



From agricultural residues to
value added bio-based
products
**A CLARIANT INNOVATION
JOURNEY**

CLARIANT 

Public

Martin Vollmer
Clariant International Ltd
20.11.2015

what is precious to you?

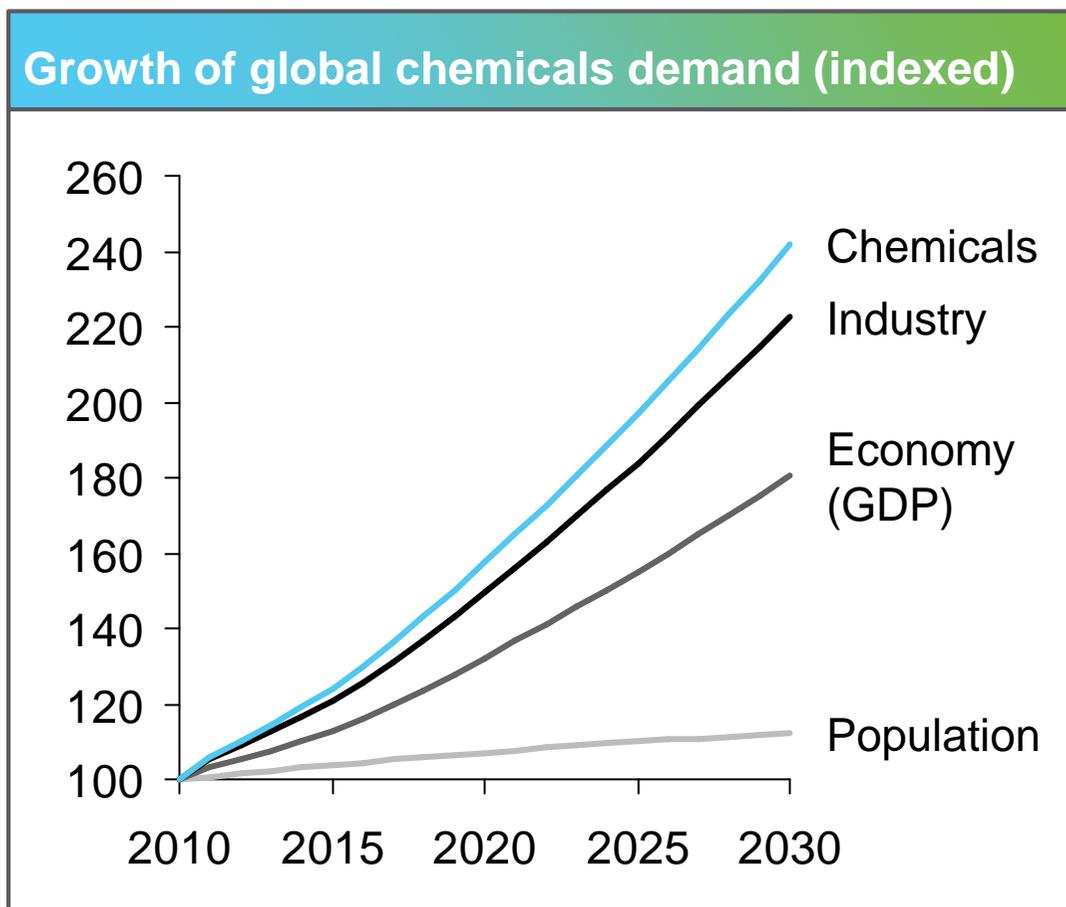
Today's global changes

- World population is growing to >9 billion by 2050.
- Buying power and wealth in the emerging countries are growing.
- Demand is increasing for resources (fossil energy, minerals, water, renewables, nutrition, land).
- Environmental issues are becoming more evident (climate change, biodiversity, water supply, waste).
- Today mankind is consuming the resources of 1.5 planets.



This conflicting situation causes **social, economic, and ecological** challenges we are facing today under the headline Sustainability.

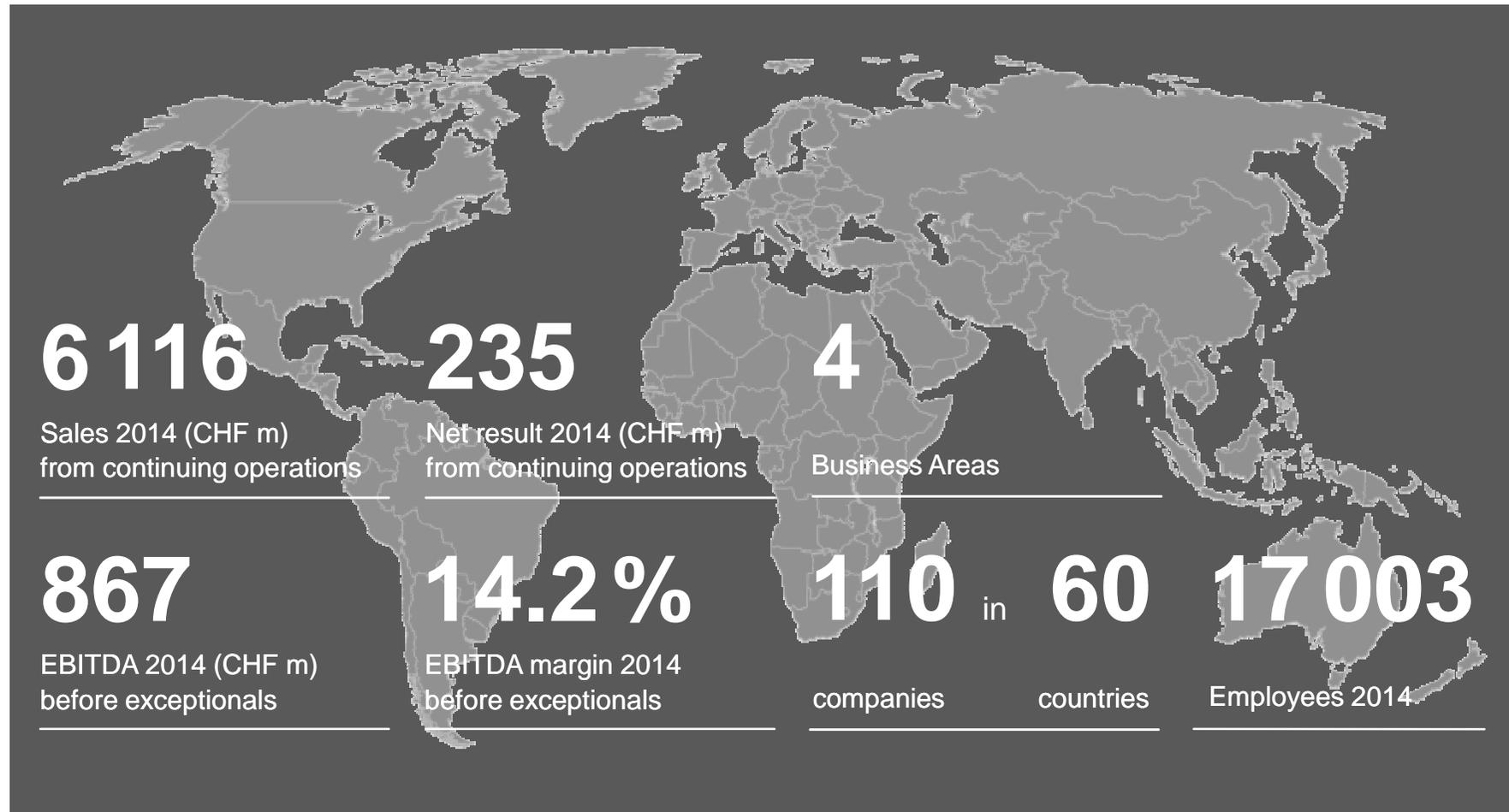
The demand for chemicals will grow strongly until 2030



UNTIL 2030...

