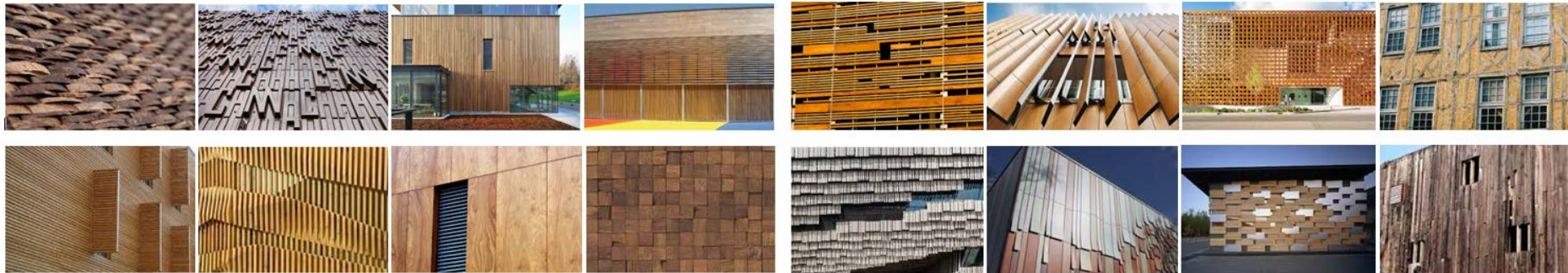


END-OF-LIFE TRANSFORMATION STRATEGIES FOR BIO-BASED BUILDING MATERIALS



Anna Sandak & Jakub Sandak,



BIO4ever project objectives

- Assuring sustainable development of the wood-related construction industry
- Promoting innovative facades made from biomaterials with minimal environmental impact
- Improving sustainability of biomaterials by proposing alternative transformations at the end-of-use

Construction market

Is one of the major employment sectors across the EU (496 billion € of value added).

The sector provides 20 million direct jobs and contributes to about 10 % of the EU's GDP

Represents a large proportion of the consumption of the earth's non-renewable resources in terms of:

- materials used for construction
- energy consumption for operation of buildings



Why biomaterials?

- Bio-based materials have the potential to produce fewer greenhouse gases, require less energy, and produce smaller amounts of various toxic pollutants along their lifecycle.
- The expansion of bio-based products availability and their wide utilization in modern buildings is a derivative of the Europe 2020
- It must be demonstrated that biomaterials are significantly more favorable than the corresponding mineral and fossil-based alternatives, technically competitive, and reasonably durable

Bio-materials in construction sector

- In Italy 1 on 12 buildings is made of wood and growing tendency is observed nowadays
- Bio-based materials are often used for retrofitting of existing structures, upward construction or vertical gardens
- Buildings that use bio-materials are not just sustainable, strong and durable; they are also beautiful



A key issue in building construction: durability and performance



Development priorities

- **Structural components**

(need for developed wood products - Engineered Wood Products, high strength wood, moisture resistant sills, light-weight beams/joists/studs of bio-composites, sandwich panels for exterior walls)



- **Insulation**

(need for compactable bats of cellulose insulation, environmentally friendly fire impregnation, high-performance insulation that provides thinner walls, insulation, optimized for soundproofing)



- **Barrier Materials**

(need for bio-based wind and vapor barrier for moisture-proof exterior walls, waterproofing for wet areas, **façade** and roofing materials **with improved durability/serviceability**)



