METGEN

A NEW WAVE IN BIO-BASED MATERIALS

De-bottenecking biorefineries & creating maximum value for biomass

W H Y ?

We have a tremendous amount of oil based materials and products in our lives.

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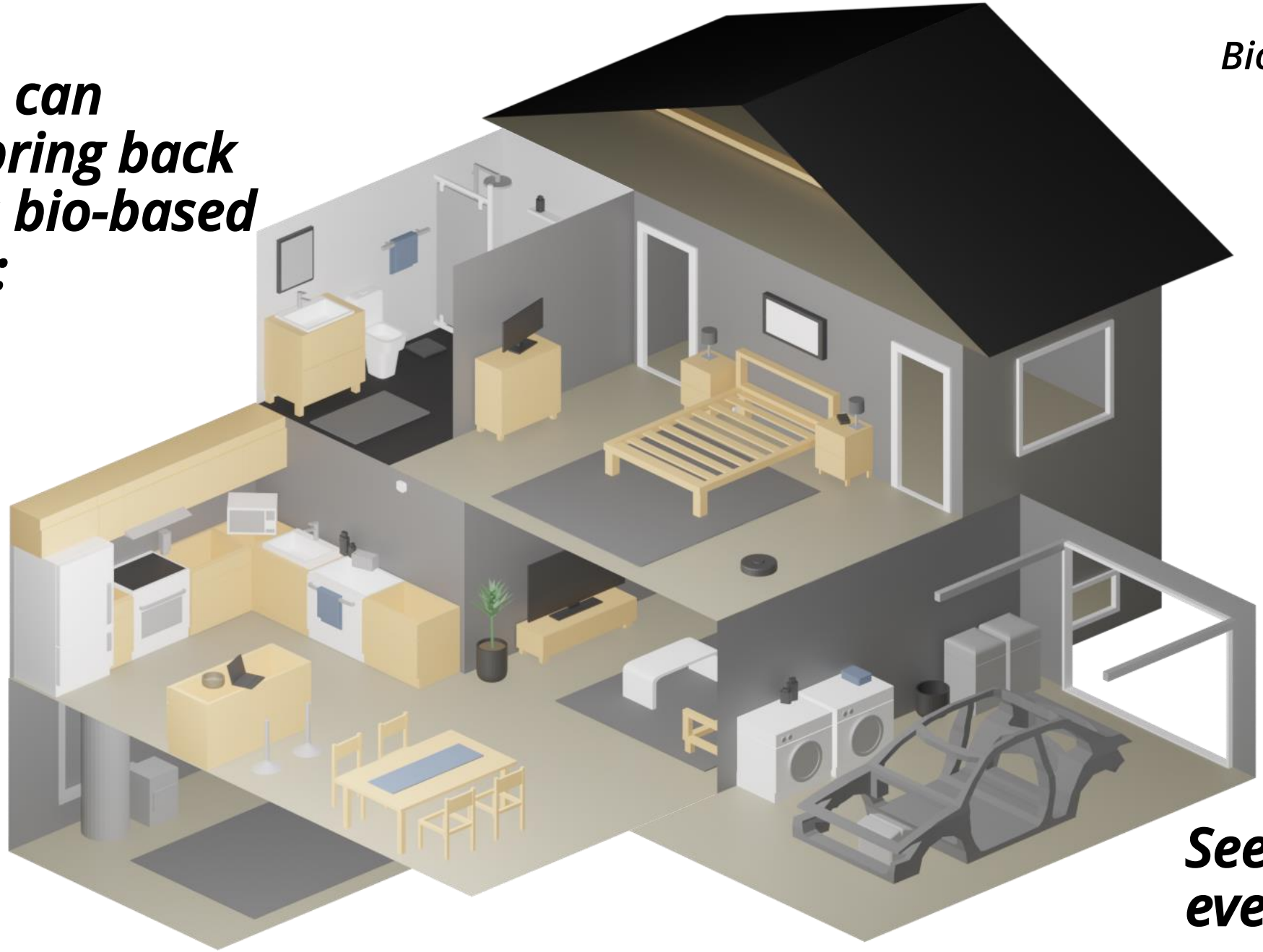
These we can already bring back to you as bio-based products:



Sugar-based Bioplastics and lignin-based composites

See? That's everything!

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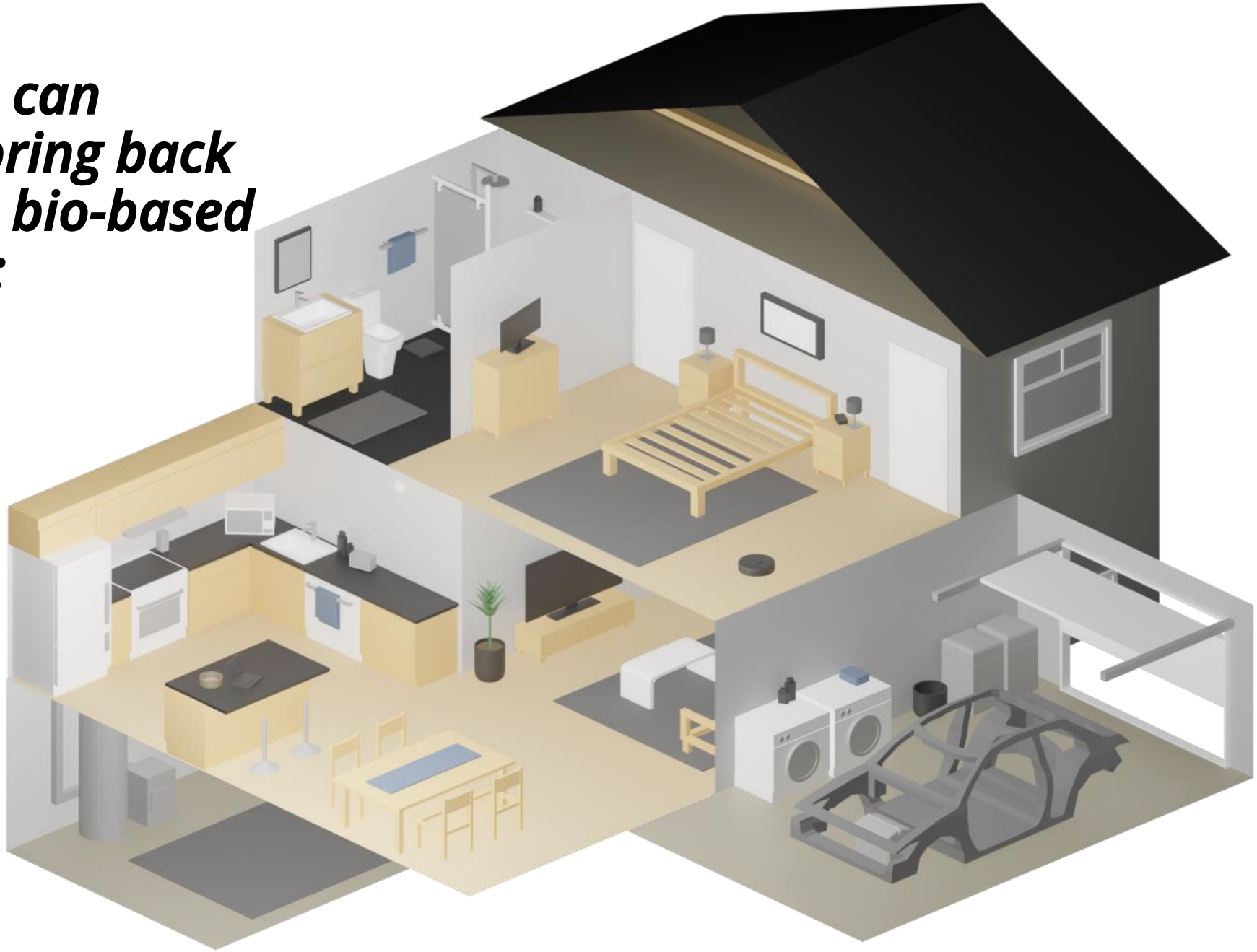
These we can already bring back to you as bio-based products:



Lignin-based resins and adhesives, wood-fibre composites

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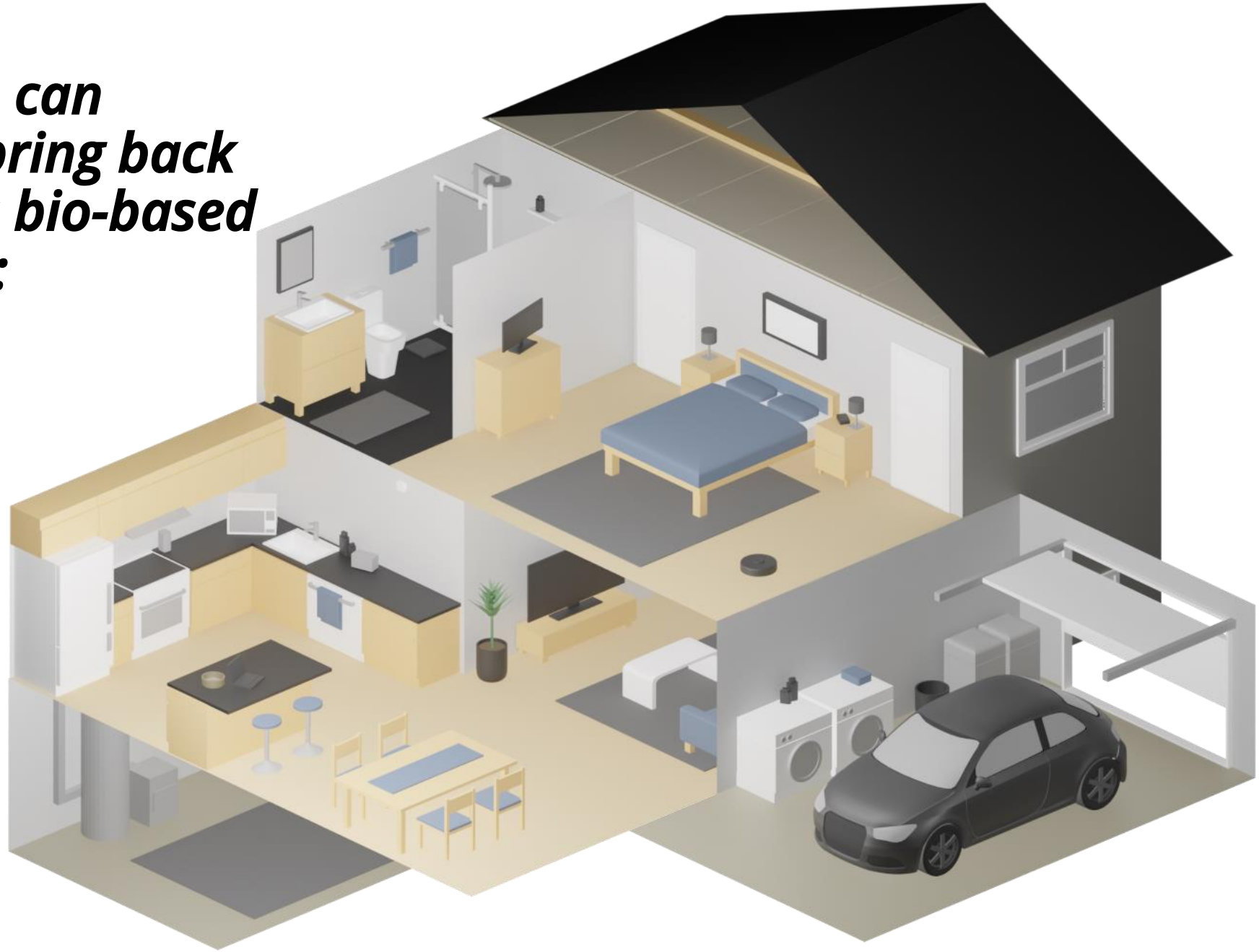
These we can already bring back to you as bio-based products:



Lignin-based foams and composites

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WASTE:

Oil	versus	Renewable materials
Low	Raw material variability	High
High	Yield-to-products	Low
Adds Carbon to the system	Carbon capture	Has high potential to capture carbon
Cumulates to environment	End-of-life	Has high potential for recycle or degradation


We need to find NEW SOLUTIONS.

Vocabulary

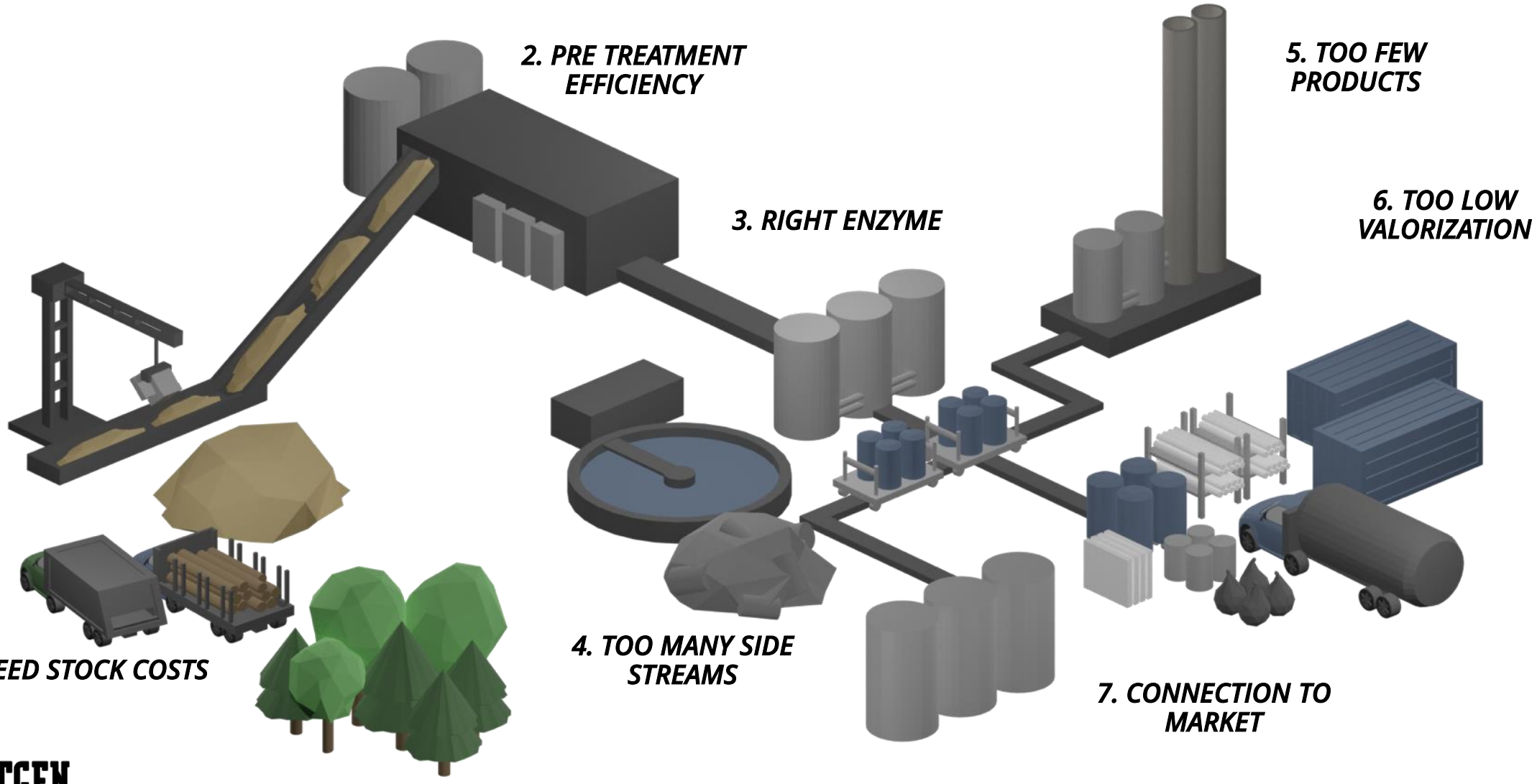
BIOREFINERY

The **coproduction** of a range of **biologically**-based products (food, feed, materials, chemicals) and **energy** (fuels, power, heat) from **biomass**

LIGNOCELLULOSIC

Lignocellulose refers to plant dry matter (biomass), so called lignocellulosic biomass. It is the most abundantly available raw material on the Earth for the production of renewable fuels, chemicals and materials. It is composed of carbohydrate polymers (cellulose, hemicellulose), and an aromatic polymer (lignin)

THE BIG PICTURE: HAVE A BIOREFINERY AND MAKE IT WORK



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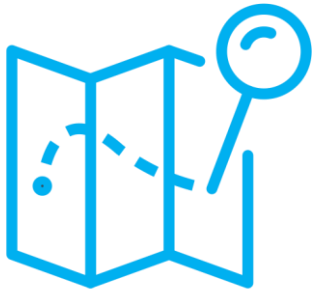
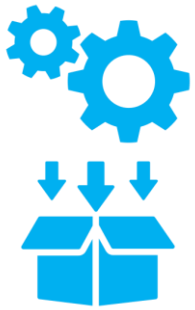
FEEDSTOCK COSTS

Selection of material



Location



Market supply and demand

Regulation

Technologies

Sustainability

"You do not want to replace all plastic with one feedstock. It's not sustainable."