- ... The global chemicals demand is expected to more than double
- ... ~2/3 of the market is expected to be owned by Asia
- ... The share of specialty chemicals in total chemicals has significantly increased
- ... >20% of chemicals sale are expected to be based on bio-based chemicals

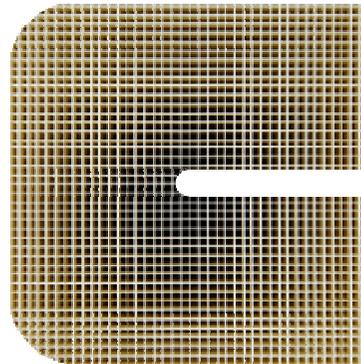
Clariant at a Glance



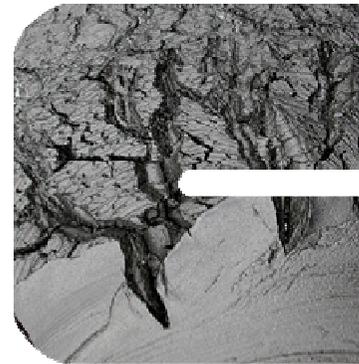
A globally leading company in specialty chemicals

Clariant: Four Business Areas

The right portfolio with leading market positions



Catalysis



**Natural
Resources**



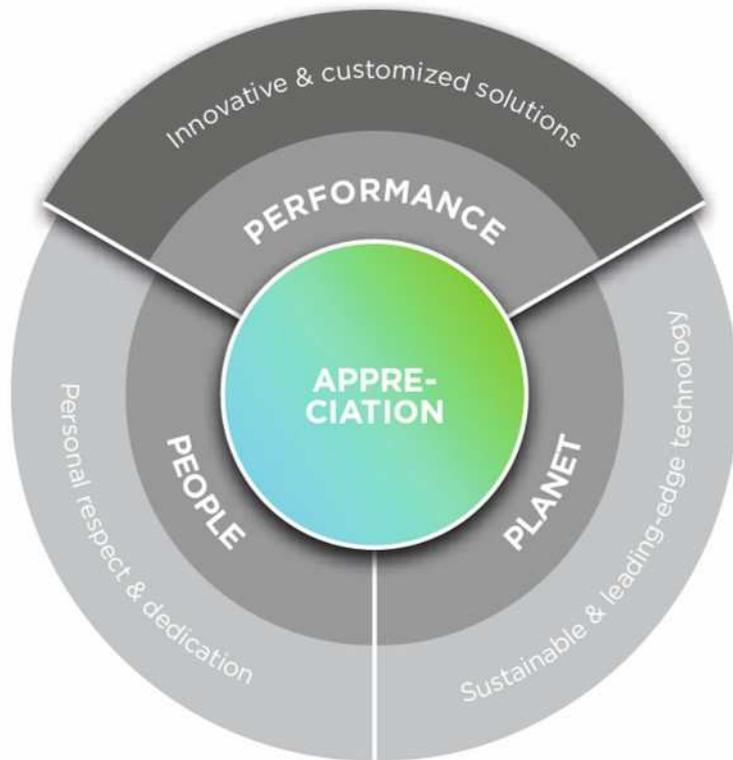
**Care
Chemicals**



**Plastics
& Coatings**

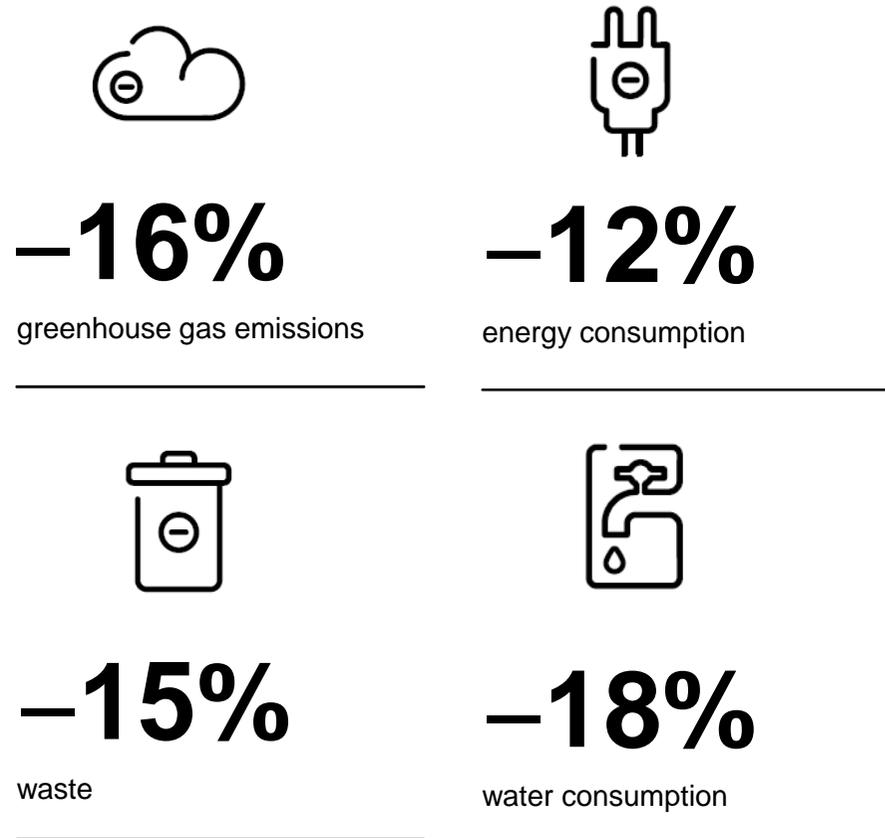
Economy and environment go hand in hand

SUSTAINABILITY IS ANCHORED IN CLARIANT'S STRATEGY AND BRAND VALUES



SUSTAINABILITY ACHIEVEMENTS IN 2014

Per ton of products produced



Innovation@Clariant – The Innovation Chain