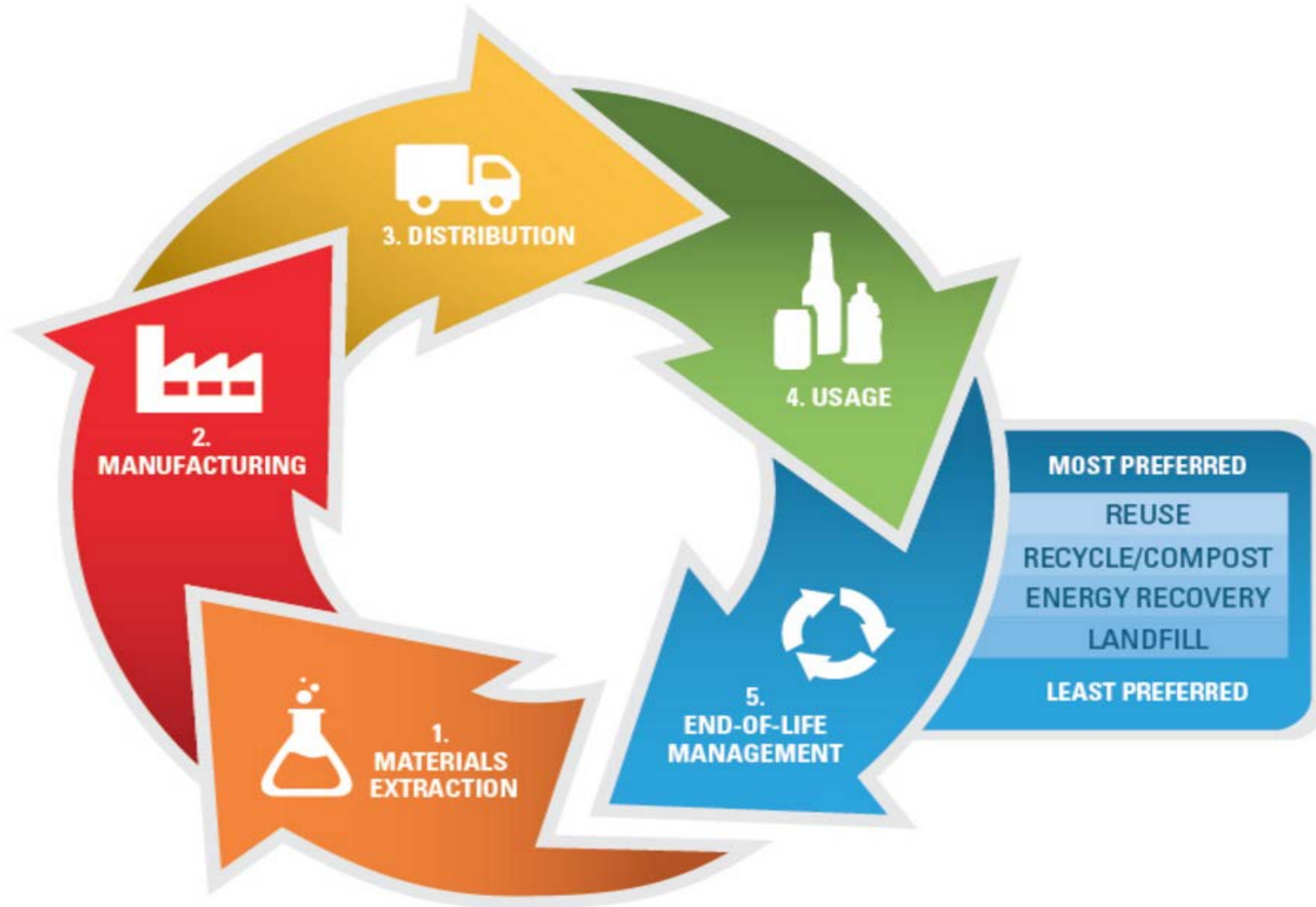
Experimental samples

31 companies & research organization from 17 countries provided best performing building facades biomaterials

The experimental samples include: different wood species from various provenances, thermally and chemically modified wood, composite panels, samples finished with silicone, silicate, nano-coatings, innovative paints and waxes, melamine treated wood, copper treated wood, bamboo cladding, reconstituted slate made with bio-resin and shou-sugi-ban.