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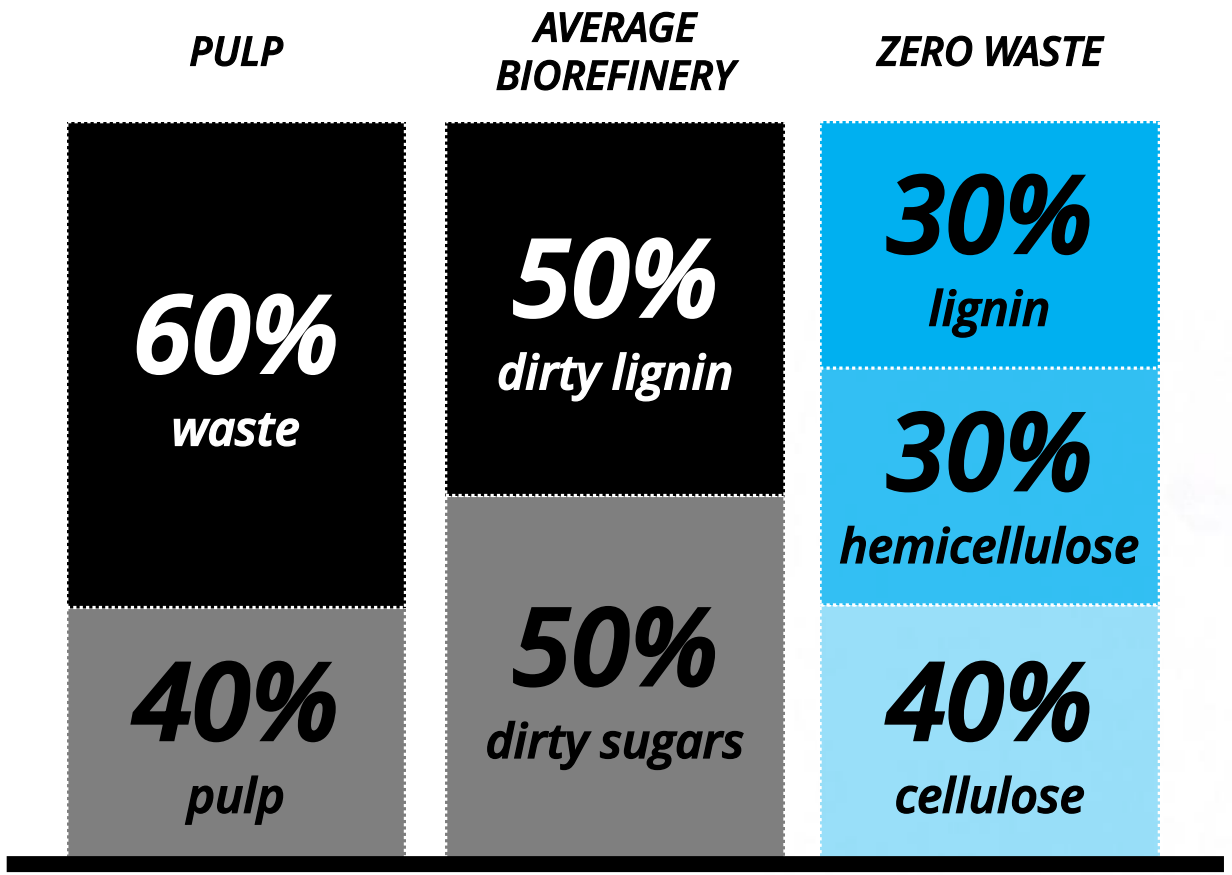
PRE TREATMENT EFFICIENCY



"Enzyme technologies can be integrated part of the refinery concept – we have just the model for you!"

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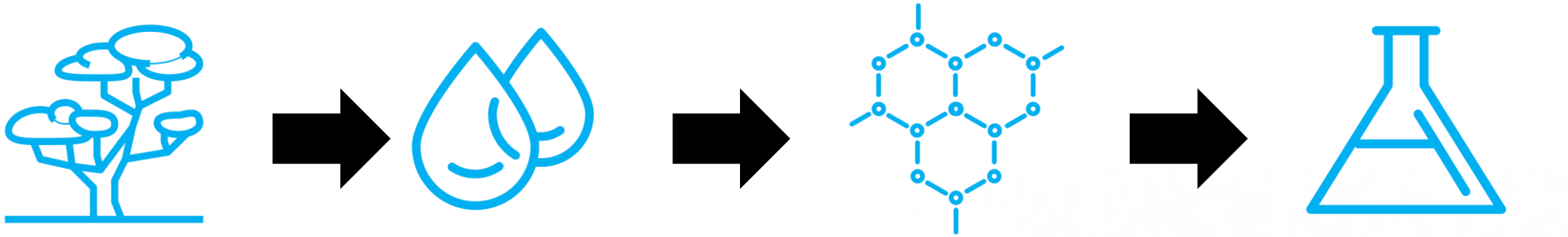
3 RIGHT ENZYME AND RIGHT PRICING



SUBSTRATE
Specific solutions

HYDROLYSIS & DETOXIFICATION
Sugar platform
SUNO™

BIOCHEMICAL CONVERSIONS
Chemical building blocks
PURECO™ & METNIN™

SIDE STREAMS AND ENVIRONMENT
Water & Biogas
FORICO™ & FORCI™

Enzymatic technologies work seamlessly with chemical and mechanical solutions creating a full value chain.


FINDING THE RIGHT ENZYME IS LIKE
MIXING YOUR OWN SPICES

BENEFIT OF TAILORED HYDROLYSIS ENZYMES

Every substrate can be addressed with multitude of enzymes, and a failure to find an optimal one leads to overdosing, low process yields, increased waste volumes and – what is worst – loss of money.

MetGen's production strains and processes together with the flexible business model allow for licensing and on-site manufacturing options.

Collaboration with other players in the value-chain lowers the technology costs even further.

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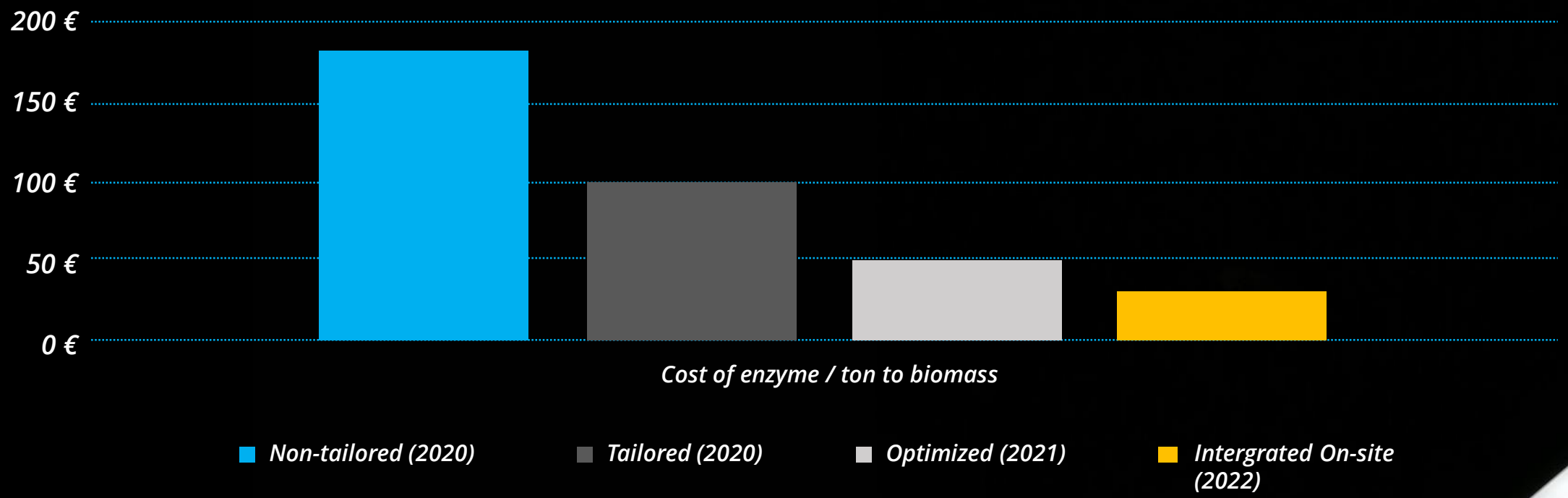
COST OF ENZYME / TON OF BIOMASS

COST PROJECTION FOR HYDROLYSIS ENZYMES FOR >90% SUGAR YIELD FOR AN ASIAN BIOREFINERY PROJECT



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„Biomass is not oil –
it's a soup of the day."