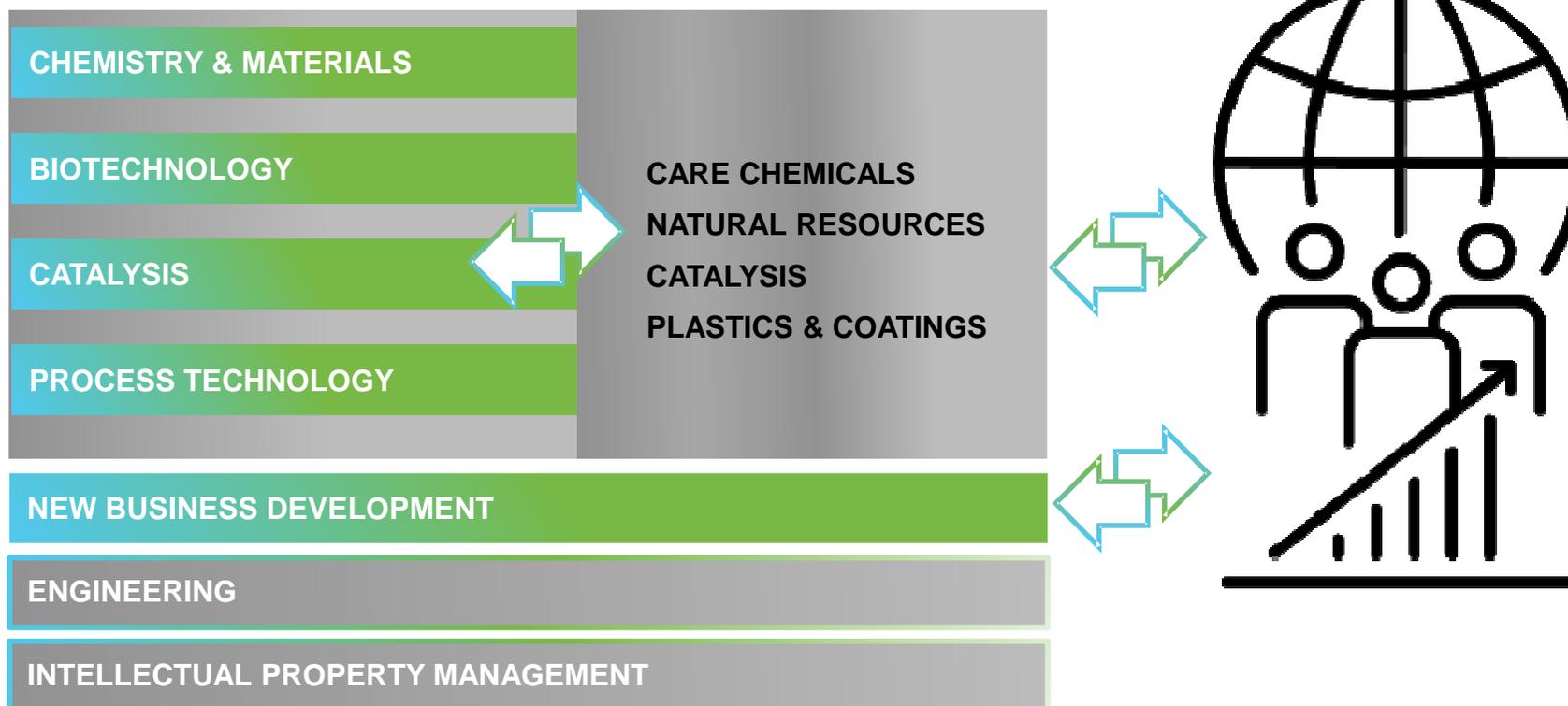
GROUP TECHNOLOGY & INNOVATION

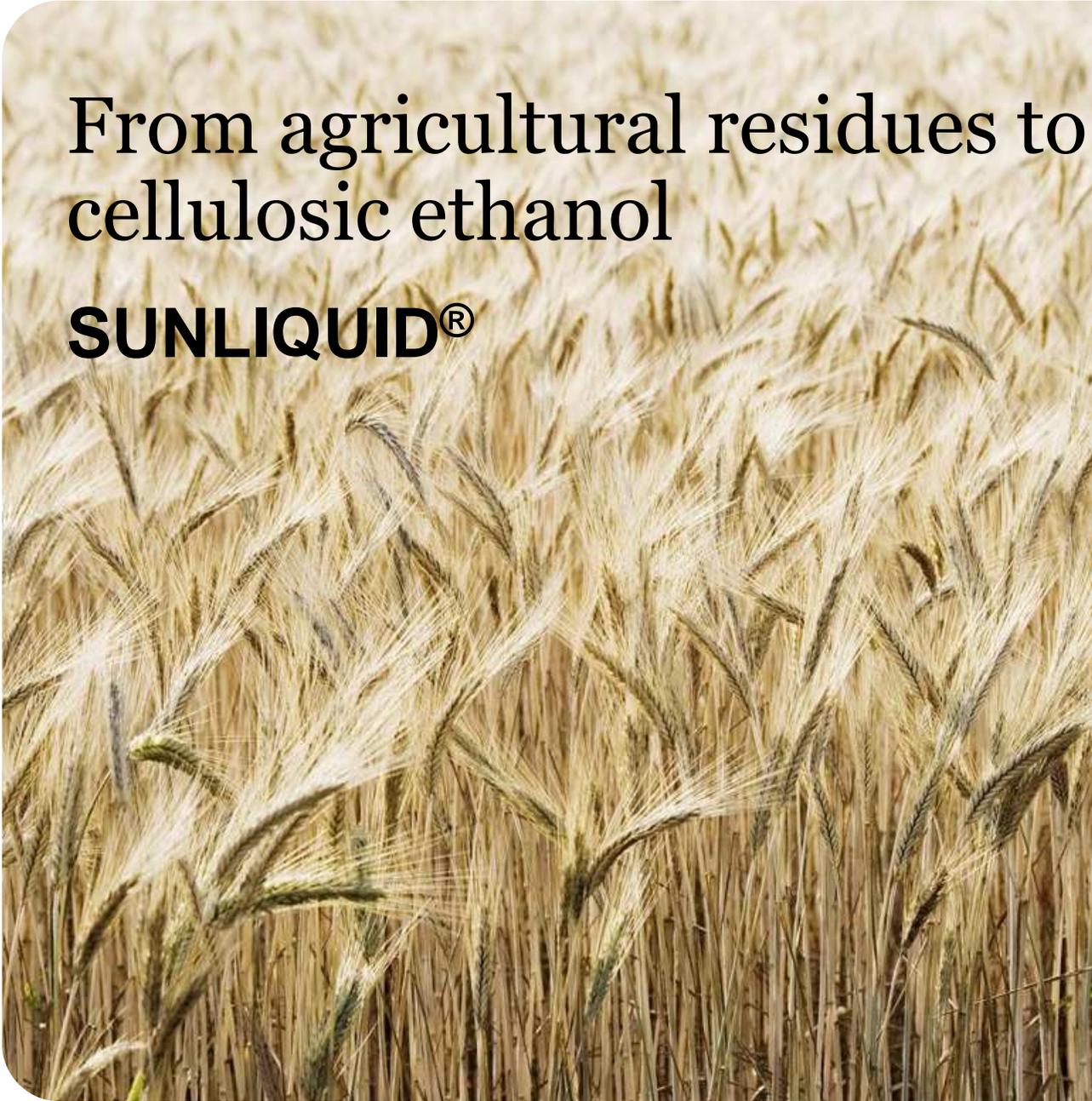
R&D shaped along
Technology Platforms

BUSINESS AREAS

Application Development
Technical Service
Marketing, Production

MARKETS & CUSTOMERS





From agricultural residues to
cellulosic ethanol

SUNLIQUID®

CLARIANT 

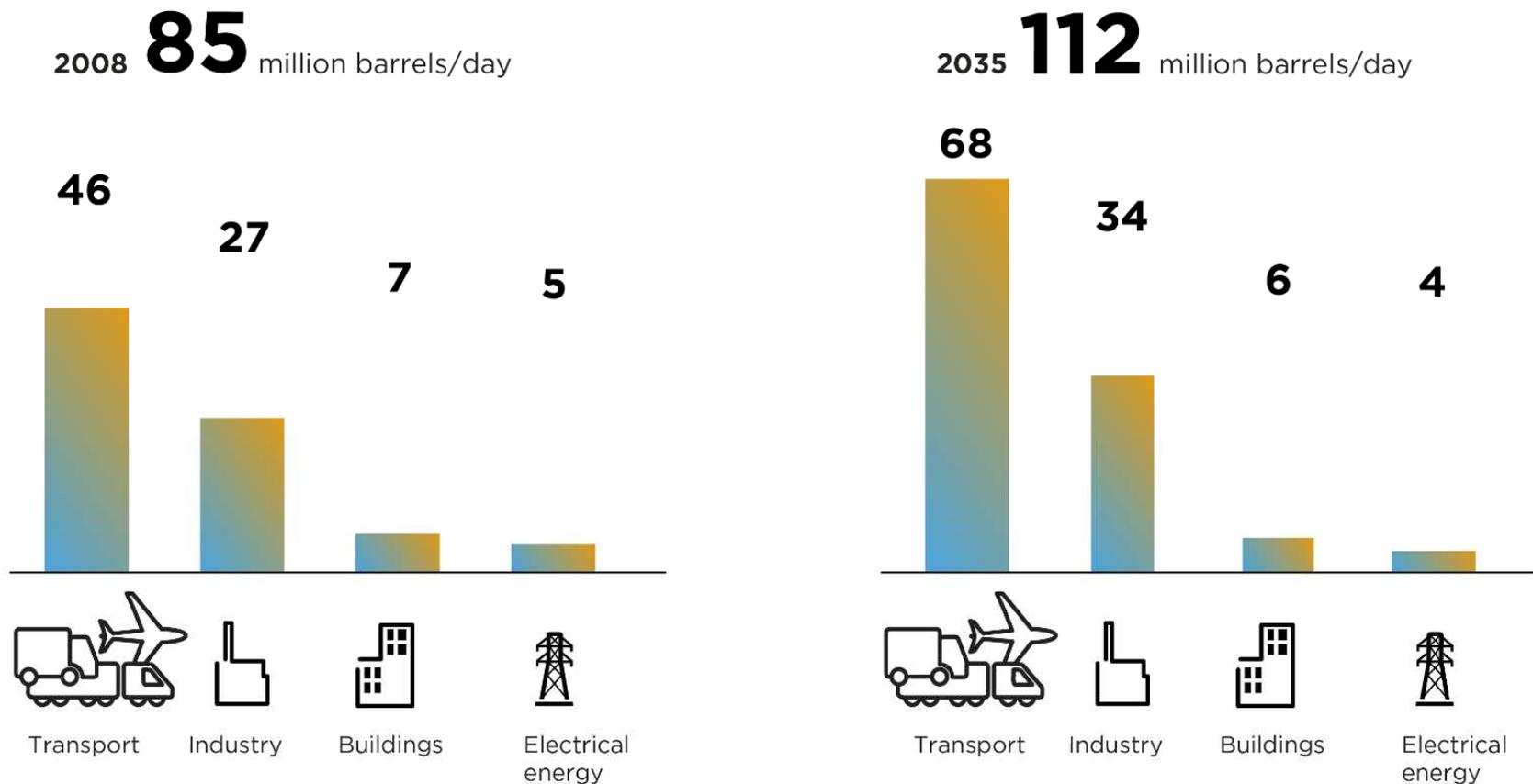
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what is precious to you?

