Rehap

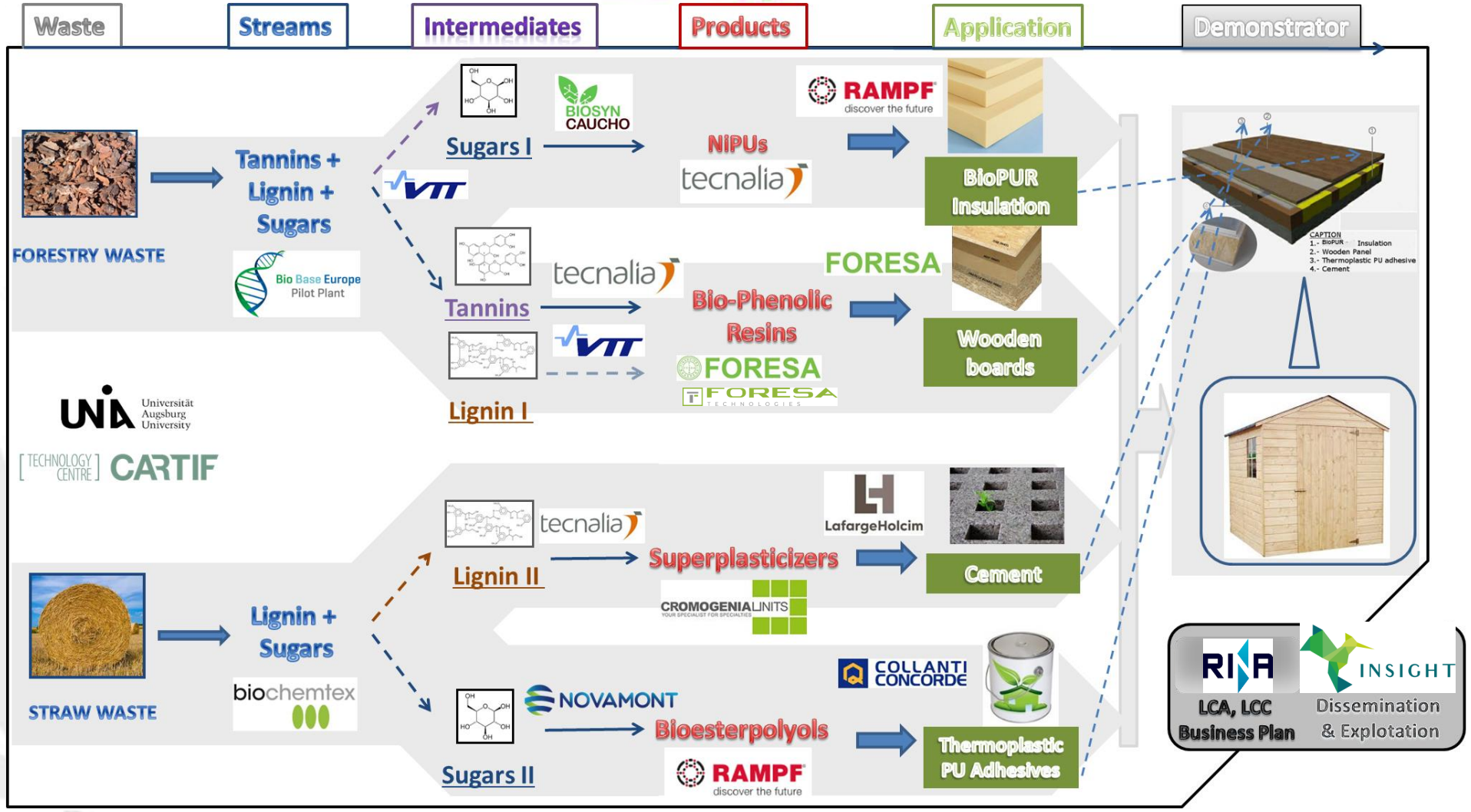
New Biophenolic resins and biopolyesterpolyols based on biomass