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TOO MANY SIDESTREAMS AND TOO MUCH WASTE.

One-product-in-one-product-out is outdated and wasteful model

Waste is expensive!

Traditional process uses 40.

We can extend this to 95 %

GOAL IS ZERO-WASTE

"These things are not complicated, they are very black and white."

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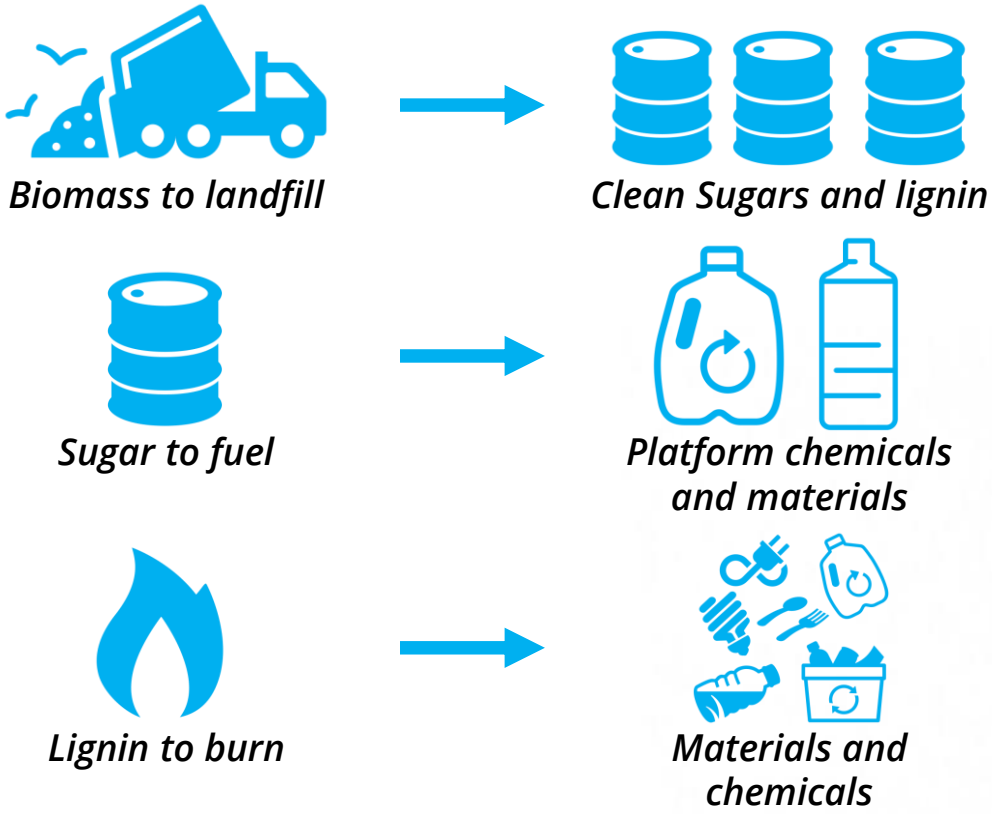
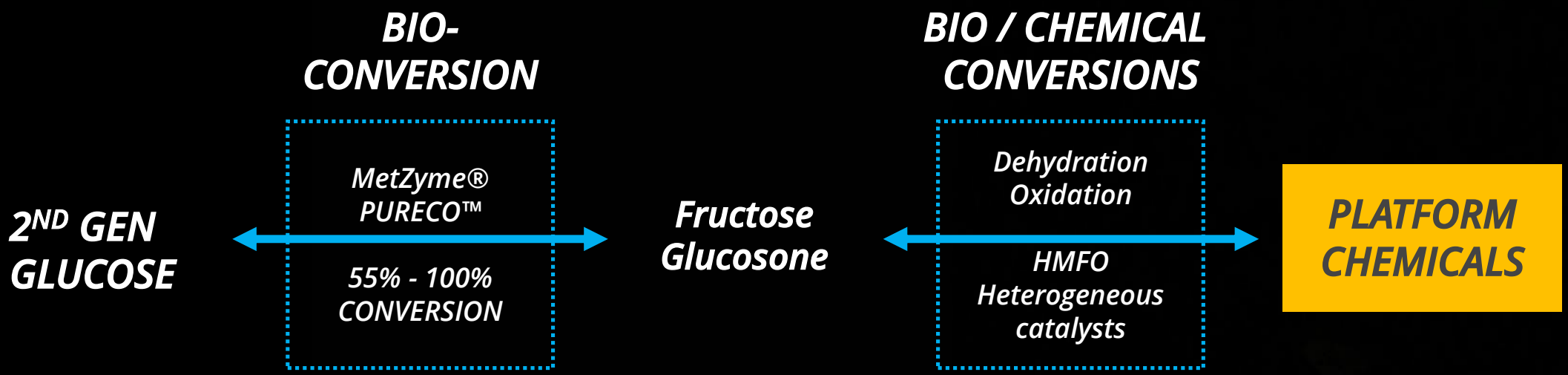
TOO LOW VALORIZATION



HOW TO DO THIS?

STREAMLINED CHEMO-ENZYMATIC ROUTE TO BIOPLASTICS AND PLATFORM CHEMICALS



MetGen's patent-filed processes enable:

- *Complete C6 conversion*
- *Use of 2nd Gen sugars*
- *Streamlined processes and higher yields*
- *New routes to platform chemicals*

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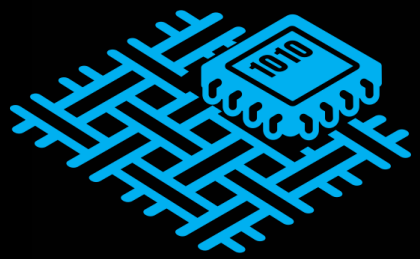
ENZYMATIC SOLUTIONS FOR FIBRE MODIFICATION

Nanocellulose & MFC

Textiles



Grafting and surface charge

Recycling

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"You don't make sneakers, loudspeakers or dashboards out of crude oil. You use refined fractions."