Global liquid fuel consumption in 2008 and 2035

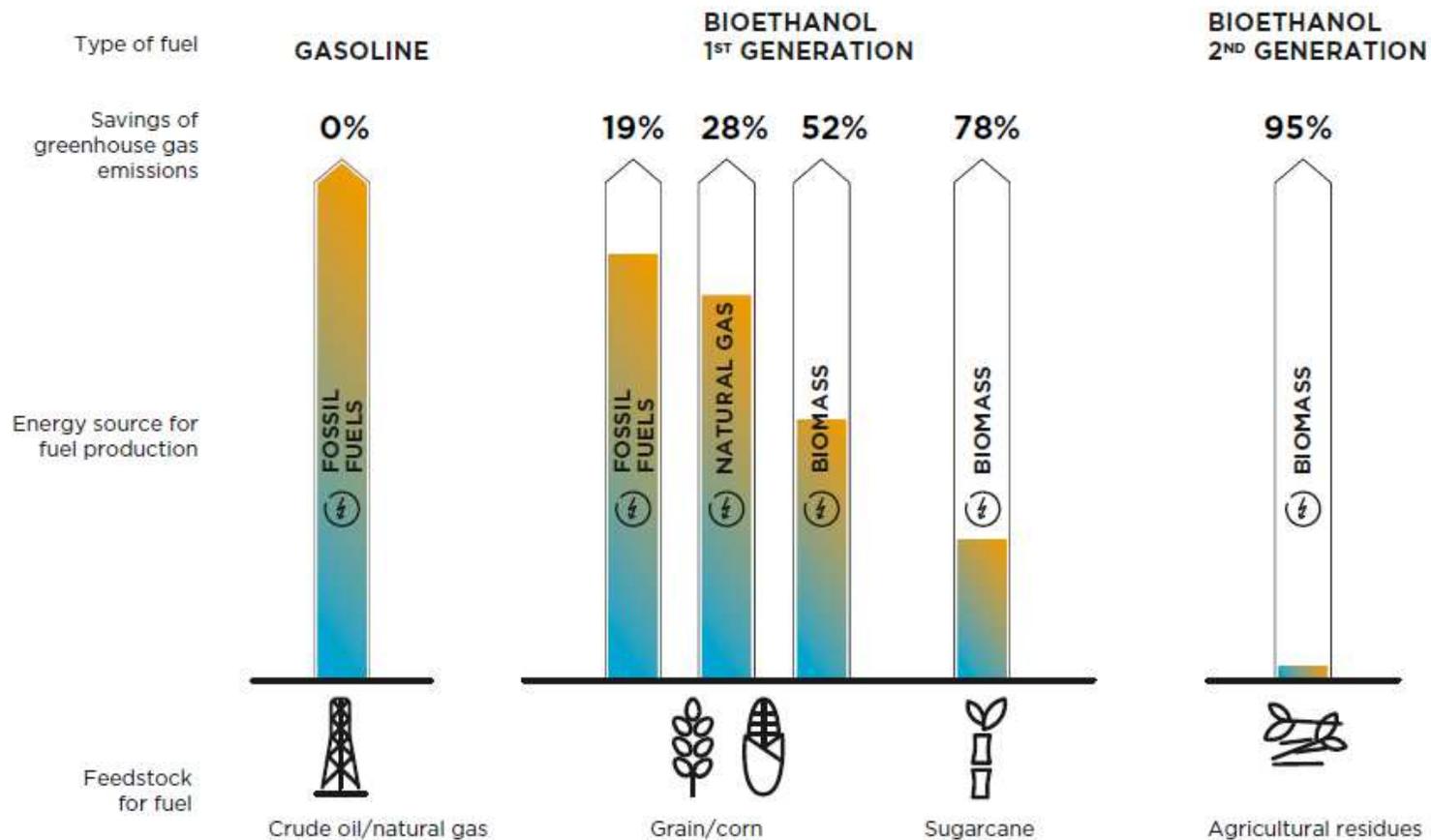
IN MILLIONS OF BARRELS PER DAY



Source: James O'Sullivan (U.S. Energy Information Administration): International Energy Outlook 2011 (September 2011), p. 29, available online at <http://large.stanford.edu>

Savings of greenhouse gas emissions in the production of different biofuels

COMPARED WITH GASOLINE



Source: Michael Wang, May Wu, Hong Huo (Center of Transportation Research – Argonne National Laboratory): Life-cycle energy and greenhouse gas emission impacts of different corn ethanol plant types (22.05.2007), in Environmental Research Letters, Volume 2, Nr. 024001, p. 12, available online at <http://iopscience.iop.org> and Markus Rarbach (Clariant): Zellulose-Ethanol aus Agrarreststoffen – Biokraftstoff der 2. Generation für eine nachhaltige Mobilität (02.12.2011), p. 28

Biomass resources alternatives – What's in a hectare of wheat?



6-7t Wheat Grain

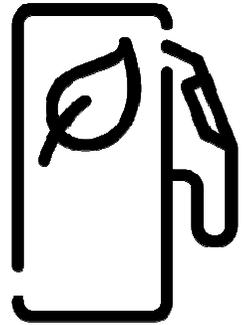
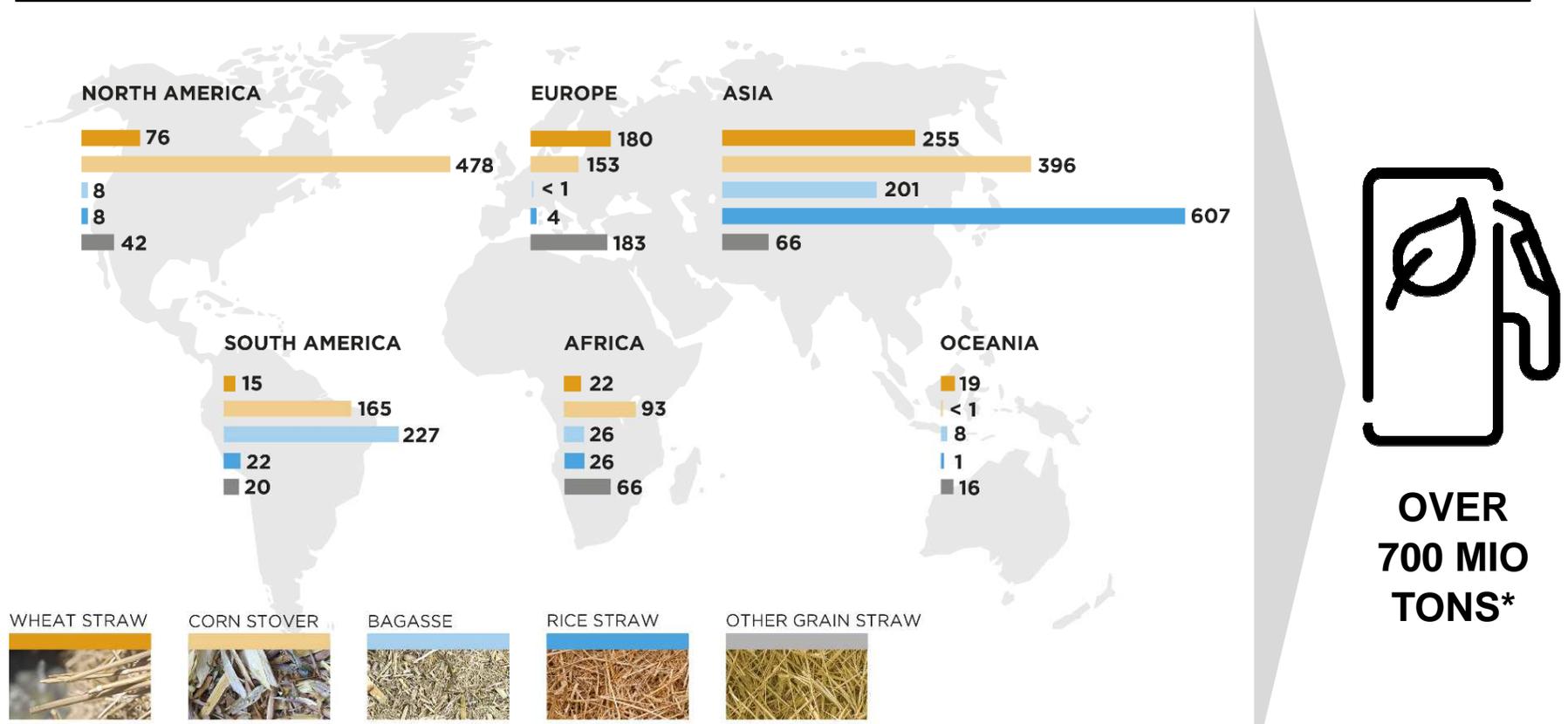
= 4.0–4.5 t sugars as starch