Dr. Aitor Barrio (TECNALIA), Project Coordinator

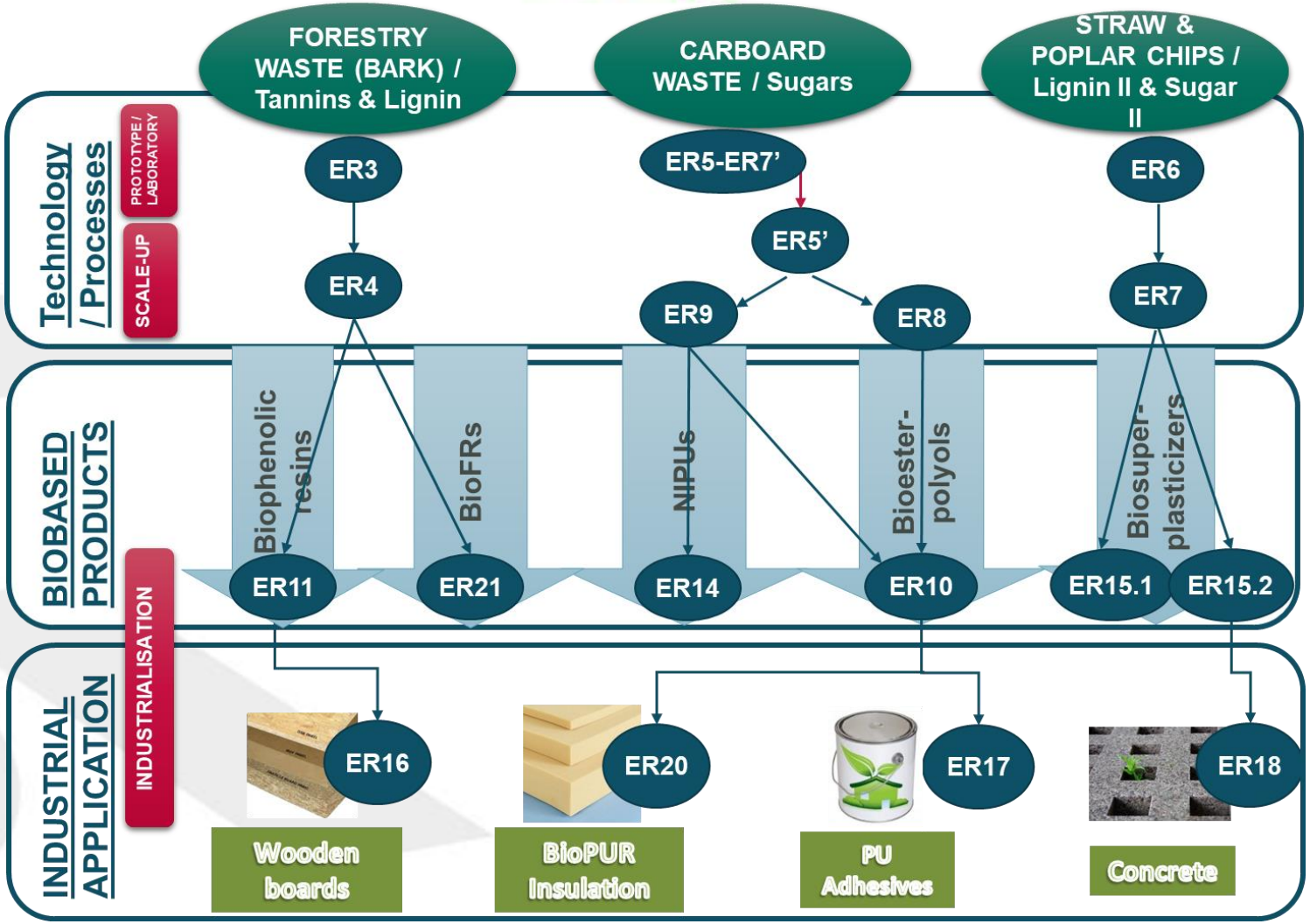
FINAL Workshop, EU Industry days, 17th Feb 2021