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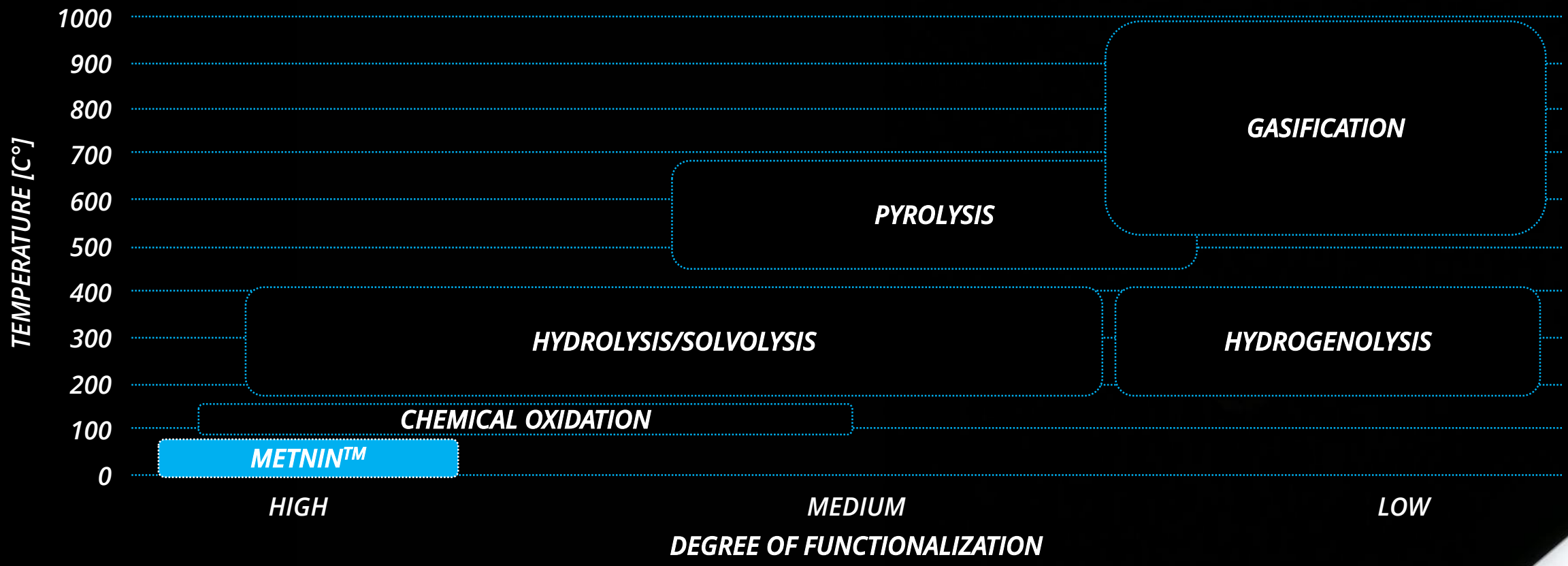
ENZYMATIC LIGNIN VALORIZATION WITH METNIN™ TECHNOLOGY



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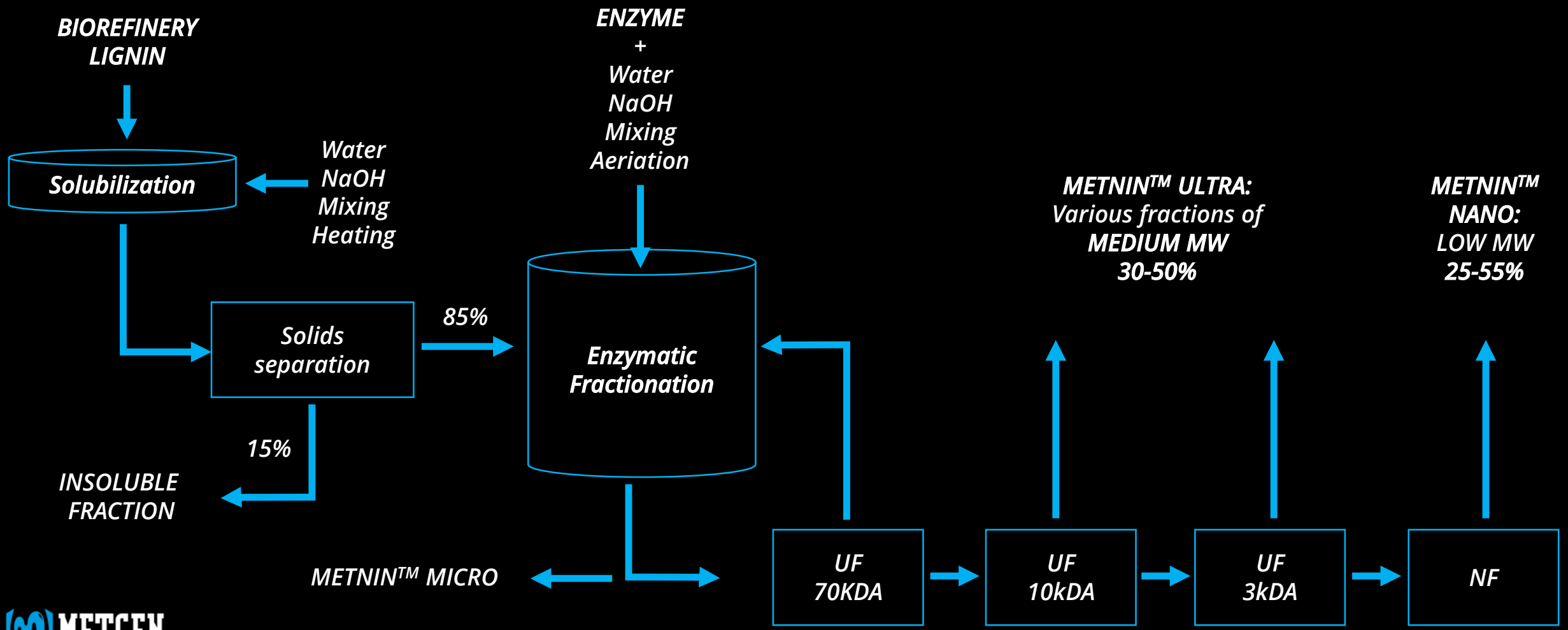
ENZYMATIC LIGNIN FRACTIONING PROCESS



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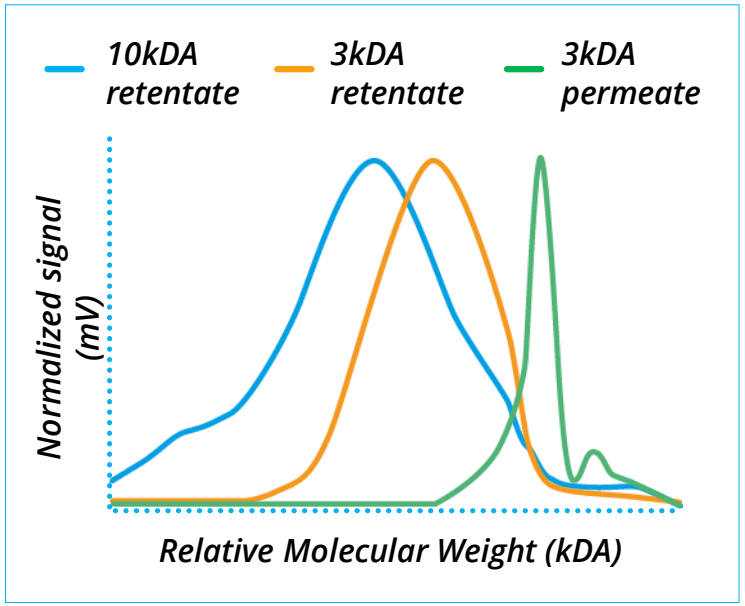
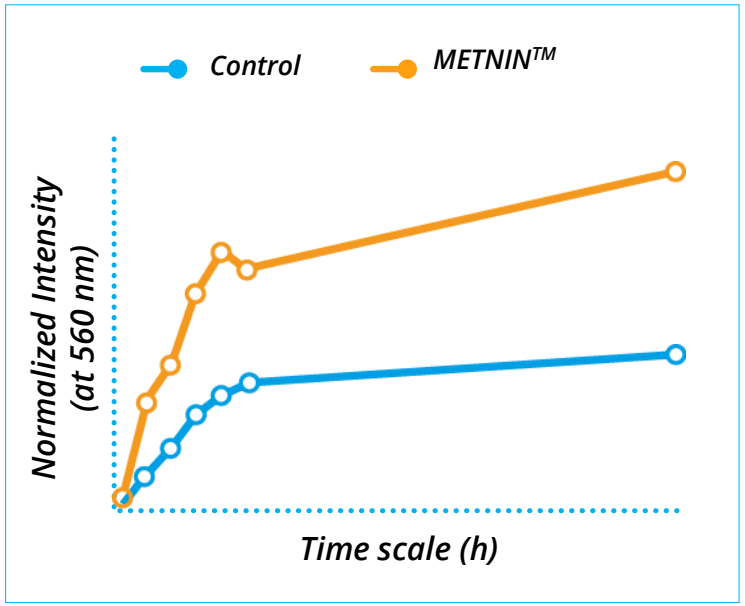
METNIN™ IMPACT ON LIGNIN

