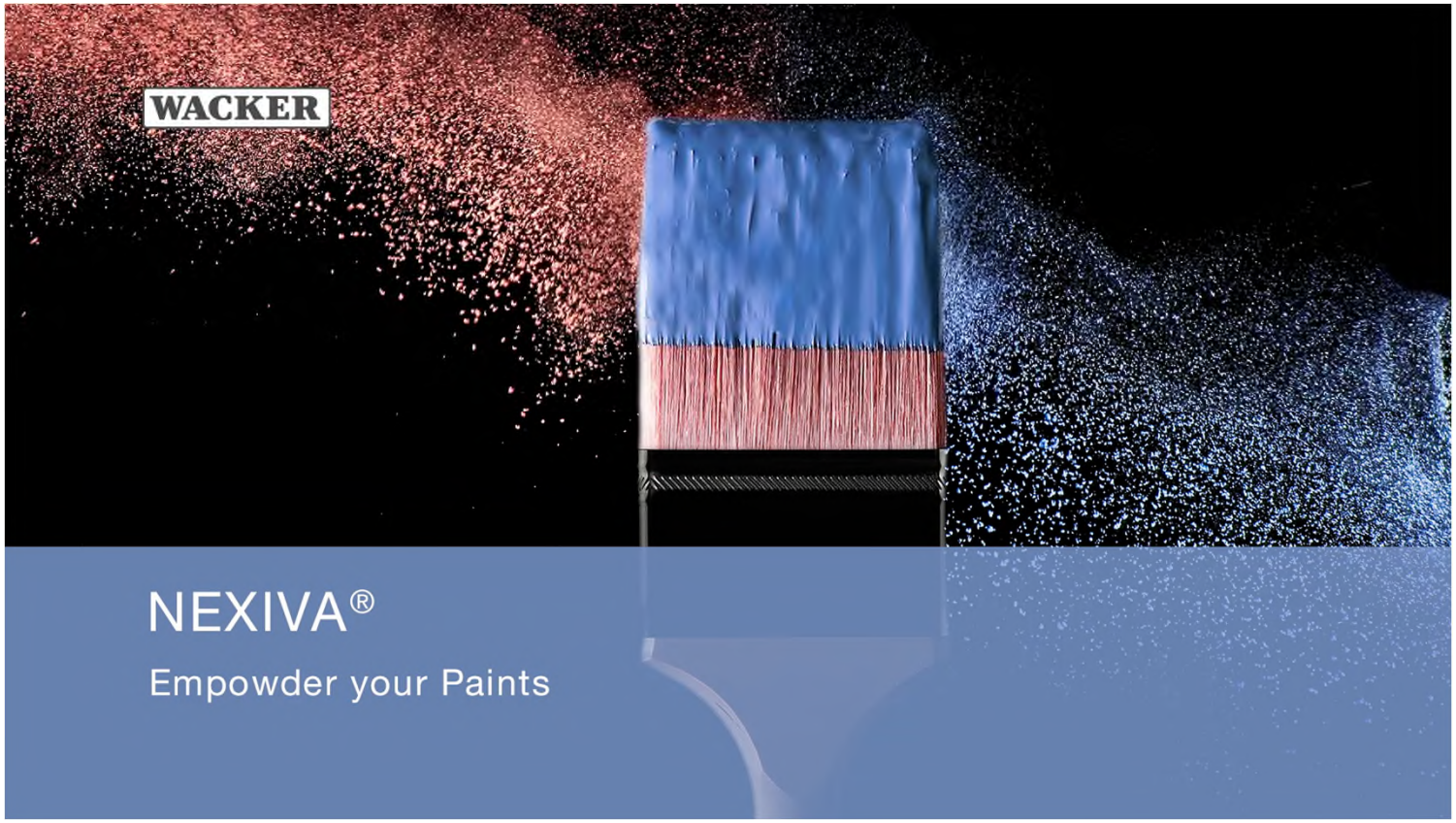
- Coloration before water addition using pure pigments

Granulated Pigments



- Easy and reproducible coloration via colored pellet addition prior to water addition