HORIZON 2020

General Overview



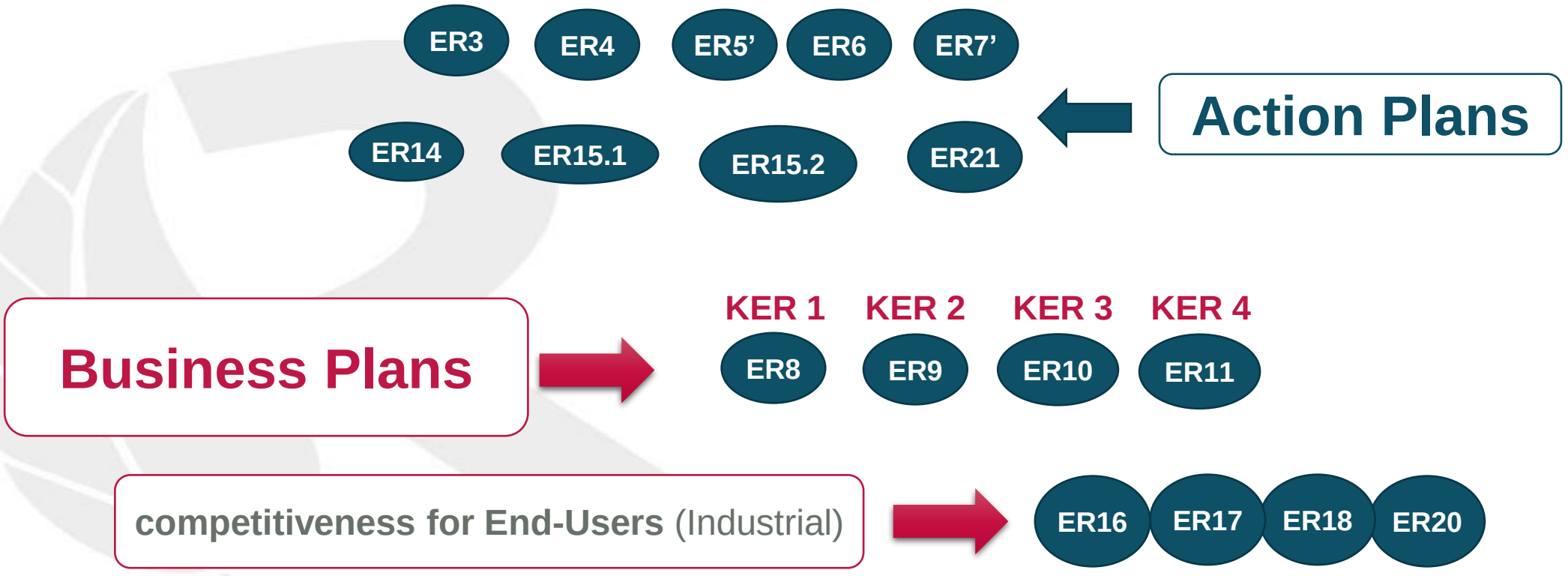
Exploitable results



Key Exploitable results

LIST OF ERS AND SELECTION OF KERS

MOST PROMISSING Key Exploitable Results
(for market uptake)



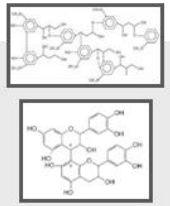
Rehap

Waste → Streams → Intermediates → Products → Application

FORESTRY WASTE (BARK)

VTT

Bio Base Europe Pilot Plant



Tannins

Lignin I

FORESA TECHNOLOGIES

FORESA

Bio-Phenolic Resins

FORESA

Wooden boards

Rehap

Waste | Streams | Intermediates | Products | Application

FORESTRY WASTE (BARK)

VTT

Bio Base Europe Pilot Plant

Sugars I

tecnalia

BIO-2,3-BDO

BIOSYN CAUCHO

Bio Base Europe Pilot Plant

RAMPF discover the future

BioPUR Insulation

CARDBOARD WASTE

Bio Base Europe Pilot Plant

RAMPF discover the future

Bio-polyesterpolyols

+ Bio-Diacids

STRAW WASTE

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Sugars II

NOVAMONT

BIO-1,4-BDO

Bio Base Europe Pilot Plant

POPLAR chips

1C-2C PU Adhesives

COLLANTI CONCORDE

Bio-1,4-BDO

- A protocol has been validated for the production of **1,4 bio-BDO from 2nd generation sugars** alternative to 1st generation and obtained from different feedstock

- The **amount and purity** of 1,4 bio-BDO produced were **similar** to those obtained using 1st generation sugars (benchmark)