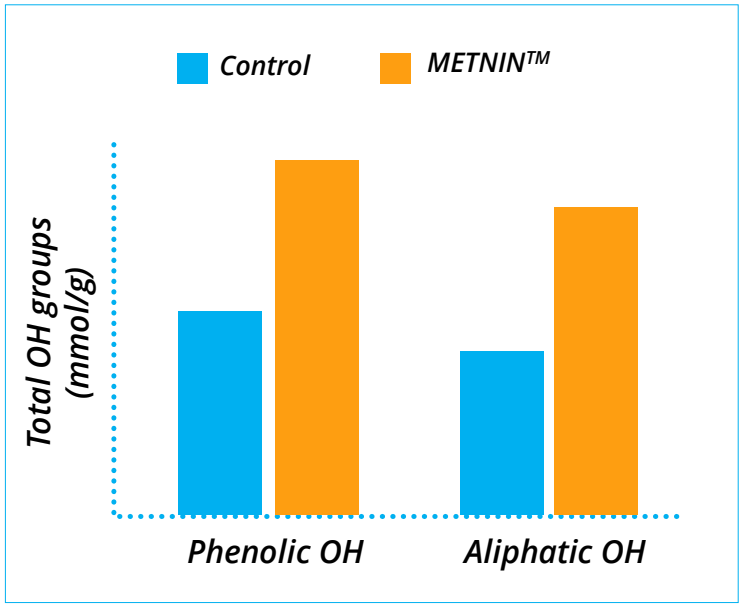
FRACTIONATION



DEMETHYLATION



ACTIVATION



Analysis provided by Prof. N. Labbé et al.
Department of Forestry, University of Tennesee, USA.

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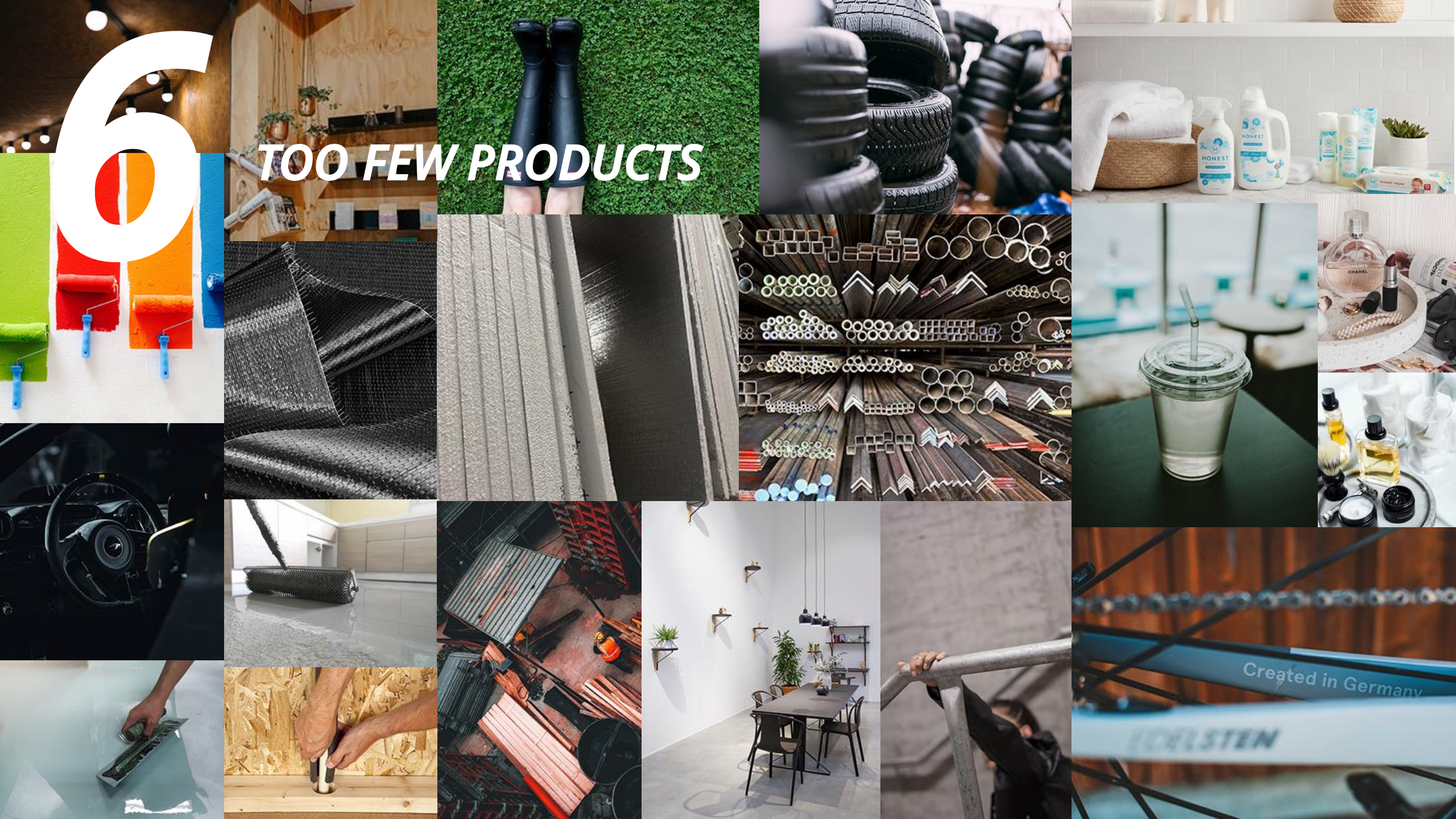
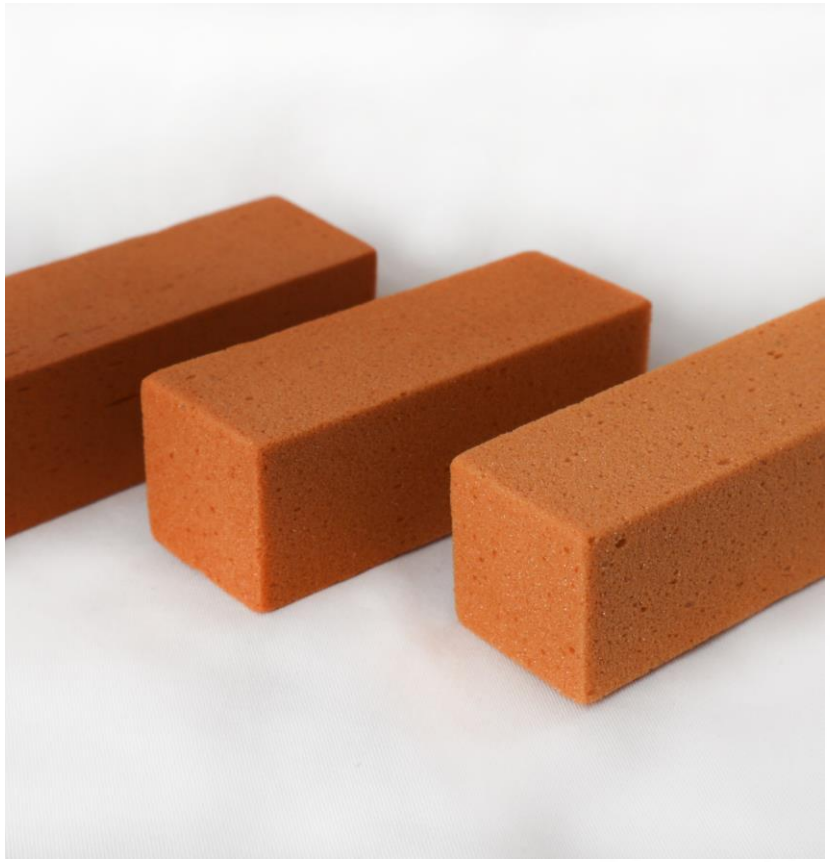