NEXIVA® Based Powder Paint – Application Properties



Binders Using Renewable Resources in the Value Chain

Adhering to a Global 2° Target Means 68% of Fossil Fuel Energy Sources Need to Stay in the Ground ("Unburnable Carbon")*

- Climate change is likely to become one of the most significant drivers of biodiversity loss
- Greenhouse gases: ¾ of emissions are directly related to additional fossil carbon from the ground
- Decarbonization (renewable energies) does not work for chemicals and materials: transition to "renewable carbon"
- Key challenge: replace demand for fossil carbon with alternative carbon sources
- Alternative carbon sources are biomass, CO_2 and recycling of carbon-containing waste streams

* Oil Change International (http://priceofoil.org), 2016

Inspired by

RENEWABLE CARBON & nova

www.renewable-carbon.eu http://nova-institute.eu/

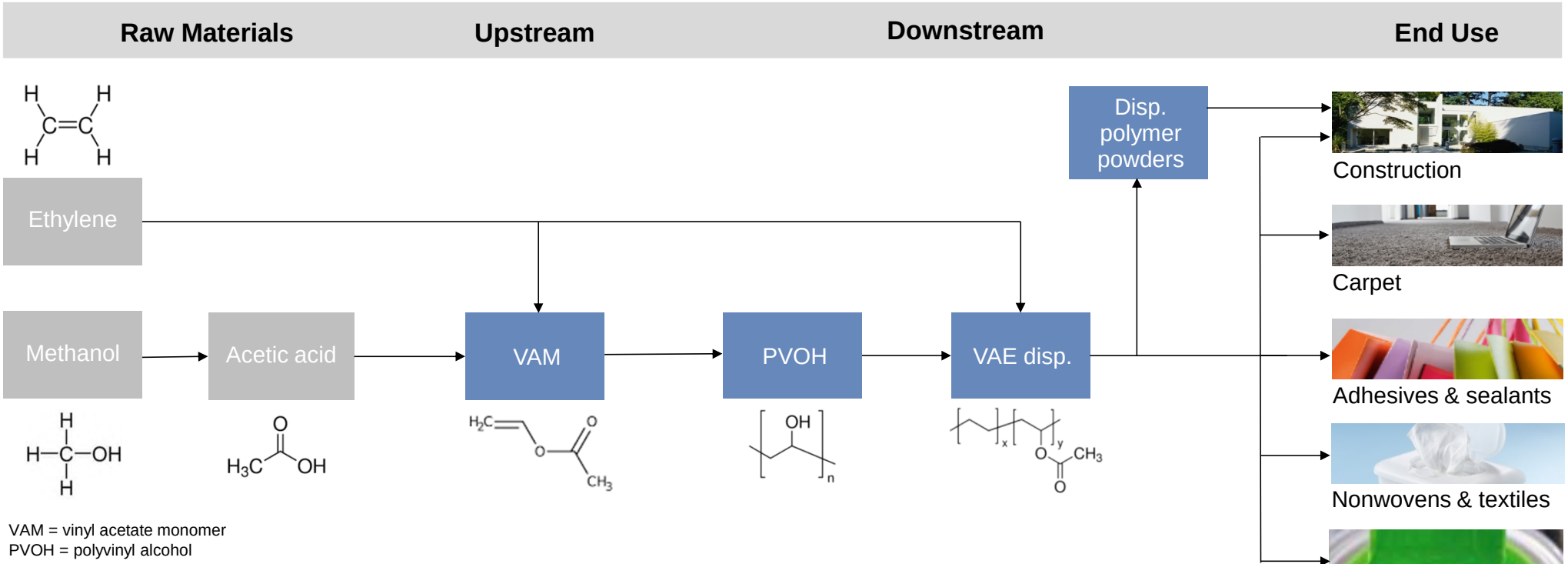
Member of

Stiftung 2° Deutsche Unternehmer für Klimaschutz

United Nations Climate Change Global Climate Action

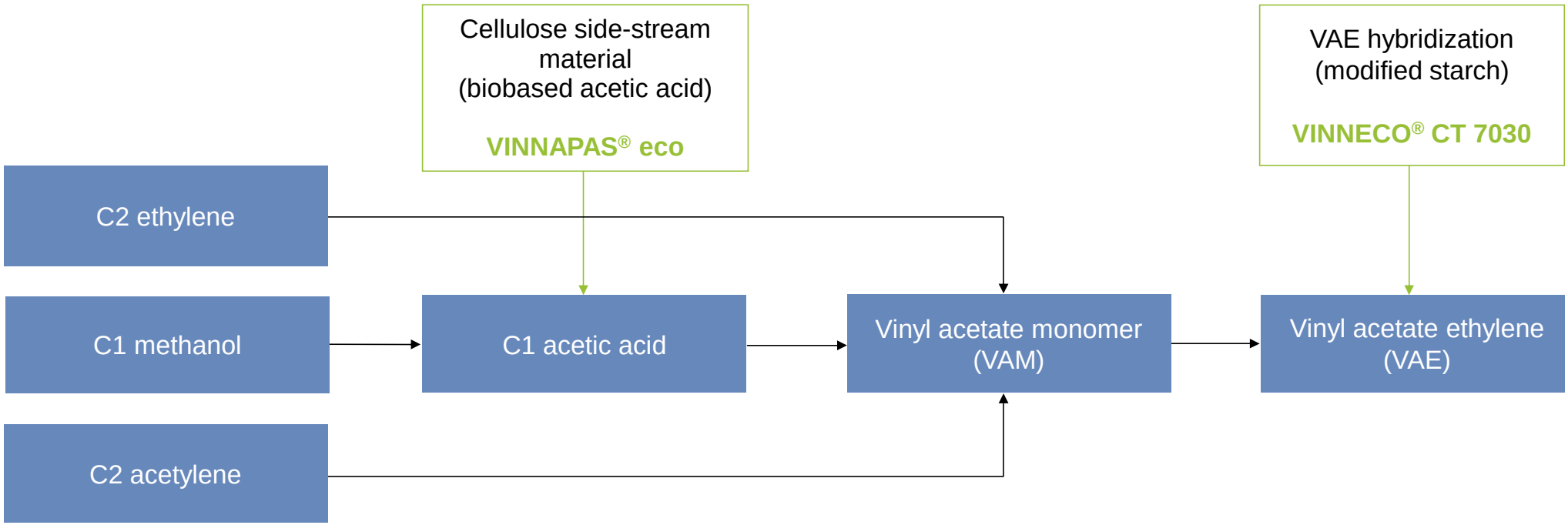
RACE TO ZERO

WACKER POLYMERS – Global Set-Up to Deliver Best Value to the Customers



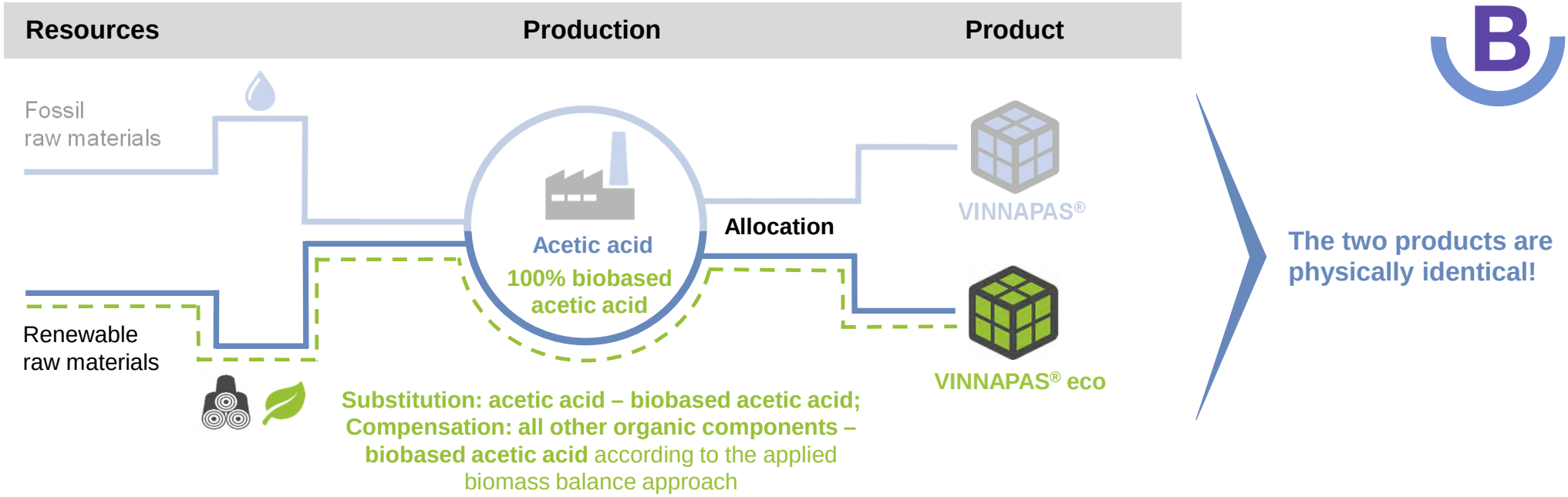
How can we introduce biobased raw materials in this value chain?