4-5t Wheat Straw

= 3.0–3.5 t sugars as cellulose/hemicellulose

Main source materials for lignocellulose in various regions of the world

IN MILLION TONS

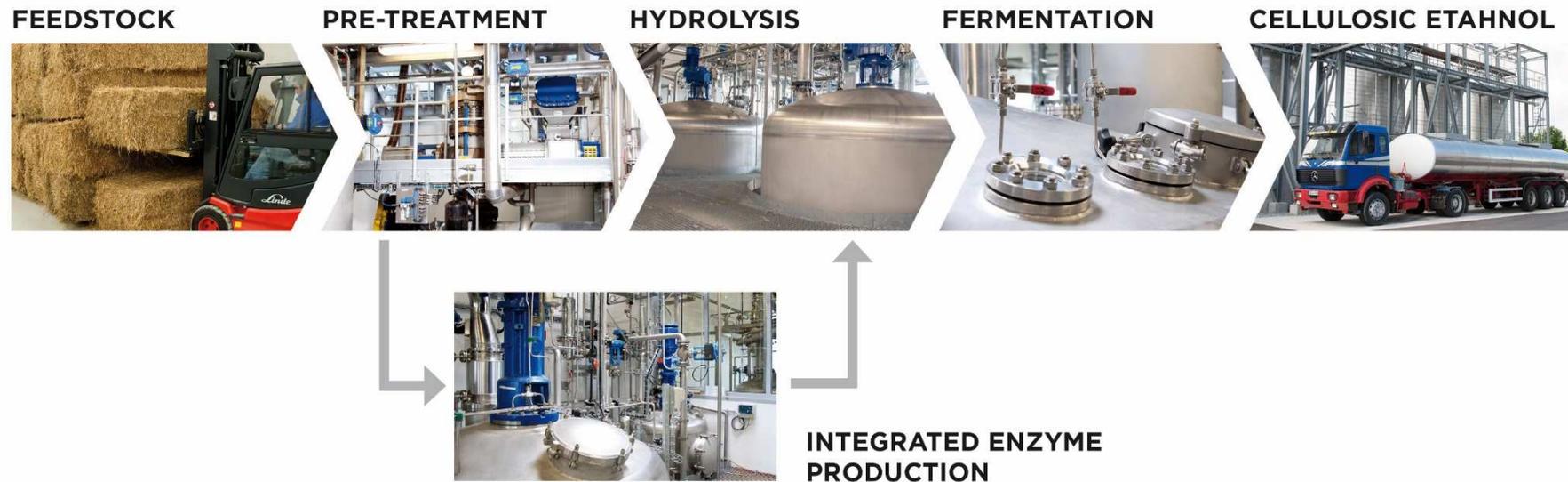


**OVER
700 MIO
TONS***

Source: UN Food & Agriculture Organization, FAO, Faostat, 2013

* with technologies like sunliquid®

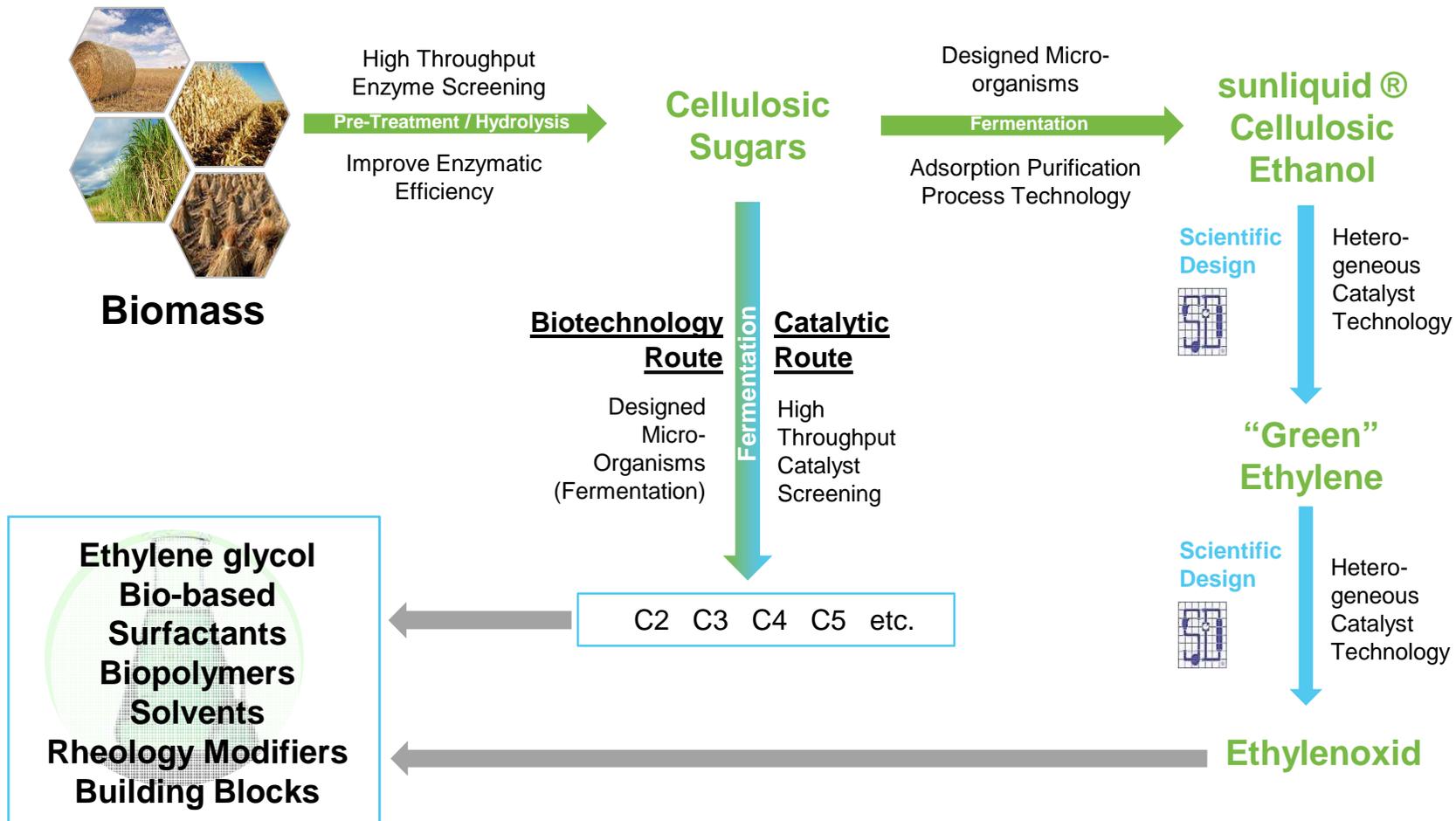
The sunliquid[®] process offers competitive path to cellulosic ethanol