- **By-products valorization** has been also addressed in order **to increase resource efficiency** through anaerobic digestion of **deactivated cells** from fermentation demonstrating that such by-products are a **good substrate for biogas/biomethane production**, in terms of quality and quantity, contributing to the energy efficiency of the whole biorefinery

Exploitation

- **1,4 bio-BDO as building block** into new biopolymers applications

- The use of 2nd generation feedstock for the production of 1,4 bio-BDO is technically feasible, with reduced environmental impacts. Some bottlenecks to be overcome for further industrialization: **availability of large quantity and quality of the 2nd generation feedstock**

- Environmental technical verification (**ETV**) scheme have been studied to qualify **the new process** for the production of 1,4 bio-BDO from 2nd generation feedstock

Bio-2,3-Butanediol

- **Successful fermentation and downstream process at lab scale for 100% 2nd G sugars**
- Successful fermentation process **scaled up to 1.5 m³ bioreactor** scale for **1st and 2nd G sugar mixtures (50%)**. Some room for improvement in the downstream process

Explotation plans

Construction of a **2,3-BDO demo plant:** Look for industrial investment partners

RAMPF
discover the future

Rehap

BIO-ESTERPOLYOLS

- Development of bio ester polyols
  - With **bio content 80-100%**
  - **Scale Up in industrial production**
  - **Tailor made with different functionalities, mol masses, viscosities**…
    - For adhesives/elastomers
    - For PIR/PU insulation foams
- Development esterification process
  - Optimized distillation process for low boiling point monomers (e.g. 2,3-BDO)
- Development of PIR/PUR insulation foams
  - Based on bio ester polyols
  - **With standard foam characteristics and better adhesion** (to facers)
  - **Ready for industrial production**

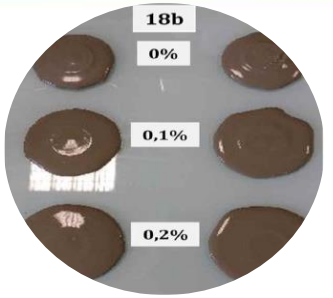
RAMPF discover the future

Rehap

Exploitation

- Synthesis, optimization and marketing of the novel Bio ester polyols
  - **Directly for application like PIR-insulation foams and specialties**
  - Step by step for other PUR/PIR applications to replace petro based monomers by Bio monomers
  - Production of Bio ester polyols worldwide at other Rampf related polyol production plants (licensing)
- Optimized ester polyol synthesis
  - Generally using monomers like 2,3-BDO with very low boiling points
  - **Using 2,3-BDO** as a branched glycol for ester polyols with special characteristics (**low viscosity, low reactivity**)
- PUR/PIR with special characteristics
  - Marketing of PIR insulation foams or adhesives with special characteristics (adhesion, hydrolysis resistance, improved shear resistance, bio based)

ER15.2: Bioplasticizers



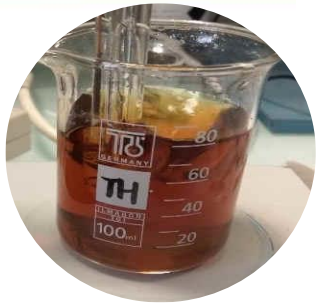
LIGNIN based superplasticizers

- Four lignin modification protocols have been upscaled
- Issues in the upscaling of REHAP's lignin obtained from lignin residues(Bioethanol process).
- Sulfonating and grafting route synthesis was applied on commercial lignin (6000 Da). Tested in LAFARGE (PJ 2011 and PJ 2012) are able to **compete with commercial lignosulfonate** from Borregaard (Borrement CA 124) **in a C25/30 concrete** not reaching superplastizing effect.
- The lignin modification protocol developed by TECNALIA and CROMOGENIA were upscaled at CROMOGENIA pilot plant in Barcelona.
- The **technical viability** was found **good** with the chemical modification protocols.

Exploitation

The feature of the functionalized commercial lignin used to synthetize PJ 2011 and PJ 2012, could be a target for future lots of REHAP's lignin.