Pathways to Introduce Renewable Feedstock into VAE Production



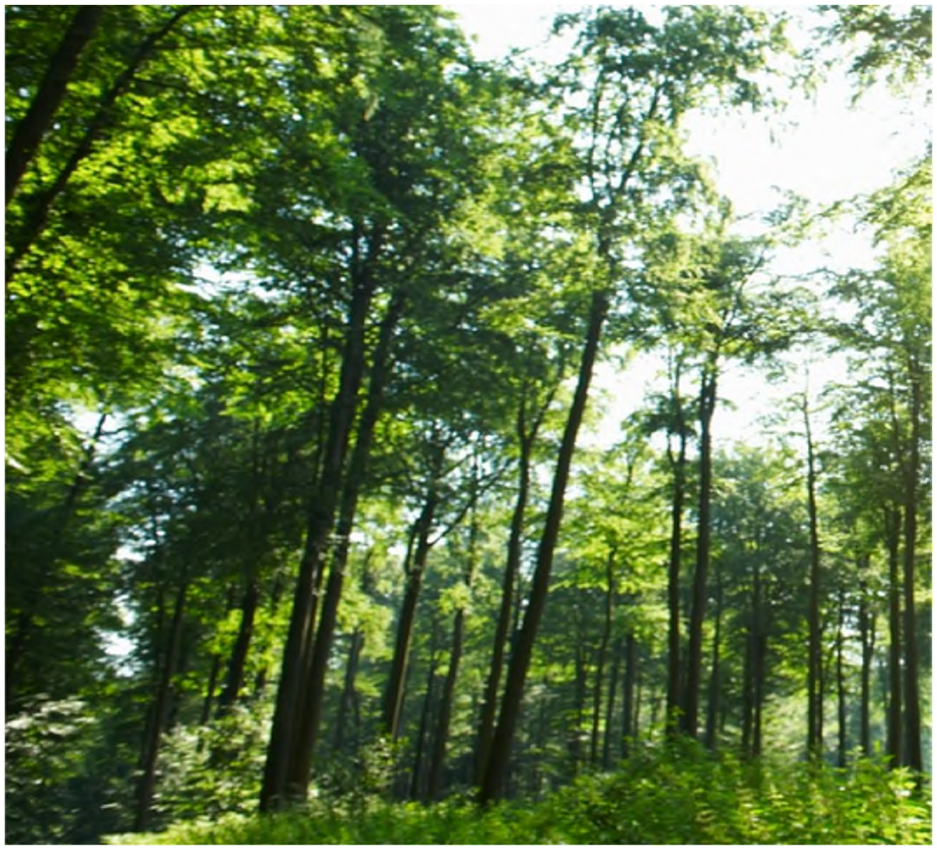
- **Starch as new raw material introduced into the value chain: VINNECO® CT 7030**
- **Biobased acetic acid as new raw material to replace a fossil feedstock: VINNECO® eco**

The Smart Alternative: Biomass Balance for Polymer Binders Leads to Products 100 % Based on Renewable Raw Materials – VINNAPAS® eco



- The amount of biobased acetic acid within the production chain is inspected according to the REDcert² biomass balance approach and audited by independent external auditing companies

Where Does the Renewable Raw Material for Our VINNAPAS® eco Binders Come From?