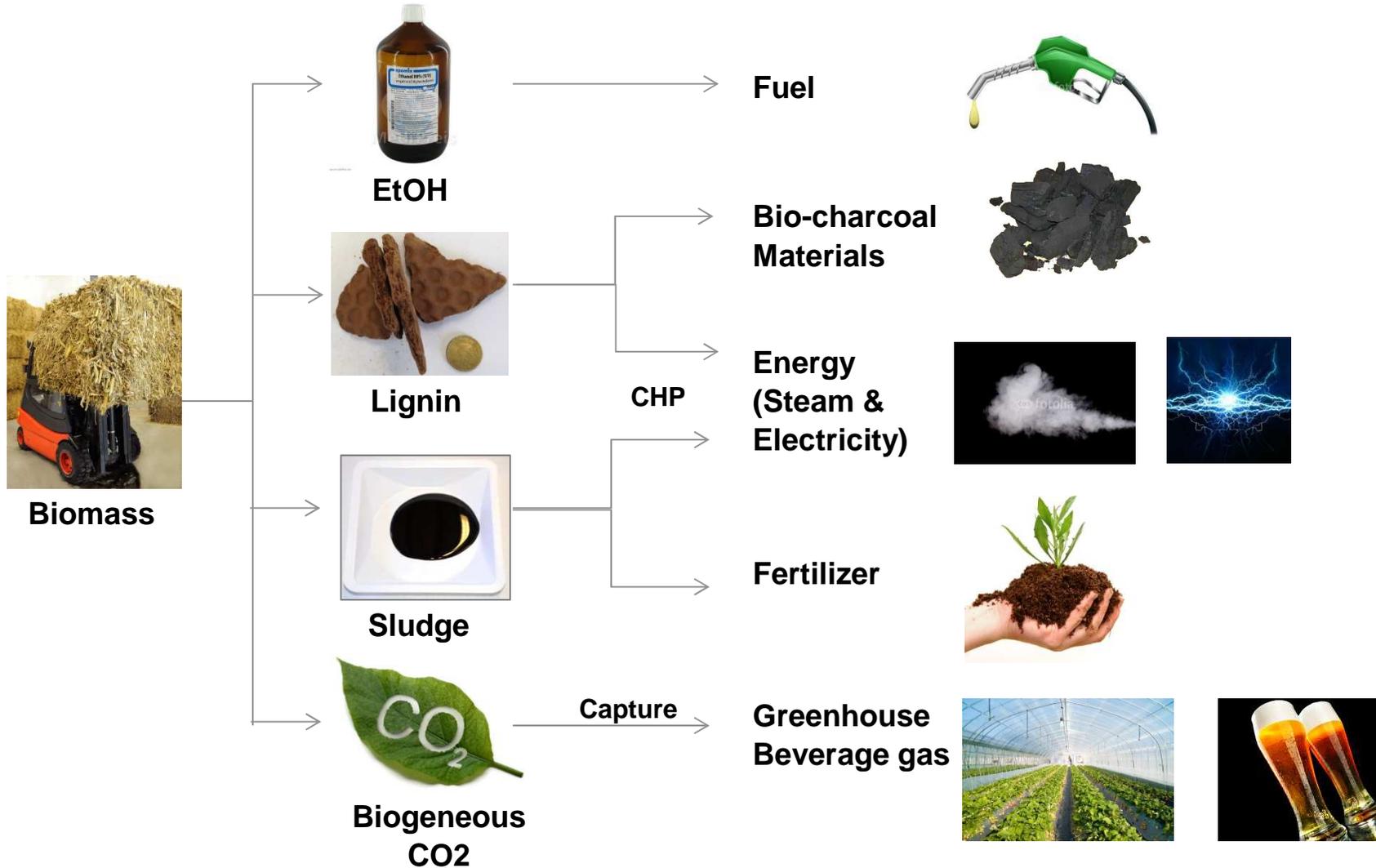
Key features and advantages

- Integrated enzyme production
- Simultaneous fermentation of C6 and C5 sugars into ethanol
- Feedstock and process specific enzymes
- Chemical-free pre-treatment
- Energy self-sufficiency

sunliquid® and cellulosic sugars – our platform for the production of sustainable solutions

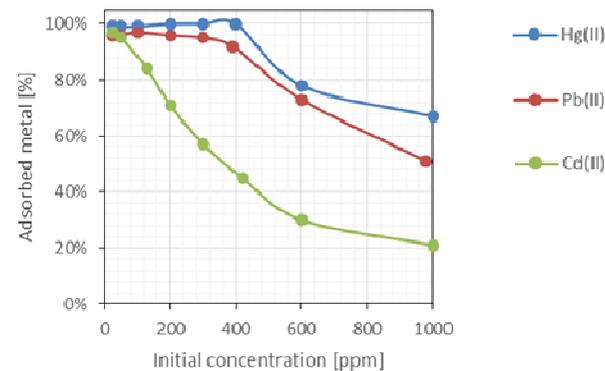
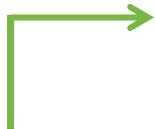


By-Products can be used for energy self-sufficiency or to generate additional revenue-streams



Valorisation of lignin – more than just an energy source

HEAVY METAL ADSORBENT



FILLER MATERIAL



Benefits compared to alternative systems based on Wood Plastic Composites (WPC):

- Acoustic properties improved
- Minor shrinkage
- Less moisture absorbance
- Less sensitivity to shear and heat during processing
- Higher elastic modulus
- Less tendency to incrustations
- Potentially UV stabilizing
- Minor warpage