ER11: Biophenolic resins



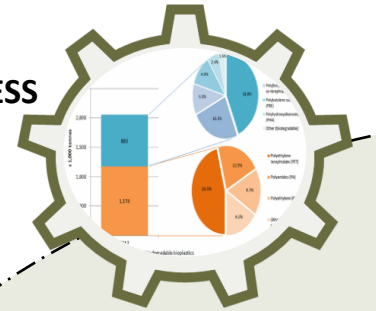
BIO-PHENOLIC RESINS

- Development of bio-phenolic resins
  - New route of synthesis of resins to be able to polymerize the lignin.
  - Resins with **50% replacement of phenol for lignin**.
  - Resins with the **same performances as phenolic resins**.
  - Development and optimization of processes for manufacture of:
    - **MDF panels**
    - **Plywood**

Exploitation

Investments in Foresa's facilities are being made to carry out the **first industrial productions of biophenolic resins in the first quarter of 2022**.

Systemic Approach



MARKET ANALYSIS, BUSINESS
LAN, STANDARDISATION,
XPLOITATION

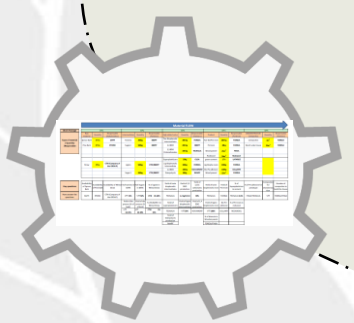
INTERMEDIATES

FEEDSTOCK
AVAILABILTY

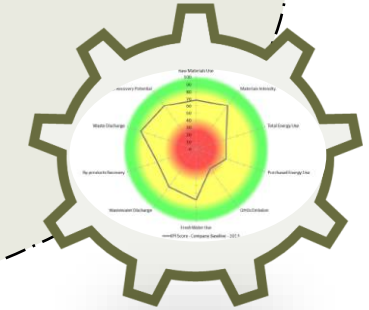
DEMO
Bench-scale building

LCA, SLCA, LCC

BIOPRODUCTS
VALIDATION



INTEGRATION PLAN



OPTIMIZATION OF
PROCESSES

SIP, Multilayer composite

Systemic Approach

Rehap

RINA

MARKET ANALYSIS, BUSINESS PLAN, STANDARDISATION, EXPLOITATION

INSIGHT

VTT

Bio Base Europe Pilot Plant

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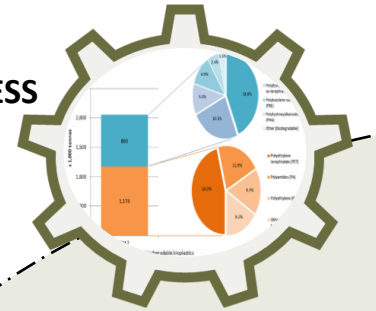
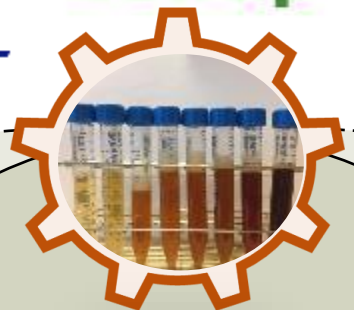
UNIA Universität Augsburg University





INTERMEDIATES

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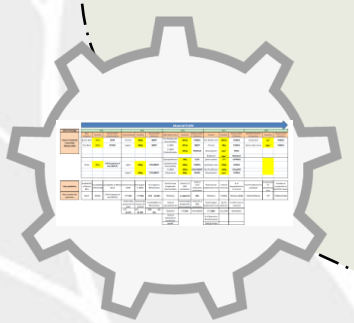
RINA LCA, SLCA, LCC

BIOPRODUCTS VALIDATION



INTEGRATION PLAN

TECHNOLOGY CENTRE CARTIF

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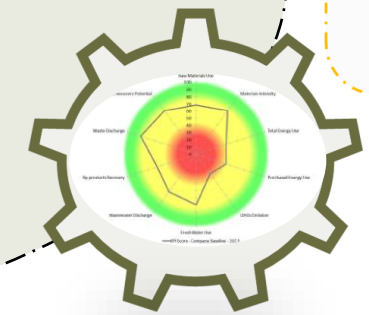
SIP, Multilayer composite



OPTIMIZATION OF PROCESSES

RINA

RAMPF discover the future

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CROMOGENIA UNITS

LafargeHolcim

Rehap

THANK YOU VERY MUCH

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HORIZON 2020