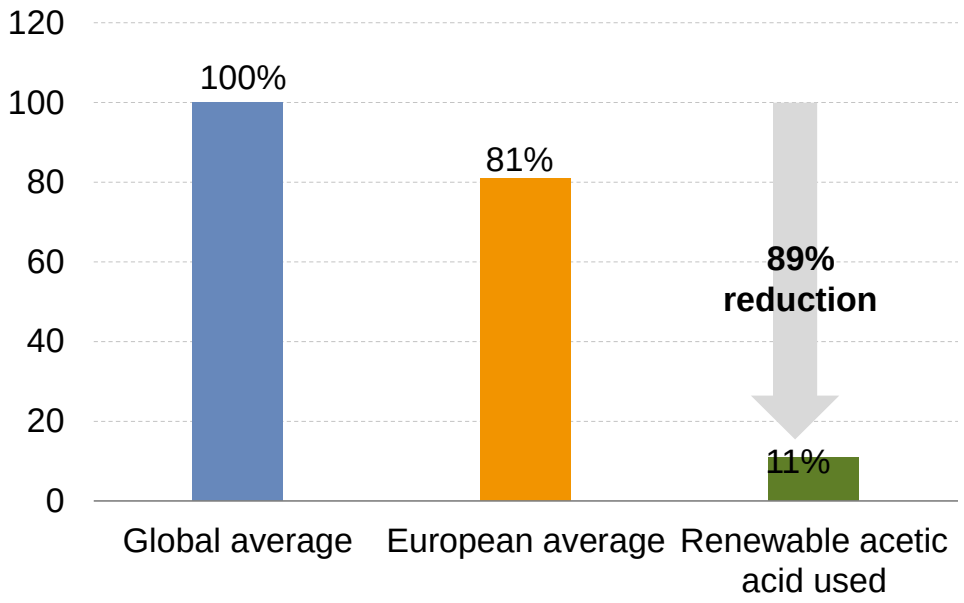


Biobased Acetic Acid Is Sourced from Wood Waste

- Regionally sourced from within 400 km
- No competition to food usage
- Biobased acetic acid as byproduct from pulp production
- Supplier converts > 50% of wood into products, the rest is used to generate energy for production
- The wood comes from sustainable forestry and the biobased acetic acid is certified in accordance with the “Programme for the Endorsement of Forest Certification Schemes (PEFC)”

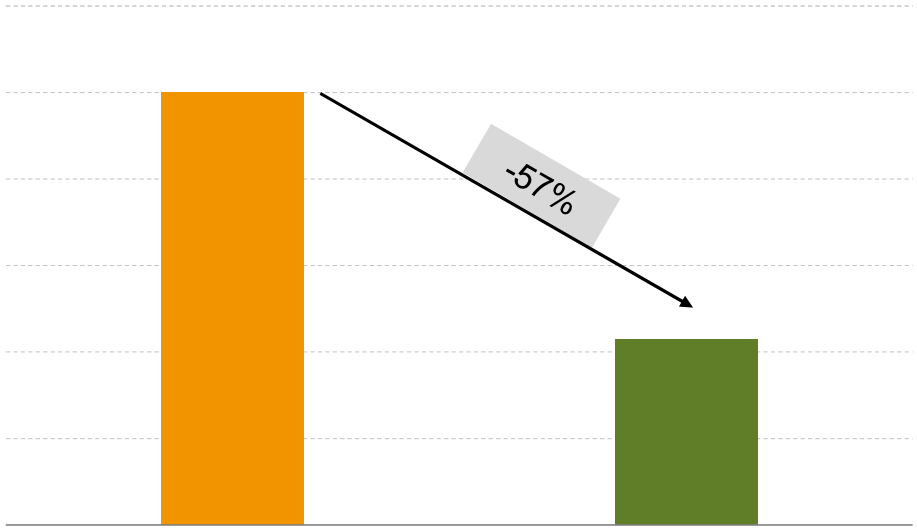
Estimated Reduction Potential for Carbon Footprint – PRELIMINARY DATA