Consequently, 120 various bio-materials are currently under investigation

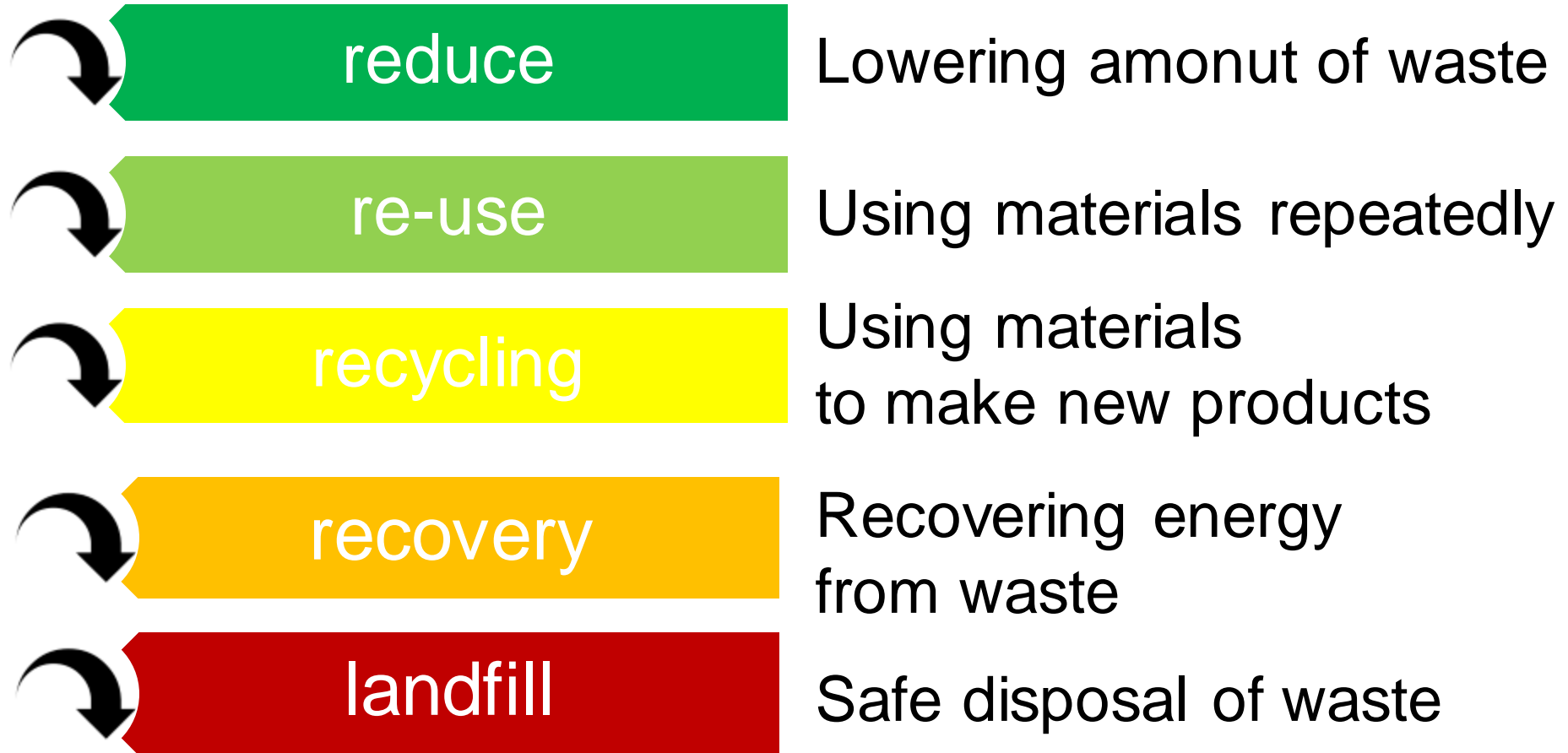
Life cycle diagram



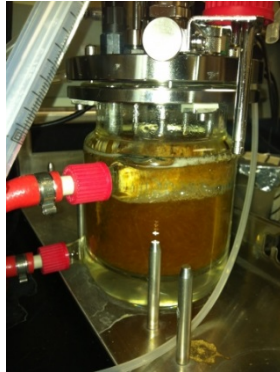
Wates in Europe



Waste management scenarios



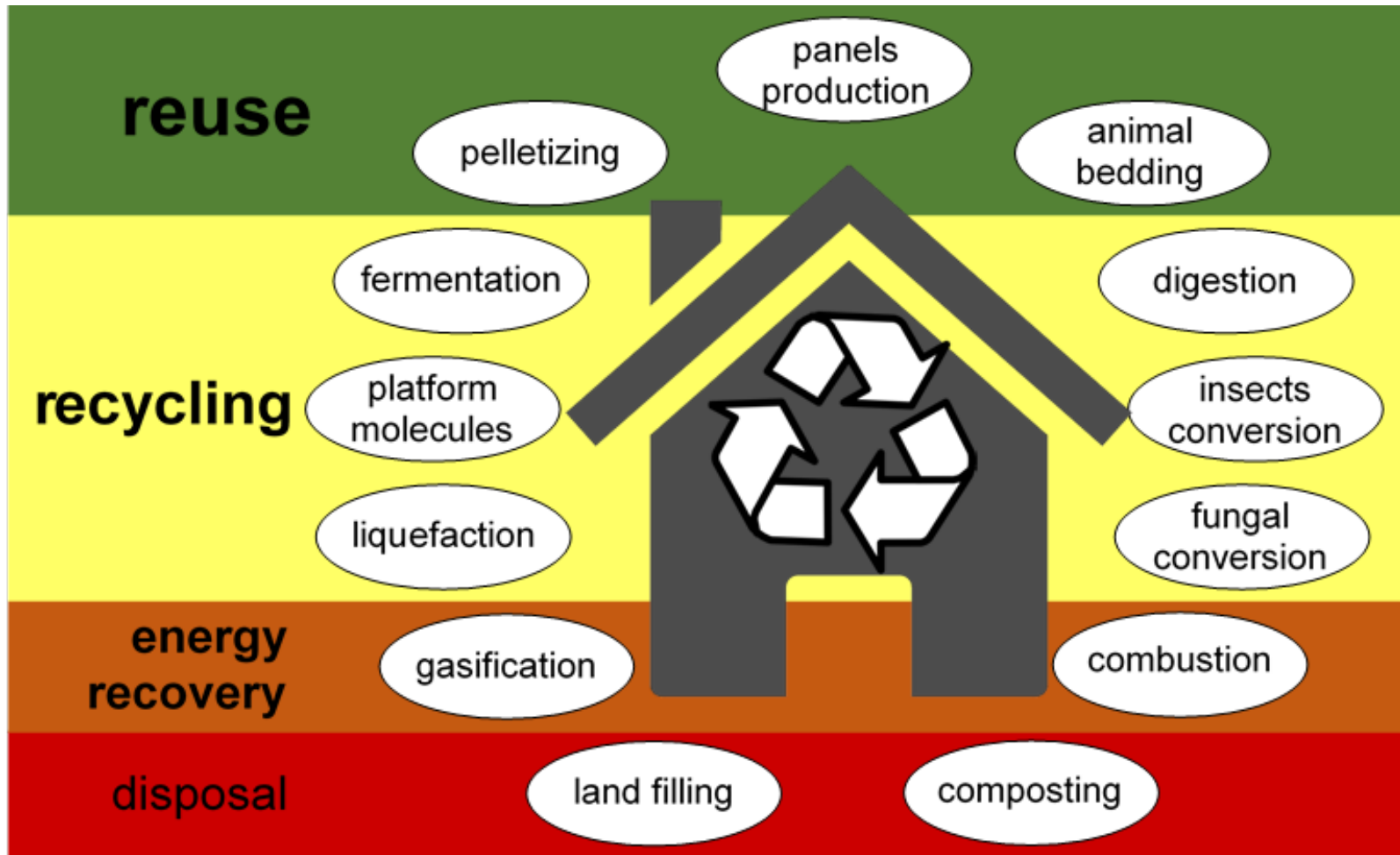
Biomaterials end-of-life



Pathways flexibility and developmnet

Processing technology	Feedstock flexibility	Conversion efficiency	Market value of product	Development status
combustion	high	low	low	established
digestion	low	medium	medium	established
fermentation	low	medium	high	established
pyrolysis	high	medium	medium	established
gasification	medium	medium	medium	established
platform molecules	medium	medium	high	early commercial
liquifaction	high	low	high	lab traials
panels manufacturing	high	high	high	established
animal bedding	high	medium	low	established
peletizing	high	high	high	established
insects conversion	medium	medium	high	lab traials
fungal conversion	medium	medium	high	lab traials
composting	high	low	low	established
land filling	high	low	low	established

Pathways for end of life transformation



Acknowledgment

- This work has been conducted within the project BIO4ever (RBSI14Y7Y4) within a call SIR funded by MIUR.
- The authors acknowledge COST action FP1407 for providing the travel reimbursement

BIO4ever



BIO4ever project partners



bre



SWM WOOD



Univerza v Ljubljani

DRYWOOD



Uniwersytet Przyrodniczy w Poznaniu



BioComposites Centre
Innovation in biomaterials for industry



inolalegno



NOVELTEAK



POLITECNICO
DI TORINO
Dipartimento di
Architettura e Design



Thank you