6
TOO FEW PRODUCTS
HONEST
CHANEL
Created in Germany

6 METNIN™ *PRODUCTS*

Resins and Adhesives for Board



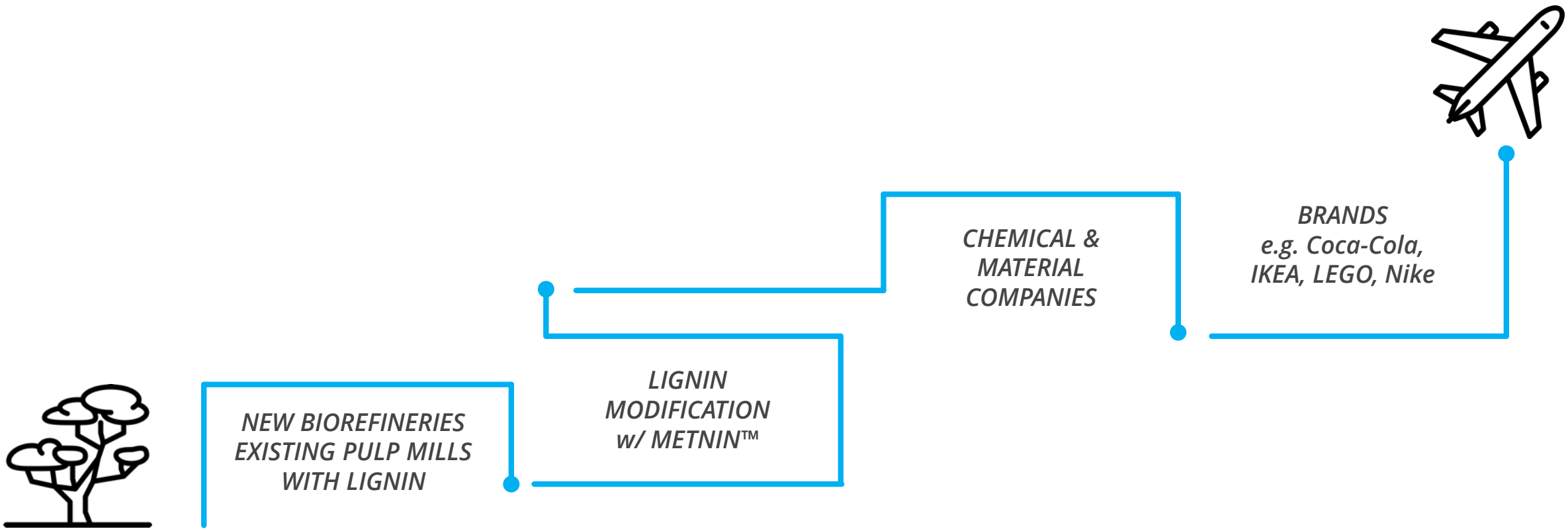
Polyurethane Foam

Packaging Boxes

ENZYMATIC LIGNIN REFINING ADDS VALUE

METGEN	MOLECULAR WEIGHT	REACTIVITY & SOLUBILITY	APPLICATION	BIO-EQUIVALENT OF	PRICE	COLLABORATION PARTNER PRODUCTS
CURRENTLY AVAILABLE LIGNIN	5–100 kDa	Poor	Fuel	Oil/ Elecricity	50–100 €/ton	Fuel, thermoplastics, fillers
ENZYME ACTIVATED LIGNIN	METNIN MICRO 3–50 kDa	Medium	Resins & Adhesives	Phenol From-aldehyde	400–500 €/ton	MDF, plywood, epoxy, and paint resins, carbon black
ENZYME DEPOLYMERIZED LIGNIN	METNIN ULTRA 0,3–2 kDa	Good	Foams & Composites	Polyols	1000–2000 €/ton	Insulation panels, flexible foams, furniture, construction material, car tires, barrier coatings
ENZYME DEPOLYMERIZED FRACTIONS	METNIN NANO 0,3 kDa 0,5 kDa 0,7 kDa	Excellent	New materials	Speciality Chemicals & Polymers	> 2000 €/ton	Coatings, Plasticizers, Cosmetics, carbon nanofibers, flavors, fragranses, detergents

FROM FOREST TO BRANDS – WHERE METNIN™ FITS?



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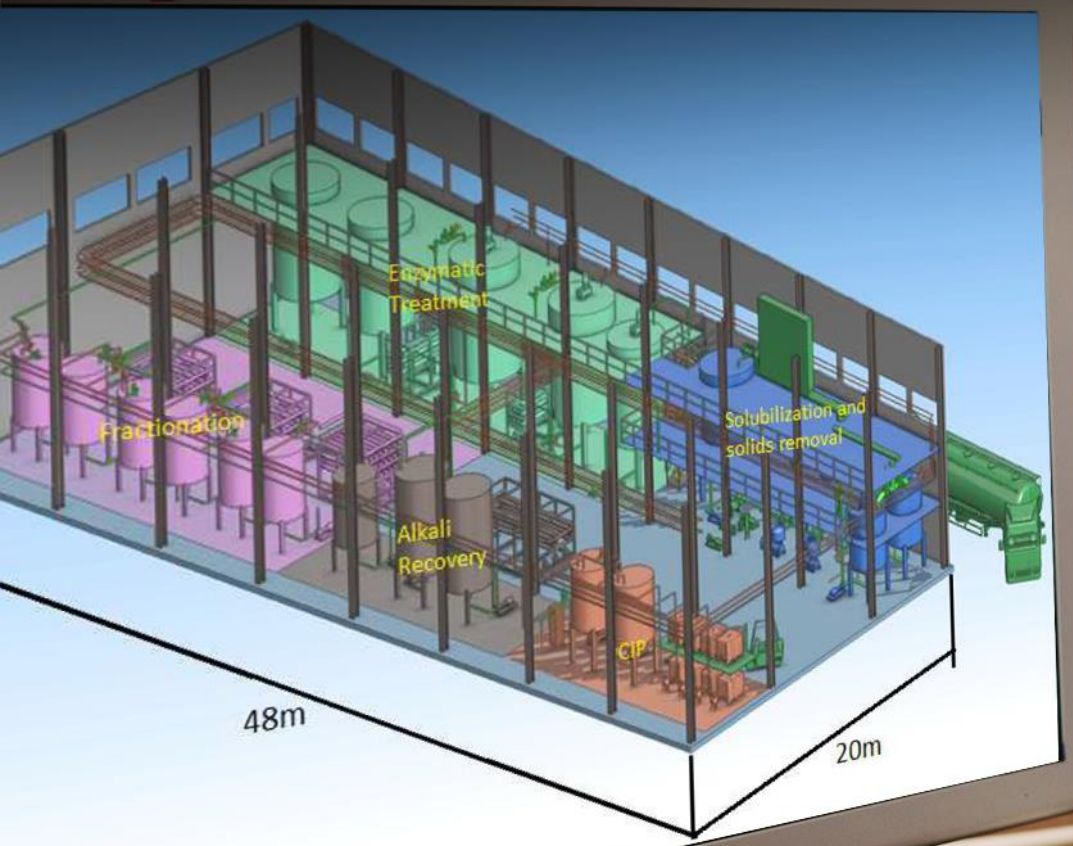
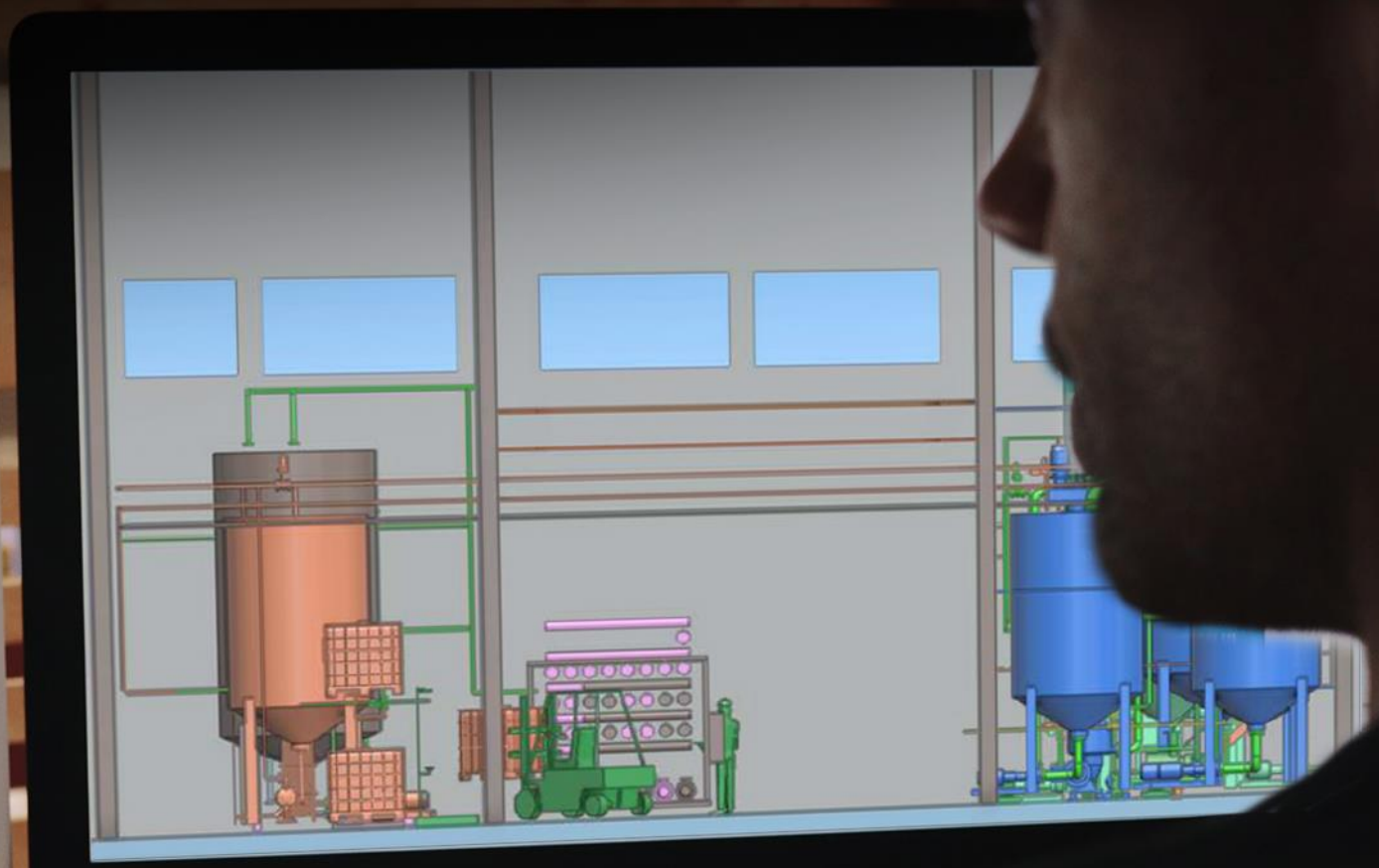
BASIC ENGINEERING PACKAGE