Acetic Acid Raw Material



Source: data from acetic acid supplier based on third party LCA report

VINNAPAS® Dispersion



Values shown are WACKER internal calculations based on simplified assumptions, not according the LCA method, full LCA pending
*Relative reduction compares absolute reduction to LCA values for VAE dispersion from EPDLA 2012

Biomass Balance vs. C^{14} Approach

Biomass Balance Approach

- Wood origin, byproduct from pulp production
- Renewable content available at 60% and 100% based on solids
- Product performance identical to VINNAPAS® parent grade: no reformulation necessary
- **Renewable content not measurable**
- Certification via RedCert^2 standard CMS 71 “Renewable Resources"

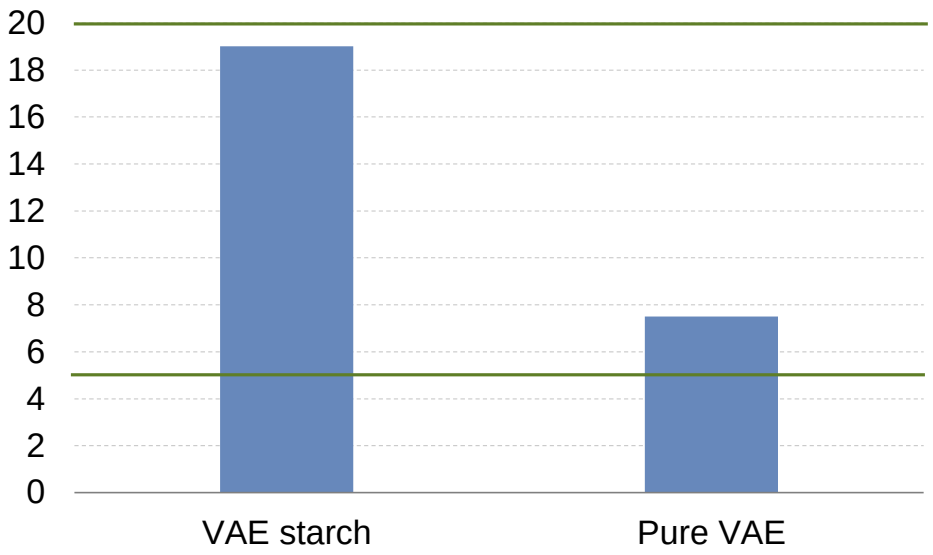
Carbon 14 Approach

- Starch derived from industrial potato processing
- Bio-content: 30% based on solids
- New product with new properties
- **Measurable via isotope analysis**
- Certification possible via biobased content analysis acc. to EN 16785-1

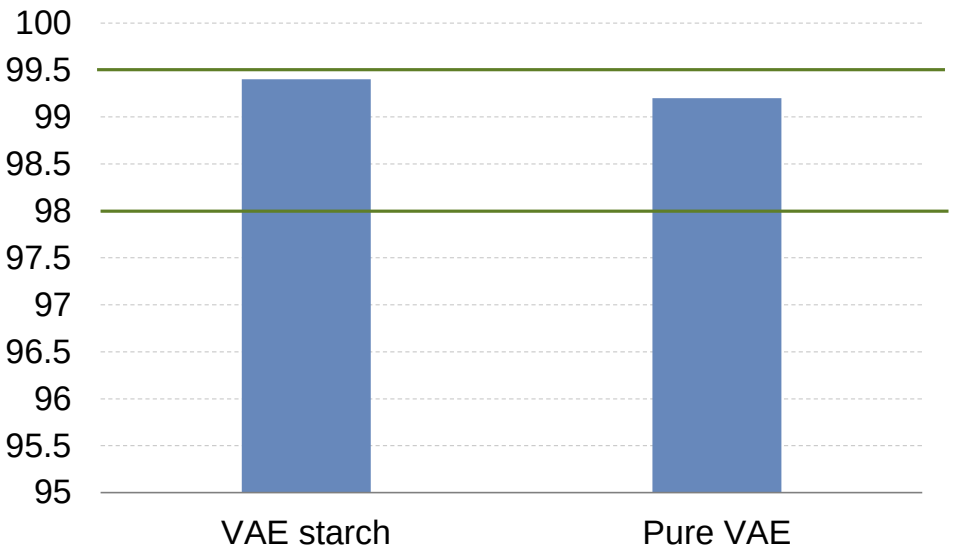
- **Different raw materials will result in different communication and marketing**