From agricultural residues to
ingredients for cosmetics

**PLANTASENS® OLIVE
SQUALENE**

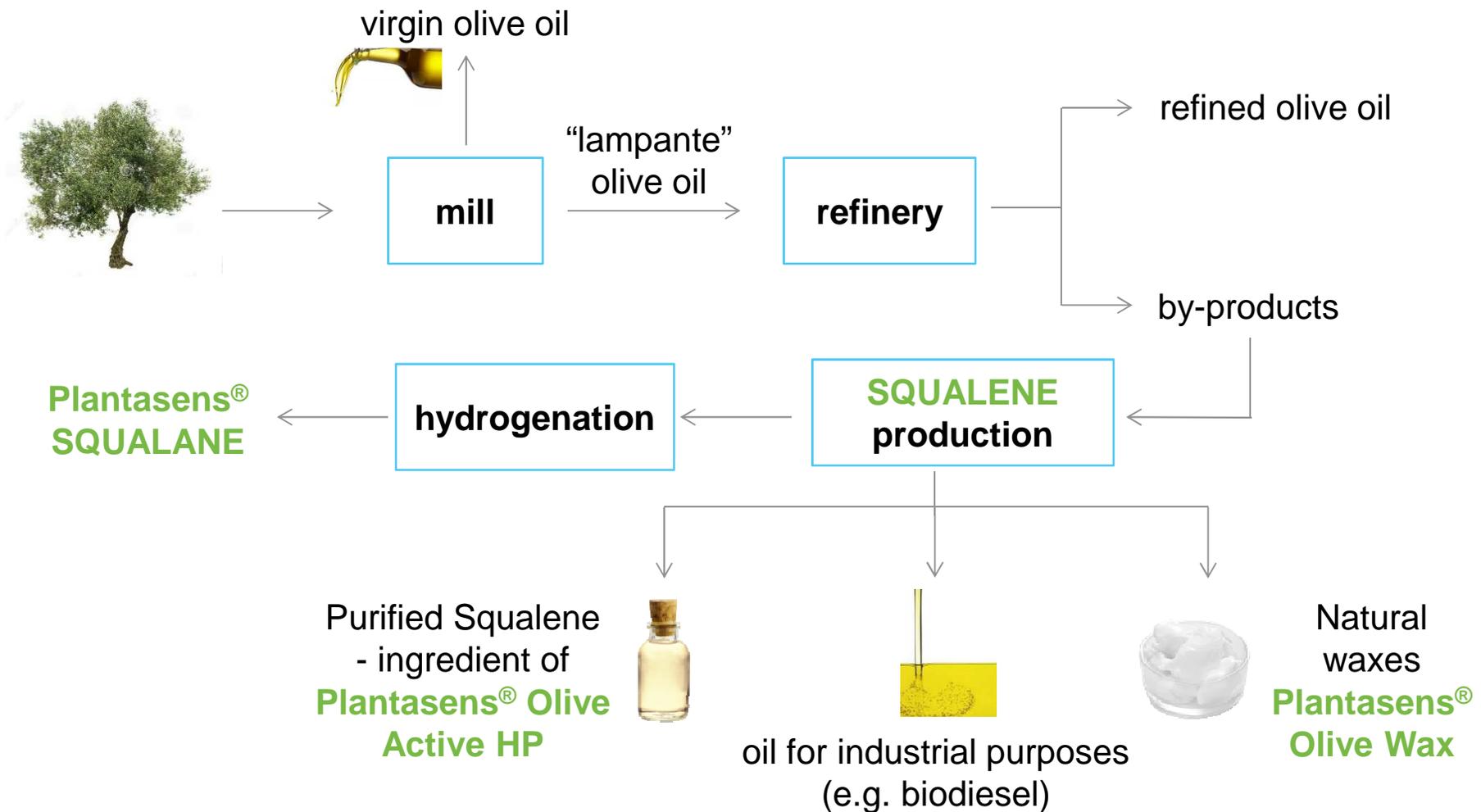


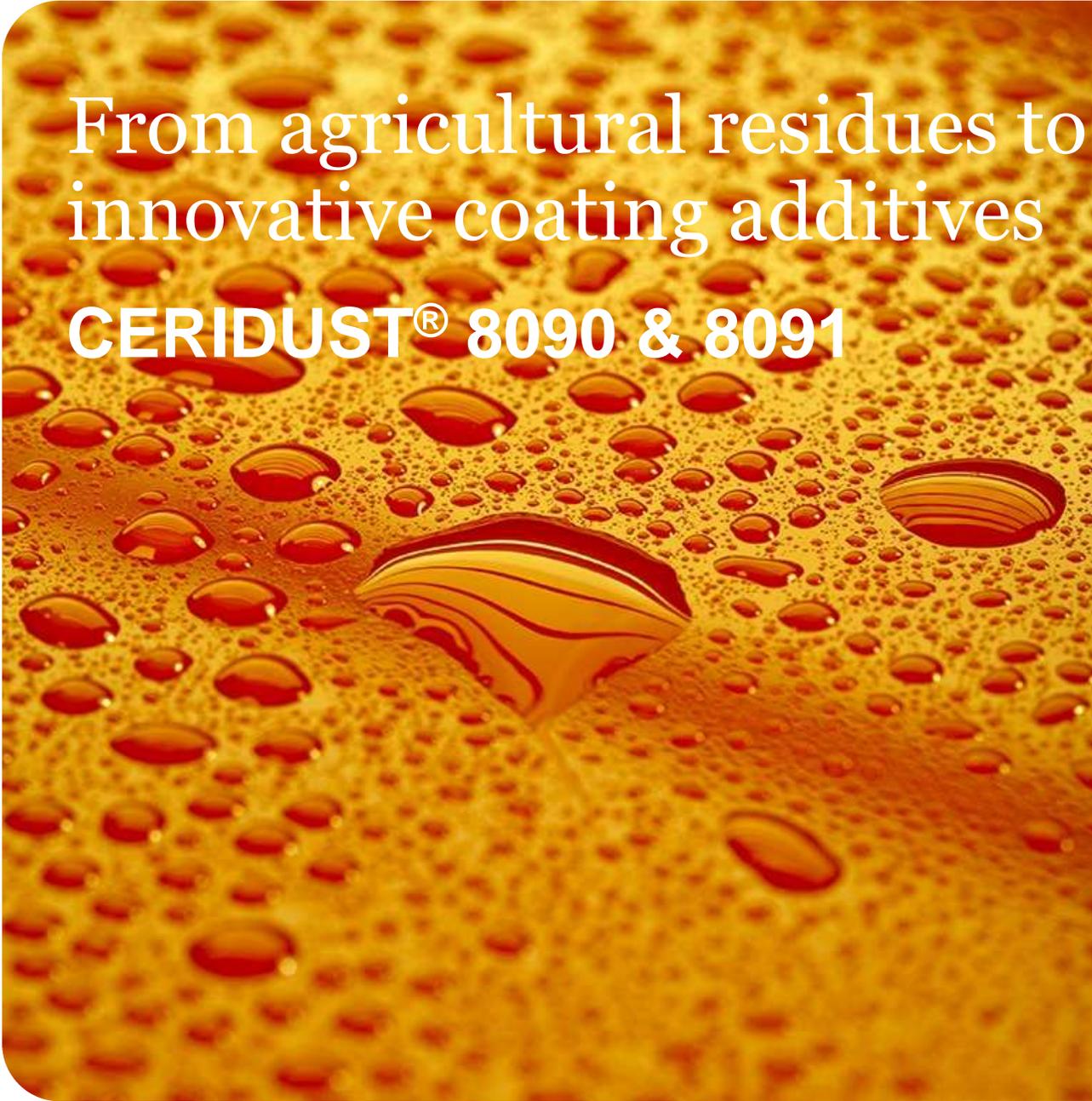
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what is precious to you?

By products from olive oil production – contributing to the secret code of beauty





From agricultural residues to
innovative coating additives

CERIDUST® 8090 & 8091

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what is precious to you?

Ceridust[®] 8090 & 8091 - Revolutionary bio-based additives for wood coating applications



CHALLENGE

- Replacement of waxes based on polyolefines in wood coating application by sustainable solution without compromising performance

SOLUTION

- Micronized polysaccharide based solution
- Outstanding performance profile in water-based coatings
- Pleasant wooden touch that feels like untreated wood
- Increased coefficient of friction and outstanding scratch resistance



NON HAZARDOUS



**BEST FOR WATER
BASED, SOLVENT FREE
COATINGS**



**COOPERATION WITH
SUPPLIER ON
SUSTAINABLE RAW
MATERIALS**



**100% RENEWABLE RAW
MATERIAL, NOT FOOD
COMPETING**



**INCREASED
COEFFICIENT OF
FRICTION AND
OUTSTANDING
SCRATCH
RESISTANCE**

Summary & Conclusion

Waste Streams

Unlimited potential for innovation.....

Agricultural Residues

Offering access to a wide variety of value-added products, e.g. via the cellulosic sugar route

Innovation Chain

Strong link of Technology & Application Platforms needed, combined with multidisciplinary expertise

Partnering

Partnering along the value chain involving academia is key to success