INVESTMENT COST

PLANT CAPACITY (feed)
7 kt
DS/year

BUILDINGS
1120 k€

TOTAL INVESTMENT COST
5850 k€

EQUIPMENT
2780 k€

OTHERS
1950 k€

Precicion of cost
+/- 20 %

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CASH FLOW

TOTAL INVESTMENT COST
5850 k€

OPERATING DAYS
350 days/year

PLANT CAPACITY (feed)
7 kt DS/year

OPERATING COST
-735 k€

INCOME
5390 k€

CASH FLOW
2555 k€ /year

RAW MATERIAL UTILIZATION
70%

RAW MATERIAL COST
300 €/t DS

OPERATING COST
150 €/t DS

RAW MATERIAL COST
-2000 k€

PRODUCT PRICE
1100 €/t DS

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INVESTMENT COST

PLANT CAPACITY
7 kt DS/year

CASH FLOW
+2,55 M€ /year

TOTAL INVESTMENT COST
5,85 M€

PLANT CAPACITY
50 kt DS/year

CASH FLOW
+18,25 M€ /year

TOTAL INVESTMENT COST
28 M€

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"Valorization of lignin has a lot of impact."

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7

CONNECTION TO MARKET

> Future of leadership is like conducting an orchestra where everyone plays their own instrument – with passion.”

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7

CONNECTION TO MARKET

There is no reason to build a bridge unless you have a vision of the other side.

WE BUILD BRIDGES.

Open innovations


We know
HOW to do this.

THE BIG PICTURE: HAVE A BIOREFINERY AND MAKE IT WORK

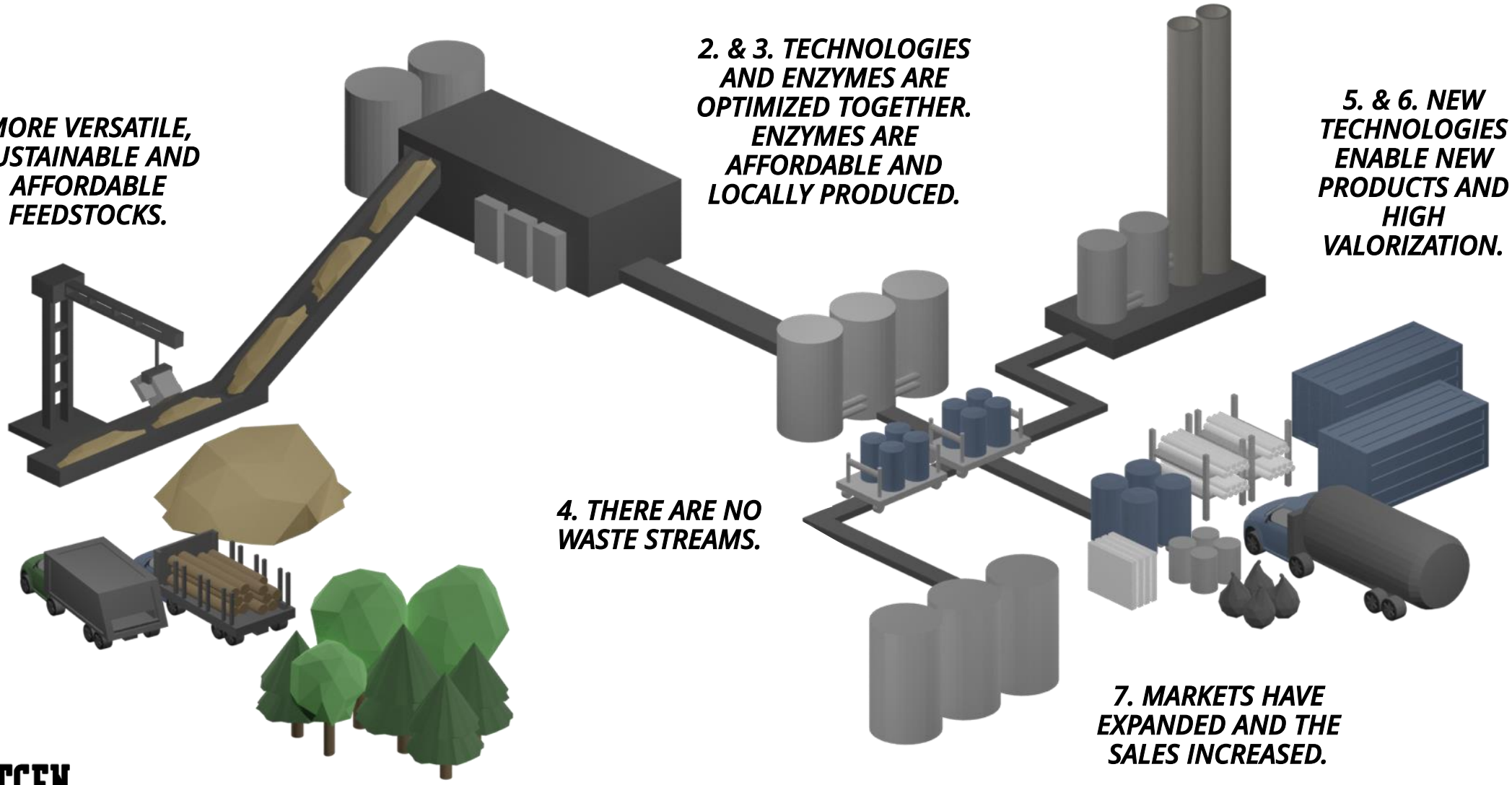
1. MORE VERSATILE, SUSTAINABLE AND AFFORDABLE FEEDSTOCKS.

2. & 3. TECHNOLOGIES AND ENZYMES ARE OPTIMIZED TOGETHER. ENZYMES ARE AFFORDABLE AND LOCALLY PRODUCED.

4. THERE ARE NO WASTE STREAMS.

5. & 6. NEW TECHNOLOGIES ENABLE NEW PRODUCTS AND HIGH VALORIZATION.

7. MARKETS HAVE EXPANDED AND THE SALES INCREASED.



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"This is a true refinery, not a waste generator."

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MetGen – the friendly enzyme company invites you to join in the bio-based industry revolution.

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