Properties of Interior Paint Based on C^{14}-Detectable Binder

Wet Scrub Resistance [µm]



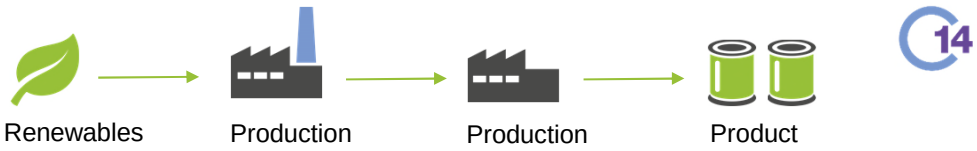
Hiding Power at 8m²/L [%]



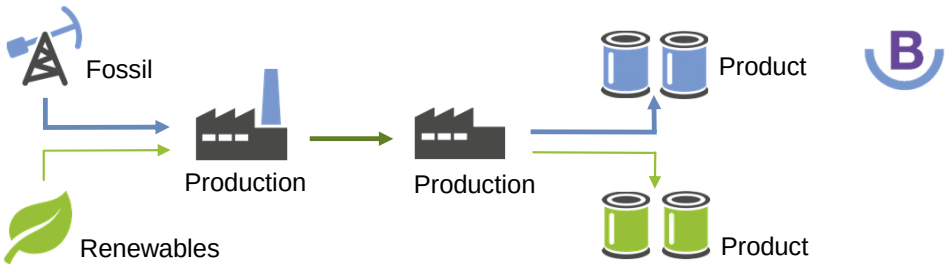
- Binder “diluted” with C14-detectable starch
- Good paint performance can still be achieved

Product Portfolio Using Renewable Raw Materials

Product	SC [%]	Viscosity	pH	Tg [°C]	MFFT [°C]	% Renewable	Type
VINNECO® CT 7030	46	1,000 – 4,000	5.0 – 6.0	12	1	30%	14
VINNAPAS® eco EP 3360 (60MB)	60	3,000 – 6,000	4.0 – 6.0	10	2	60%	B
VINNAPAS® eco EP 3360	60	3,000 – 6,000	4.0 – 6.0	10	2	100%	B
VINNAPAS® eco EF 3777 (60MB)	56	150 – 1,850	3.5 – 5.5	10	1	60%	B
VINNAPAS® eco EF 3777	56	150 – 1,850	3.5 – 5.5	10	1	100%	B



- Dedicated storage silo – build a new silo or full switch to biobased monomer
- For new monomer technology: low volume and R&D development required



- Cost controlled approach aiming at increasing the proportion of biobased materials in the coating industry – direct drop-in!

Disclaimer

The information contained in this presentation is for background purposes only and is subject to amendment, revision and updating. Certain statements and information contained in this presentation may relate to future expectations and other forward-looking statements that are based on management's current views and assumptions and involve known and unknown risks and uncertainties. In addition to statements which are forward-looking by reason of context, including without limitation, statements referring to risk limitations, operational profitability, financial strength, performance targets, profitable growth opportunities, and risk adequate pricing, as well as the words “may, will, should, expects, plans, intends, anticipates, believes, estimates, predicts, or continue”, “potential, future, or further”, and similar expressions identify forward-looking statements. By their nature, forward-looking statements involve a number of risks, uncertainties and assumptions which could cause actual results or events to differ materially from those expressed or implied by the forward-looking statements. These include, among other factors, changing business or other market conditions and the prospects for growth anticipated by the Company's management. These and other factors could adversely affect the outcome and financial effects of the plans and events described herein. Statements contained in this presentation regarding past trends or activities should not be taken as a representation that such trends or activities will continue in the future. The Company does not undertake any obligation to update or revise any statements contained in this presentation, whether as a result of new information, future events or otherwise. In particular, you should not place undue reliance on forward-looking statements, which speak only as of the date of this presentation.

Thank You for Your Attention