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From Wood Waste to Wonder Materials

Circular Bio-based Europe Joint Undertaking

Bio-based Industries Consortium

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From wood waste to new materials: an educational journey

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What if the materials of the future did not originate from fossil resources, but from what we usually discard as waste?

This project starts from a simple idea: **using wood leftovers as a valuable resource.** The pathway is straightforward:
wood waste → intermediate components → new material building blocks.

Our work focuses on **second-generation biomass** and aims to develop building blocks that can support the creation of high-performance materials. The broader goal is to contribute to a **more resource-efficient future.**

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What is 2G biomass?

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"Second-generation" simply means we don't use food crops. We use **residues**, materials left over from forestry and wood-based processes that are often undervalued.

Why does this matter? Because the sustainability conversation gets messy fast. So here's the simple point: **using residues helps avoid competition with food resources**

In our project, these residues are the **starting point** for producing new "ingredients" that can become advanced materials.

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Bio-based ≠ biodegradable

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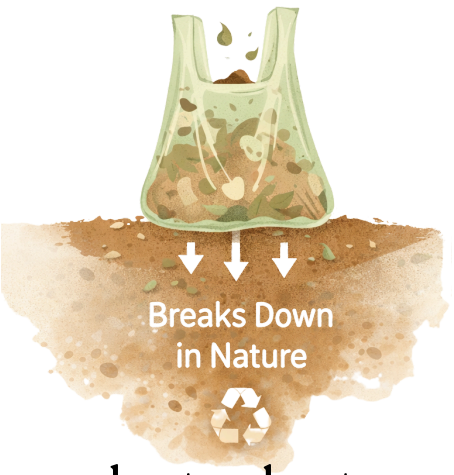
Bio-based **does NOT** automatically mean biodegradable.

Bio-based describes <u>where a material comes from</u> (renewable sources).

Biodegradable describes <u>what happens at end-of-life</u> (breakdown under specific conditions).



Some bio-based materials are made to last a long time, because **durability can be part of sustainability too.**

So when we talk about **bio-based building blocks**, we are talking about **renewable origin and designed performance**, then we also evaluate safety and end-of-life options.

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Why new materials at all?

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Why do we keep talking about materials? Because **materials quietly shape everything**: how long products last, how much energy we use, how often we replace things, and how much waste we create.

<u>A better material can mean:</u>

- lighter (less resource/energy in use)
- more durable (longer life)
- more heat-resistant (safer performance)

Our work starts upstream, **creating new building blocks from wood residues** that can enable these kinds of improvements downstream.

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The ‘ingredients’ idea

Think of our project like a recipe.

Wood residues are not the final dish, they are the starting ingredient. We transform them into building blocks (like key ingredients) that can later be used to **“cook” new materials.**

This is an important mindset shift: **we are not making a single product.**

We are creating a platform of ingredients that can be used in different material families and applications.

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What happens first?

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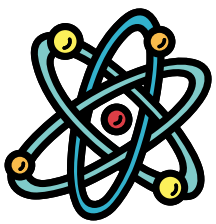
So what actually happens first, before any "new material" exists?

The biomass is processed to obtain useful streams (think: the parts we can transform).

Then those streams can feed biological and chemical steps that create building blocks.

The key idea: we extract value from residues in a **controlled, measurable way.**

Science isn't magic, it's a sequence of steps that must be repeatable, safe, and scalable.



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Meet the micro-makers

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Here's one of the coolest parts: **micro-makers.**

In some steps, we use **microorganisms** like tiny living factories. They help **transform certain feedstocks into useful building blocks**, efficiently and under controlled conditions.

Fermentation isn't only for food. It's also a **powerful tool in modern industrial biotech**, used to make everything from enzymes to ingredients for advanced products.

Micro-makers help turn inputs into useful molecules. Then **chemistry helps turn those into building blocks** for materials.

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From lab idea to real batches

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A big challenge in innovation is moving from “it works once” to “it works reliably.”

That’s why **scaling up matters.** It’s the difference between making a small sample and producing consistent batches that can be tested properly.

Scaling isn’t just “making more.” It’s about **maintaining quality, repeatability, and safety** while increasing volume.

In our journey, step by step, we move **from early trials toward meaningful quantities**, so we can test materials realistically.

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What does ‘high-performance’ mean?

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“High-performance” can sound abstract, so let’s ground it. In everyday terms, it often means a material can handle:


heat,


stress,


time (durability),

} and still do its job reliably.

We are designing building blocks that can lead to materials with these kinds of strengths, because **performance can reduce failures**, **replacements**, and **waste**.

Sustainability is not only about origin. It is also about **how well something works, and how long it lasts.**

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How we choose what's worth developing

We don't start with one perfect solution. We explore options, then **select the best candidates.**

Think of it like auditions: many "recipes" enter, and the ones that meet the right criteria move forward.

What criteria? At a high level:

 performance potential,

 consistency,

 and sustainability/safety checks.

This is how research becomes real: **measure, compare, improve, repeat.**

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The honest difference: origin vs impact

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A key idea we want to be transparent about: **renewable origin helps, but it is not the whole story.**

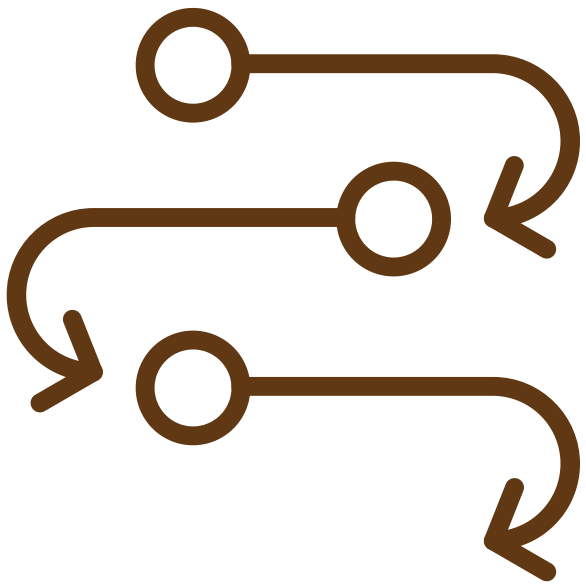
Impact depends on many things: how the material is made, how long it lasts, how it's used, and what happens at end-of-life.

That's why we communicate in steps.

First: explain the origin (wood residues).

Next: explain the process (how it's made).

Then: connect to real-world uses and end-of-life thinking.



Step by step is how you build trust.

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